THE

VOYAGE OF H.M.S. CHALLENGER.

ZOOLOGY.—VOL. I.

(*Provisional Title*)

REPORT

ON THE

SCIENTIFIC RESULTS

OF THE

VOYAGE OF H.M.S. CHALLENGER

DURING THE YEARS 1873-76

UNDER THE COMMAND OF

CAPTAIN GEORGE S. NARES, R.N., F.R.S.

AND

CAPTAIN FRANK TURLE THOMSON, R.N.

PREPARED UNDER THE SUPERINTENDENCE OF

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PROVISIONAL PREFACE.

On the return of the exploring voyage of H.M.S. Challenger in the summer of the year 1876, I was instructed by Her Majesty's Government, in pursuance of the arrangement under which I had undertaken the direction of the Civilian Scientific Staff on board, to prepare a detailed Report on the scientific results of the expedition.

A complete report of a voyage such as that of the Challenger must consist of two parts, which, although interdependent, are essentially distinct. The first of these includes the account of the whole mass of hydrographical details, and the magnetical, meteorological, and other physical observations which enter more or less fully into the routine of every surveying ship; with the exception of the determination of the specific gravity of sea-water, which was undertaken by Mr J. Y. Buchanan, M.A., F.R.S.E., the whole of the work under this head was carried on on board the Challenger by the Naval Surveying Staff, and it was conducted with more than ordinary care and skill. A copy of the observations was taken daily during the voyage for the use of the civilians.

The second part consists of the record of the observations of the naturalists, the descriptions of the animal forms acquired which are new to science, the report of the special work of the geologist and of the analytical chemist, and the discussion of the correlation and the general bearings of the results in all the departments. This part has been relegated in the present instance to a staff of specialists under my direction.

The preparation of the Hydrographical and Physical Report would naturally have devolved upon Sir George S. Nares, K.C.B., F.R.S., under whose direction the whole system of observation was carried out during the first two years of the voyage. When Captain Nares was recalled to take command of the Arctic Expedition which left England in 1875, he was succeeded in the command of the CHALLENGER by Captain Thomson, and by the wish of that officer the same system was continued during the remainder of the cruise, the Hydrography and Meteorology being under the superintendence of Staff-Commander Tizard, in whose hands Captain Nares most liberally left his notes and memoranda. When the ship returned to England in 1876, the Hydrographer of the Admiralty, who has throughout taken the warmest interest in the success of the undertaking, so adjusted the duties of Staff-Commander Tizard that that officer has been able to give his effective assistance in the preparation of the Report. All the charts and plans have been prepared under his superintendence; and all the physical data which occur, whether in the first volume, to which his name is attached, or in the volumes devoted to special subjects, have been supplied or revised by him.

For the general instructions under which the expedition was despatched, I must refer to Appendix A of the first volume of the Report. I need only mention here that one of our principal objects of inquiry was the nature and distribution of the fauna of the ocean basins, and the form under which life was maintained under different physical conditions; and that my own instructions as to the conduct of the zoological investigations were very general, the details being left almost entirely to my own discretion. Three gentlemen versed in different branches of Zoology were associated with me in this department,—Mr H. N. Moseley, M.A. (Oxon.), Mr John Murray, and Dr v. Willemoes-Suhm, a young naturalist of great promise, whose death from an attack of acute erysipelas during our home voyage, was a serious loss to the expedition and to science. Mr Frederick Pearcey, then a mere lad, was entered at Sheerness to assist in the Zoological workroom. His services from that time to the present have been of the greatest value.

I was well aware from the first that although much of the success of the enterprise depended upon the intelligence with which conditions and phenomena were observed and correlated during the voyage, original investigation must be carried on under very special difficulties at sea; and I believed that our object would be best attained by multiplying and recording accurate observations, and by making large zoological collections preserved in the condition best suited for after study. In carrying out this view I was heartily and loyally seconded by all my colleagues; few seriously untoward circumstances broke the even current of our work; and the three years and a half of the ship's commission was occupied almost continuously in recording observations in the different departments included in our instructions, and in capturing, labelling, and preserving animal species. The natural result has been the accumulation of observations and numerical data which may be reckoned by millions, and of a collection in certain branches of Marine Zoology incomparably larger than any one collection which has hitherto been procured. It is needless to say that the reduction and discussion of so extended a series of observations, and the examination and description of so large a number of animal forms, is a work necessarily involving a considerable amount of time, and the labour of many hands.

The complete Report will extend, as was originally contemplated, to fourteen or fifteen quarto volumes. The first volume will contain a short narrative of the voyage, with all necessary hydrographical details; an account of the appliances and methods of observation; a running outline of the results of the different observations; and a chapter epitomising the general results of the voyage. This volume will be illustrated by a general physical chart; a series of charts of the ship's course; a series of diagrams of the vertical distribution of temperature; and some photographs of scenery. It will probably be in two parts, and is being prepared by Staff-Commander Tizard, R.N., and myself. The illustrations are now complete, and the letterpress is nearly so. Some delay has occurred in collecting the information necessary to give a general outline of the results of the dredgings and other investigations, but I hope the first volume may appear within a year.

The second volume contains the Meteorological Observations taken by the Naval Scientific Staff on board, under the direction of Staff-Commander Tizard, and reduced and tabulated by him; the extensive series of observations of the magnetic inclination and intensity made both on land and at sea by Commander Maclear, R.N., and Lieutenant Bromley, R.N., reduced by those officers, and prepared for publication by Staff-Commander Creak, R.N., under the superintendence of Captain Evans, R.N., C.B., F.R.S., Hydrographer of the Admiralty; the Tables of the Specific Gravity of Sea-Water, observed by Mr Buchanan; and some other tables. This volume is printed off, and will be published along with the first.

The General Report on the Zoology of the expedition will consist of about fifty distinct Memoirs, which will occupy from ten to twelve volumes. I have arranged, with the sanction of the Controller of H.M. Stationery Office, to print the Zoological Reports as they are prepared, and to publish them as soon as a sufficient bulk of Memoirs is ready to form a volume. Copies of each Memoir may also be had separately. I have adopted the plan of publishing the Zoological results in this somewhat fragmentary form, in preference to delaying them until the Report is completed, in order that working naturalists may have them in their hands at the earliest possible date; and to avoid as far as possible the multiplication of synonyms by the description of the same species simultaneously by different observers. That this overlapping must occur to some extent is inevitable. After our own earlier investigations in H.M. ships Lightning and Porcupine, and those of Count Pourtalès in connection with the American Coast Survey, had demonstrated the existence of a varied and remarkable fauna at extreme depths, as well as the possibility of bringing the nature and distribution of that fauna within the range of human knowledge, the study of the biological conditions of the deep sea was rapidly and energetically extended. In most cases this question has been made a national one, the extent and cost of such explorations being beyond the ordinary limit of private enterprise, and the American, the Swedish, the German, the Austrian, the Italian, and the French Governments have already made valuable additions to our knowledge. One systematic series of investigations requires special notice; for several years Professor Alexander Agassiz has undertaken successive expeditions under the auspices of the United States Coast Survey, for the purpose of observing the conditions of the Caribbean Sea and the Gulf of Mexico. Results of these cruises of the highest interest are being published in quick succession, and, for reasons which will be explained hereafter, many of the species in different invertebrate groups procured by the Challenger are described by the specialists who have undertaken the preparation of Mr Agassiz's Reports. The extent of our collections makes the rapid publication of the descriptions of the larger groups, and the discussion of the general phenomena of distribution impossible, but the inconveniences arising from delay may be reduced to a minimum by the plan which we have adopted. Each Memoir will be paged separately, and a legend will be attached to each by which it can be referred to; for example (Zool. Chall. Exp.—Part I.—1880). Each of the Zoological series of volumes, of which this is the first, will contain one or more Memoirs, and will be published with a provisional title; and when the work is complete a collation and a new set of titles will be issued, with directions for rebinding the Memoirs in zoological sequence.

The second volume, which will appear immediately, will contain the description of the Birds, by Dr P. Lutley Sclater, F.R.S., with the assistance of the late Marquis of Tweeddale, F.R.S., Dr O. Finsch, C.M.Z.S., Professor Salvadori, C.M.Z.S., W. A. Forbes, F.Z.S., Osbert Salvin, F.R.S., Howard Saunders, F.R.S., and the late Professor Garrod, F.R.S.; and the account of certain Corals belonging to the groups Hydrocorallinæ, Helioporidæ, and Madreporaria by H. N. Moseley, M.A., F.R.S., Fellow of Exeter College, Oxford, and one of the Civilian Staff attached to the expedition.

The third and the fourth volumes, which will be issued before the end of the year, will probably contain Memoirs on the Echinidea by Professor Alexander Agassiz; on the Deep-Sea Medusæ by Professor Haeckel; on the Pantopoda by Dr P. P. C. Hoek; on the Ophiuridea by Theodore Lyman; and on the Deep-Sea Fishes by Dr Günther, F.R.S.

Reports on the Foraminifera by Henry B. Brady, F.R.S.; on the Radiolaria by Professor Ernst Haeckel; on the Hexactinellid Sponges by myself, with the anatomical details of the soft parts by Professor Franz Eilhart Schulze of Graz; on the Stalked Crinoids by myself; on the Holothuridea by Dr Hjalmar Théel of Upsala; on the Annelida by Dr W. C. M'Intosh, F.R.S.; on the Polyzoa by George Busk, F.R.S.; on the Tunicata by W. A. Herdman, D.Sc.; on the Cephalopoda by Professor Huxley, F.R.S.; on the Macrura by C. Spence Bate, F.R.S.; and on the Anatomy of Penguins by Professor Morrison Watson, F.R.S.E., are well advanced; and Memoirs on the Diatomaceæ by Count Castracane; on some of the Foraminifera by Dr W. B. Carpenter, C.B., F.R.S.; on the Alcyonaria by Professor Perceval Wright, M.D.; on the Free Crinoids by P. Herbert

Carpenter, M.A.; on the Gephyrea by Professor Ray Lankester, F.R.S.; on the Chætognatha by Dr Oscar Hertwig; on the Myzostomidæ by Dr Ludwig Graff; on the Mollusca Gastropoda and Lamellibranchiata by the Rev. R. Boog Watson, F.L.S.; on the Cæcidæ by the Marquis de Folin; on certain points in the Anatomy of Marsupials by Dr Cunningham, F.R.S.E.; and on Marine Mammals and on Human Crania by Professor Turner, F.R.S., are in more or less advanced stages of preparation.

The preparation of two important volumes on the nature of the recent deposits on the bed of the ocean, and their bearing upon Geology and Petrology, has been undertaken by Mr John Murray, F.R.S.E. and the Rev. A. Renard, S.J.; and a volume on the general Chemical and Physical results will probably complete the series. A few large classes of marine animals are still unappropriated, but the staff have at present on hand about as much as they can well encounter, and I hope that some of the naturalists who are now occupied with other groups may find time, when they have finished these, to take up any which may still remain.

From the preceding lists of naturalists who have kindly undertaken to work up the different groups, it will be obvious that my function is simply that of Editor, that I cannot presume to interfere in any way with the *matter* of the various Memoirs, and that I am responsible only for those contributions to the Report which bear my own signature. I also consider myself entirely free to hold and to express an independent opinion on any question upon distribution or other general physical or biological conditions. I have issued to the naturalists engaged in the work a sample Memoir, showing the general form which, as Editor, I wish the book to assume, and all I can undertake to do at the Office is to bring the series as nearly as possible into uniformity as they pass through the press.

In order to prepare within a reasonable time a report which should fully embody the results of the expedition, and indicate the extent to which the instructions of the Lords Commissioners of the Admiralty had been carried out, it was obviously necessary to invite the assistance of specialists in the different departments, and particularly in the different branches of Zoology. In doing this I had no hesitation in regarding the enterprise as thoroughly cosmopolitan in character; and although the manifest convenience of avoiding as far as possible the necessity for sending large series of specimens out of the country caused a preponderance of British workers on the list, I requested the co-operation of those naturalists with whom I was acquainted whose authority in the different groups was most generally recognised and who had time to undertake the task, without the slightest reference to nationality; this principle of selection was endorsed by nearly all the leading English men of science. From the nature of my instructions, the responsibility of selecting my colleagues in the preparation of the official report rested entirely with myself. I acted, however, in almost every case under the advice and with the concurrence of some of the leading members of the Royal Society. A few of the gentlemen to whom I applied for assistance found that their engagements were such as to prevent their undertaking so heavy a piece of work, but most met my views with friendly readiness; and for the generous consideration with which so many men of high distinction at home and abroad have given me their support and assistance in a task of no little difficulty, I cannot be sufficiently grateful.

C. WYVILLE THOMSON.

CHALLENGER OFFICE, 32 QUEEN STREET,
EDINBURGH, *June* 20, 1880.

GENERAL INTRODUCTION TO THE ZOOLOGICAL SERIES OF REPORTS.

By Sir C. WYVILLE THOMSON, F.R.S.

For a general account of the objects of the exploring voyage of H.M.S. Challenger, and the means by which these objects were carried out, I must refer to the first volume of this Report; the present introduction is to be understood to apply to the series of zoological volumes only. As, however, the Challenger work in this department was of a very novel and special kind, it may be right to explain somewhat in detail the method and appliances used in procuring and storing the collections; and the general system under which these have since been made available for scientific investigation, and the results prepared for publication.

It was a primary object of the Challenger Expedition and one of our special instructions, to determine, as far as lay in our power, the biological conditions of the great ocean-basins. During the short cruise of H.M.S Lightning in the year 1868, Dr Carpenter and I had been able to place it beyond doubt that the use of the ordinary dredge might be carried with comparative ease to a depth of 600 fathoms, and that a numerous and varied fauna existed at that depth; and in the summer of the year 1869, during the second cruise of H.M.S. Porcupine, I found no special difficulty in sounding, dredging, and determining the temperature of the water at a depth of 2435 fathoms. Even at this great depth, under a pressure of two and a half tons on the square inch, with a temperature close on the freezing point, and probably in utter darkness, animal life was still abundant, and all the principal types of marine invertebrata were represented.

We were led to believe from previous observations that the average depth of the ocean was not much greater than that of our deepest dredgings, and we were thus forced to the conclusion that there was actually no depth limit to animal life, that the enormous area of the great ocean-basin—extending to over a hundred millions of square miles—had its own special fauna, and that the nature and distribution of that fauna might be brought with comparative ease within the limits of human knowledge.

The operations carried on in the PORCUPINE in the Bay of Biscay in the year 1869 at extreme depths were merely slight modifications suited to the different conditions, of the ordinary methods which had long been employed in shallower water; and they worked smoothly and well. When it afterwards became my duty to superintend the more important arrangements for the scientific work on board the CHALLENGER, although

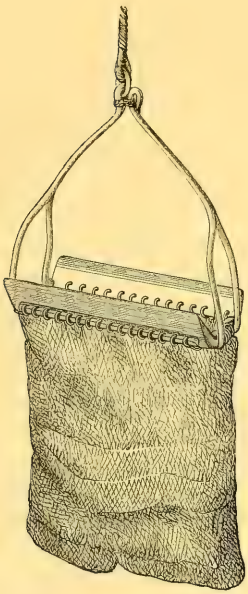


FIG. 1.—Ball's Naturalist's Dredge.

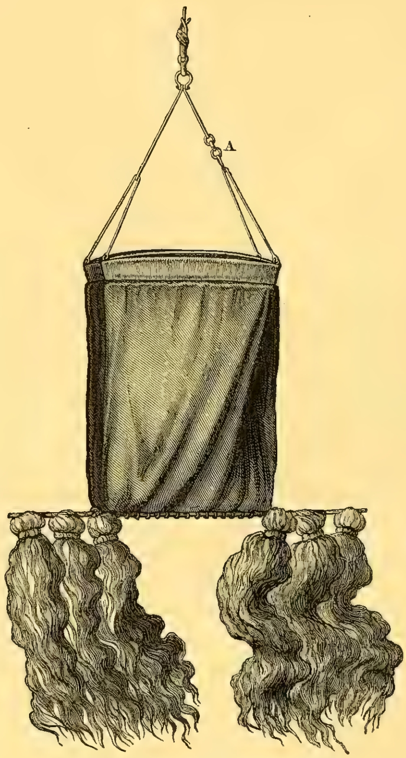


FIG. 2.—Dredge with "hempen tangles."

many changes were suggested, I made it a principle to deviate as little as possible from a plan of working which had been shown to be at all events practicable. During the progress of our voyage many alterations—some of them, such as the use of wire for sounding introduced by Sir William Thomson, and employed with such signal success by Captain Belknap in the U.S. ship TUSCARORA, and of wire-rope for dredging adopted by Professor Agassiz, evidently decided improvements—were introduced elsewhere; but as we had become accustomed to our own plans, and could depend almost with certainty upon the amount of work we could do within a certain time, I thought it better to continue steadily throughout as we had begun, and to secure the largest possible series of similar and comparable observations, rather than run the risk of losing time through possible failures.

The Trial Cruises of the Porcupine.—The PORCUPINE was a 382-ton gunboat fitted up for the surveying service, in which she had been employed for some years among the Hebrides, and afterwards on the east coast of England. She was assigned for our special work in 1869 with all her ordinary surveying fittings, and certain important additions A double-cylinder donkey-engine, which worked to about 12 horse-power, was set up on deck amidships, and was fitted with large drums for bringing up light weights rapidly, and smaller drums for heavier work; to either of which, lines might be led either from fore or aft. We almost always used the large drum both in dredging and sounding, and except on one or two occasions, when an enormous load came up in the dredge-bag, the deck-engine delivered the rope steadily at the rate of a foot per second during the whole summer. A powerful derrick projected over the port-bow. A large block was suspended at the end of the derrick by a rope, which was not directly attached to the spar, but passed through an eye, and was attached to a "bitt" on deck. On a bight of this rope was lashed a strong combination of Hodge's "accumulators" (p. 14), an arrangement invaluable in dredging from a large vessel. From the great strength of these springs the dredge is usually drawn along without stretching them to any great degree; they become tense and taut, and yield with a slight pulsation only, to the rise and fall of the vessel. Whenever the accumulators run out it is a sure indication that the dredge has caught, or that the weight in it is too great; and that the dredge-rope ought to be relieved by a turn of the paddle-wheel or screw. A second derrick, nearly equally strong, was rigged over the stern (fig. 3), and we dredged sometimes from one and sometimes from the other.

We had an excellent plan for stowing the dredge-rope in the PORCUPINE (Fig. 3), a plan which made its manipulation easy, notwithstanding its great weight. A row of about twenty large iron pins, about 2½ feet in length, projected over one side of the quarter-deck, rising obliquely from the top of the bulwark, and ending over the deck in smooth white balls. Each of these held a coil of from 200 to 300 fathoms, and the rope was coiled continuously along the whole row. When the dredge was going down, the line was taken rapidly by the men from the pins, and in hauling up a relay of men carried the rope along the deck from the surging-drum of the donkey engine, and laid it in coils on the pins in inverse order; in letting go, the rope passed to the block of the derrick directly from the pins; in hauling up, it passed from the block to the surging-drum of the donkey engine, from which it was taken by the men and coiled on the pins.

The implement which we employed throughout the several cruises of the PORCUPINE, for bringing up animals from the bottom, was the naturalists' dredge, of the form first

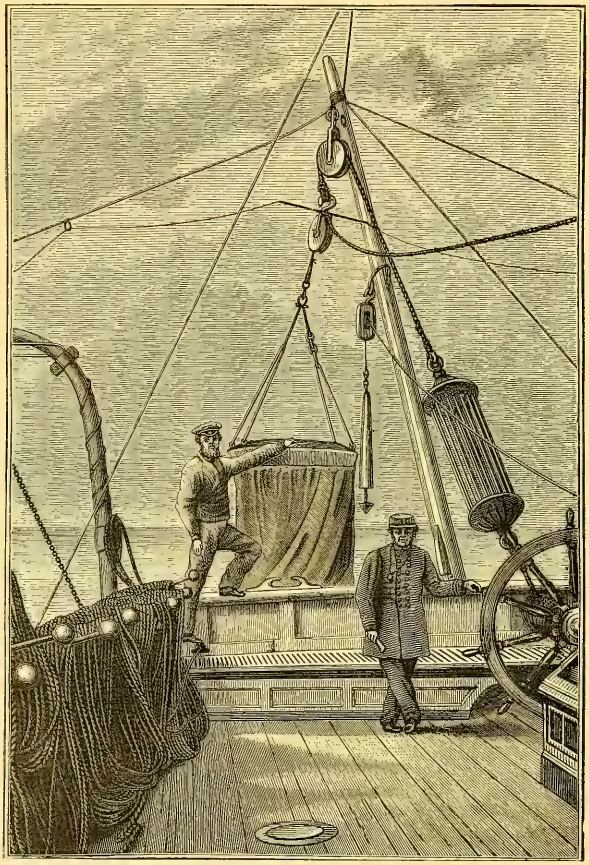


FIG. 3.—Sounding and Dredging from the Stern Derrick of the PORCUPINE.

devised by the late Dr Robert Ball of Dublin, increased in size and otherwise slightly modified to suit the size of the vessel and the command of steam-power. The construction of the frame of one of the dredges which we used in the Bay of Biscay is shown at figures 4 and 5. The length of the dredge-frame was 4 feet 6 inches, and it was 6 inches wide at the narrowest part. The scrapers were 3 inches in width, and the distance between their scraping edges $7\frac{1}{2}$ inches. On one of the arms, about

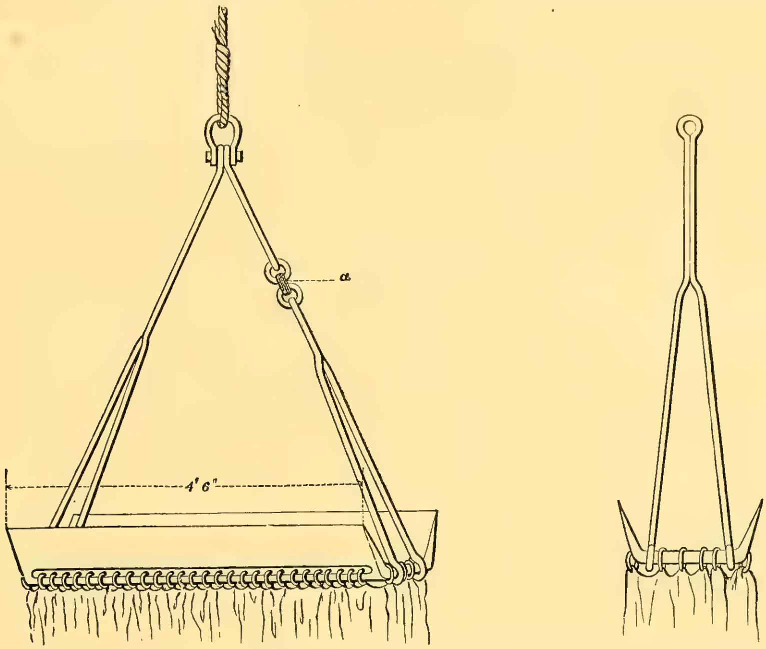


FIG. 4.—The frame of the Deep-Sea Dredges used on board the PORCUPINE, side and end view ; *a*, Spun-yarn stop.

one-third of its length from the ring to which the dredge-rope is attached, there was a breach of continuity in the arm, each free limb of the severed iron ending in an eye

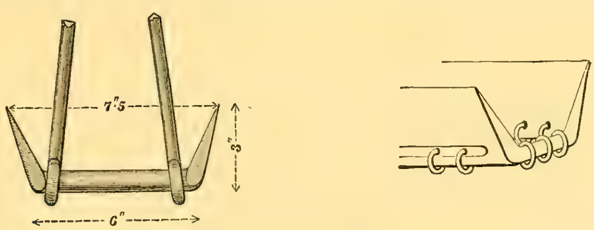


FIG 5.—The frame of the Deep-Sea Dredge, end view.

or a ring. These rings were stopped together by a couple of turns of spun-yarn (fig. 4 *a*), so that in case of the dredge becoming entangled, or wedged among rocks or coral, a strain less than sufficient to break the dredge-rope breaks the stop, and the dredge alters its position, and probably sets itself free. In case of the dredge taking in a greater load of mud than the rope can bring up, the stop likewise gives way, and allows it to fall into such a position that a large part of its contents fall out.

The dredge-bag, which is of hand-made net of strong twine, the meshes $\frac{1}{2}$-inch to the side, was attached to strong welded iron rings, passed through holes perforated in the thick edges of the scrapers, at distances of about an inch. So open a net-work would let many of the smaller things wash through, and to avoid this, the bottom of the bag, to the height of about 9 inches, was lined with "bread-bag," a light open kind of canvas.

In many of our dredgings in the PORCUPINE at all depths, we found that while few objects of interest were brought up within the dredge, many Echinoderms, Sponges, and Corals came to the surface sticking to the outside of the dredge-bag, and even to the first few fathoms of the dredge-rope.

This suggested many expedients, and finally Captain Calver sent down half a dozen of the "swabs" used for washing the decks, attached to the dredge. The result was marvellous. The tangled hemp brought up everything rough and movable which came in its way, and swept the bottom as it might have swept the deck. After various experiments, we came to the conclusion that the best plan was to attach a long transverse bar to the bottom of the dredge-bag, and to fasten large bunches of teazed-out hemp to the free ends of the bar (fig. 2). We have used the "hempen tangles" ever since, and we now regard them as an essential adjunct to the dredge, scarcely less important than the dredge itself, and often much more conspicuous in its results.

The length of the dredge-rope used in the PORCUPINE was 3000 fathoms. Of this, 2000 fathoms were "hawser-laid" of the best Russian hemp, $2\frac{1}{2}$ inches in circumference, with a breaking strain of $2\frac{1}{4}$ tons; the 1000 fathoms next the dredge were "hawser-laid," 2 inches in circumference.

The accompanying diagram (fig 6) will give an idea of the method of dredging adopted by Captain Calver, and the various relative positions of the dredge and vessel at different stages of the process of "paying-out."

On the 22d of July 1869, lat. 47° 38′ N., long. 12° 8′ N. in the Bay of Biscay, the depth was ascertained by a careful sounding to be 2435 fathoms, with a bottom of grey ooze, and at about 4.45 P.M. the dredge was let go, the vessel drifting slowly before a moderate breeze (force = 4) from the N.W. The 3000 fathoms of rope were all out at 5.50 P.M.—A represents the position of the vessel when the dredge is let go, and the dotted line A B the line of descent of the dredge. When the dredge is going down the vessel drifts gradually to leeward; and when the whole (say) 3000 fathoms of rope are out, C, W, and D might represent respectively the relative positions of the vessel, the weights attached 500 fathoms from the dredge, and the dredge itself. The vessel now steams slowly to windward, occupying successively the positions E, F, G, and H. The weights, to which the water offers but little resistance, sinks from W to W′, and the dredge and bag move slowly from D to B. The vessel is now allowed to drift back before the wind from H towards C. The pull of the vessel, instead of acting immediately on the dredge, now drags forward the weight W′, so that the dredging is carried on from the weight and not directly from the vessel. The dredge is thus quietly

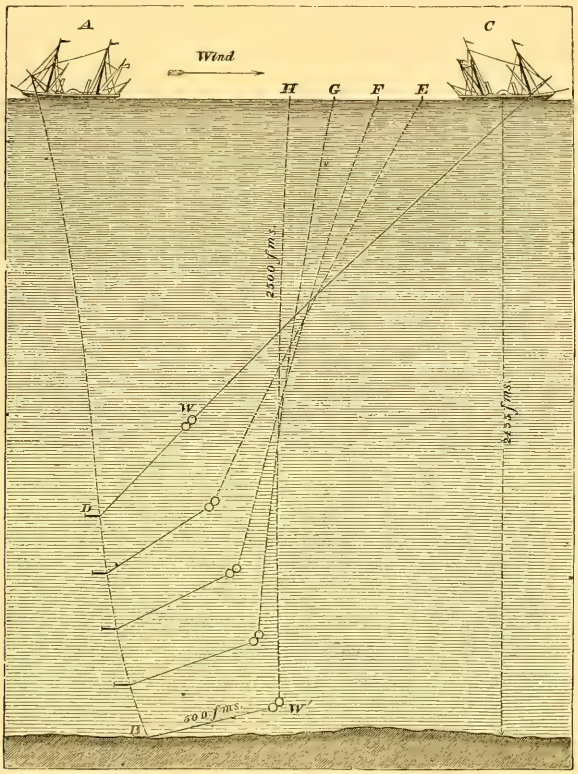


FIG. 6.—The relative positions of the Ship, the Weights, and the Dredge, at different stages of "Paying-out" from the PORCUPINE.

pulled along with its lip scraping the bottom, in the attitude which it assumes from the position of the centre of weight of its iron frame and arms.

At 8.50 P.M. we began to haul in, and the pins to fill again. The donkey-engine delivered the rope at the rate of a foot per second without a single check. A few minutes before 1 A.M. the weights appeared, and a little after one in the morning, eight hours after it was cast over, the dredge was safely hauled on deck, having in the interval accomplished a journey of upwards of eight statute miles.

This was the deepest haul which was attempted during the second cruise of the PORCUPINE, but the same routine proved equally successful on many occasions at depths almost equally great in subsequent cruises under the direction of my colleagues, Dr Carpenter and Dr Gwyn Jeffreys. The mode of working in the PORCUPINE was the simplest which could be contrived; we had started, no doubt, with greatly exaggerated ideas of the difficulty of such operations, and it was our constant aim to avoid all apparatus which might possibly go wrong; and, as these excursions usually lasted only for a short time, to use nothing but such gear as sailors are accustomed to, and require little training to handle. Some slight changes were made in the CHALLENGER, and with our additional experience, in the case of an expedition on so large a scale, the various methods might be elaborated in many ways with advantage, but I am inclined to think that the same general plans which were adopted in the PORCUPINE would still be the most suitable for a short trip in a vessel of moderate size, with a crew not specially trained. There can be no doubt that in any future expedition, on whatever scale, it would be an unjustifiable waste of time and space to neglect the use of wire for sounding, and wire rope for dredging and trawling, but it seems to me that even the use of these should be simplified and not made more complex. No one who has not had personal experience of the working of machines of any kind in a small vessel in bad weather can form an idea of the risk to the accuracy of the results, to the machines themselves, and to those who handle them.

THE SPECIAL ARRANGEMENTS AND METHODS USED ON BOARD THE CHALLENGER FOR PROCURING AND PRESERVING DEEP-SEA ANIMALS.

The arrangements on board the CHALLENGER were much the same as those on board the PORCUPINE, or any other vessel specially fitted for surveying and deep-sea investigation. The only great change which we made in our method was the gradual substitution, during the early part of the voyage, of the beam-trawl for the dredge. For the first few hauls in deep water off the coast of Portugal, the dredge came up full of the usual "globigerina ooze," very uniform throughout; and the work of hours in sifting gave but a small result. We were anxious to get some idea of the general character of the fauna, and particularly of the distribution of the higher animal groups; and, after various suggestions for modifying the dredge, it was proposed to try the ordinary trawl. We had a compact well-balanced trawl with a 15-feet beam on board, and we sent it down off Cape St Vincent to a depth of 600 fathoms. The experiment looked hazardous, but to our great satisfaction the trawl came up all right, and contained, along with many of the larger invertebrata, several fishes with what we became accustomed afterwards to recognize as abyssal characters. The plan seemed to answer so well that we tried it again a little farther south, in 1090 fathoms, and again it was perfectly successful. During the remainder of the voyage we used the trawl more frequently than the dredge, particularly in very deep water, where there was a certainty of finding a smooth bottom free from rocks. Under these circumstances the large area covered by the trawl greatly

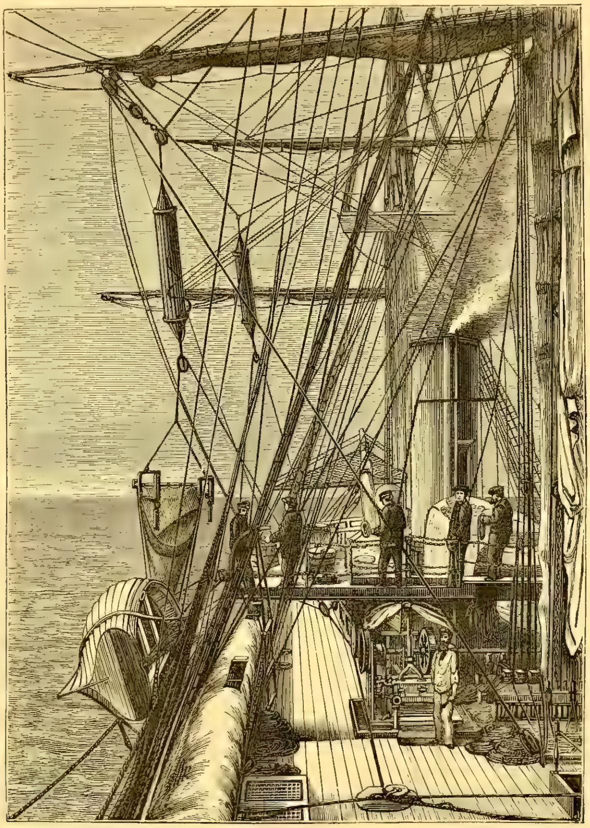


FIG. 7.—The Dredging and Sounding Arrangements on board the CHALLENGER.

increases the chance of bringing up some record of the scanty and sparsely-scattered fauna. In very extreme depths, say between 3000 and 4000 fathoms, the trawl has the disadvantage of taking rather a longer time both in letting out and heaving in, and the enormous pressure of the water affects the wood of the beam. On one occasion when a pine beam was used, the wood was compressed till the knots stood out a tenth of an inch beyond the general surface, and on another the beam was crushed as if it had been passed between two rollers. Under such circumstances the dredge works better, but a trawl with a beam of hard wood of moderate length may be used freely down to 2500 fathoms. Our deepest haul with the trawl was 3050 fathoms (Station 250).

The Alterations in the Ship.—The CHALLENGER, the vessel selected by the Admiralty for the exploring voyage which was the natural issue of the successful preliminary cruises of the LIGHTNING and the PORCUPINE, is a spar-decked corvette of 2306 tons displacement, with auxiliary steam to 1261 horse-power, and usually mounting eighteen 68-pounders. Sundry changes were made in her fittings and arrangement to suit her special service. I will here only refer to those which have a direct bearing upon the collection and preservation of zoological specimens.

Sixteen of the large guns were removed to increase the accommodation on the main-deck, and the space for storage. In the central part of the ship on the upper deck before the main-mast, a dredging platform was built level with the hammock-nettings. This platform held the tubs and jars into which the specimens were placed when taken from the dredge, and thus we could sift the mud and observe the appearance and movement of animals during life, and sketch them if necessary, without much interruption from the seamen working the ropes. The dredge and trawl were usually emptied on this platform, which was provided with two large shoots through which the mud and refuse might be ejected without messing the deck (fig. 7).

The deck-engines for hoisting the dredging-gear were placed at the foot of the main-mast on the port side, directly under the dredging bridge. They consisted of a pair of direct-acting, high-pressure, horizontal engines, collectively of 18 horse-power nominal. Instead of a connecting-rod beneath, a guide was fixed to the end of the piston-rod, with a brass block working up and down the slot of the guide. The crank-axles ran through the centre of the blocks, and the moveable block, gaining a backward and forward motion from the piston-rod, acting on the crank as a connecting-rod would do. This style of engine is commonly used for pumping, the pump-rods being attached to the guide on the opposite side from the piston-rod. At one end of the crank a small toothed wheel was fixed which drove one thrice the multiple on a horizontal shaft extending nearly across the deck, and about 3 feet 6 inches above it. At each end of this shaft a large and small drum were fixed, the larger having three sheaves cast upon it of different sizes, the lesser being a common barrel only. The dredging line was led to these drums, two or three turns being taken round the drums selected. In hauling in, the dredge-rope was taken to a gin-block, secured to a spar on the forecastle, then aft to the drum of the deck-engines on the port side of the quarter-deck, then to a leading-block on the port side of the quarter-deck, and across the deck to a block on the starboard side, then to the drum of the deck engines on the starboard side corresponding in diameter to the drum used on the port side, and from this it was finally taken and coiled. The strain was of course greatest at the yard-arm and the first leading-block, and by this arrangement it gradually diminished as the line passed round the series.

The Dredge-Rope.—For dredging and trawling we were supplied with rope of three different sizes—2 inches, $2\frac{1}{2}$ inches, and 3 inches in circumference respectively. This cordage was made of the best Italian hemp, tarred, well hackled and rubbed down, and laid up softly. The 2-inch rope weighed 95 lbs. per 100 fathoms, and its breaking strain was 1 ton 12 cwts.; the $2\frac{1}{2}$ weighed 158 lbs., with a breaking strain of 2 tons 6 cwts.; and the 3-inch, 220 lbs. per 100 fathoms, with a breaking strain of 2 tons 11 cwts. In proportion to its weight, therefore, the 2-inch was the strongest rope, and this or the $2\frac{1}{2}$-inch was used for deep trawling or dredgings, the 3-inch rope being reserved for comparatively shallow water. The dredge-rope was "marked red" at every 100 fathoms.

When we left England we had 10,000 fathoms of 3-inch rope on board, 4200 fathoms of which were expended. Of $2\frac{1}{2}$-inch rope we had 10,000 fathoms; we got out 21,000 fathoms during the voyage, and expended a total of 27,100 fathoms. Of 2-inch rope we started with 5000 fathoms, got 10,000 fathoms additional, and expended 10,860 fathoms.

The rope was spliced together so as to form an uninterrupted length of 4000 fathoms, and it was kept coiled away in racks on the forecastle, each size by itself. When we first used rope in such great lengths we spliced swivels in at each 500 fathoms to take the turns out; but if care be taken in splicing that all the lengths of rope are twisted in the same direction, this precaution is unnecessary, and as the swivels sometimes got jammed in the blocks they were shortly discarded.

The Deep-Sea Dredge.—The dredge in ordinary use in the Challenger is represented in fig. 8. The dredge-frame, of hammered iron, is 4 feet 6 inches long, and 1 foot 3 inches broad. The scrapers are 3 inches wide, and are connected at the ends by bars of $1\frac{1}{4}$-inch round-iron. The arms are of inch round-iron and slightly curved; they are bolted together to a short iron tongue which ends above in a swivel and ring. Two bars of square iron of some strength are attached by eyes to the round cross-bars at the ends of the dredge-frame, and have the other ends lashed to an iron bar which bears the hempen tangles. These rods keep the dredge-bag at full length and prevent it or the tangles from folding over the mouth of the dredge.

The dredge-bag is 4 feet 6 inches in length; it is made of netting of soft line (something like marline), the meshes an inch to the side, and the lower third is lined with bread-bag stuff to prevent even the smallest animals washing out whilst the dredge is being hove in. The bag is guarded by three loops of bolt-rope attached to the frame of the dredge, to the bottom of the bag, and finally to the tangle bar. The canvas pads represented in the figure on the dredge-frame are only to protect the seizings of the loops. The dredge is suspended from an inch iron chain which forms the first few fathoms of the dredge line, and resists chafing more effectually than rope would do.

The chain is not, however, directly fastened to the ring at the end of the arms of the dredge, but is made fast to one of the end bars of the dredge-frame, and is strapped to the

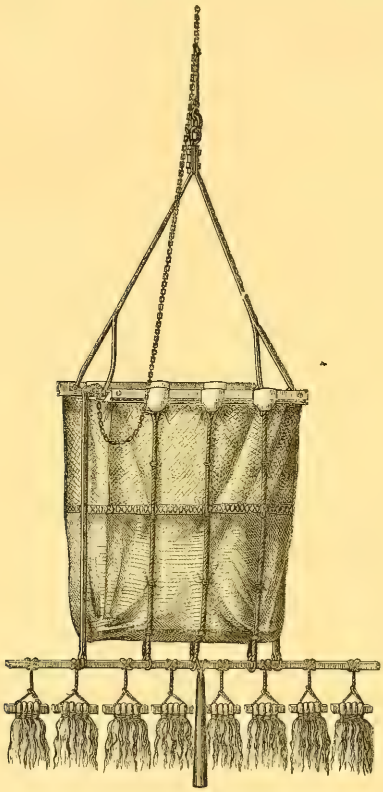


FIG. 8.—The form of Dredge used on board the CHALLENGER.

ring by a single strand of bolt-rope, so that if the dredge by any chance catches, the seizing gives way, and, by altering its position and throwing the strain in a different direction, gives a better chance for its recovery. The iron bar which runs across the bottom of the dredge-bag is of inch square iron and about 5 feet long, and to it are attached about eight hempen tangles or swabs. In deep water a 28-lb. deep-sea lead is usually hung from the centre of the tangle-bar with four tangles on each side.

The iron framework of our largest dredge was 5 feet in length, and 1 foot 3 inches in breadth—its weight being 137 lbs.; the next size, which was made much stronger, was 4 feet in length, 9 inches in breadth, and weighed 259 lbs.; and the smallest was 3 feet in length, 1 foot in breadth, and weighed 85 lbs. The smallest size was commonly used for great depths; with it we obtained a successful haul in 3875 fathoms.

The ship was provided with thirty-four dredges, eleven of which were expended.

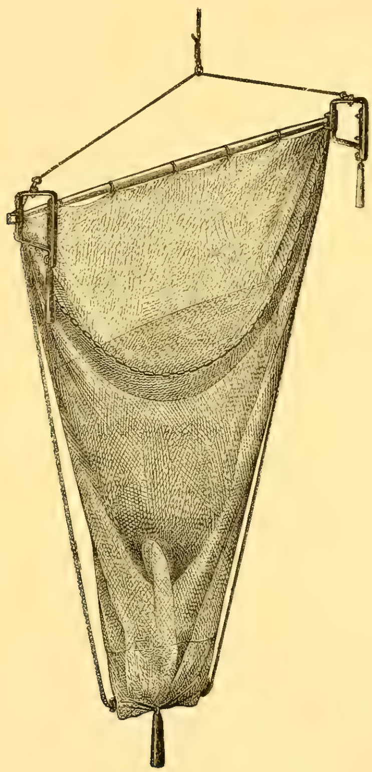


FIG. 9.—The Deep-Sea Trawl.

The Deep-Sea Trawl.—Fig. 5 represents the deep-sea trawl, which we used almost constantly during the latter part of the voyage. A conical bag, 20 feet in length, is suspended by one side to a beam of hard wood, 16 to 20 feet long, by half a dozen straps. The other side of the mouth of the net hangs loose, and is weighted with close-set rolls of thick sheet lead to drag along the bottom. Two iron runners, like the runners of a sledge, are fixed one at either end of the beam, and the runners are so weighted themselves, and so weight the beam, that they tend, if fairly launched, to keep beneath, with the trawl above them. A second bag or pocket, open at the bottom, hangs in the outer net reaching about three-fourths of its length, and acts as a valve preventing the washing out of its contents; and about a yard of the narrow end of the net is lined with "bread-bag," to give a chance of bringing up the more minute things, and a small sample of the bottom. The trawl is suspended by a bridle of rope, which is made fast to the runner at each end of the beam, and then continued down on each side and attached to the end of the trawl-bag.

The trawl was usually sent down with the additional weight of three 14-lb. hand-leads, and, and as in the case of the dredge weights, about $1\frac{1}{2}$ cwt. were slipped to a toggle 400 to 500 fathoms before it on the line.

We expended during the voyage sixteen trawls, having been supplied with twenty-two.

Dredging and Trawling.—Dredging and taking deep-sea observations from so large a ship was altogether a new experiment, and it seemed to present some special difficulties, or at all events to require great management. The weight of the ship was so great that there could be no "give and take" between her and the dredge such as we have in smaller vessels. If there were any way on, the impulse to the dredge was irresistible, and it seemed to tend to jerk it off the ground. The roll of the ship and her height above the water, and her want of flexibility of movement compared with the vessels which had been previously employed for the purpose, raised many new questions as to the most advantageous method of working.

Dredging and trawling were carried on in the CHALLENGER from the yard-arm. The "accumulators" are india-rubber bands or springs $\frac{3}{4}$ths of an inch in diameter, and 3 feet in length, having at each end a thimble "seized in." They are used in dredging to measure the amount of strain on the dredge-rope, and to give warning of any undue strain, so as to give an opportunity of easing it and preventing the rope from breaking. The accumulators are capable of stretching to a length of 17 feet, when they each exert a force of 70 lbs.; beyond this they should not be stretched, as they are liable to carry away. When stretched 13 feet they exert a force of 56 lbs. For dredging purposes we used a combination of eighty accumulators; to stretch these 17 feet, a force of $2\frac{1}{2}$ tons was required, that is, a force equal to the breaking strain of the rope. The accumulators, instead of being triced up to a block on the yard, as they were for sounding purposes, were secured to a pendant hooked on to the cap, which pendant was hauled out, or eased in by a burton on the end of the yard, as the dredge was required to plumb the sea or the dredging platform. Before fastening the dredge rope to the chain of the dredge, it was passed through two thimbles. One was used for a special purpose

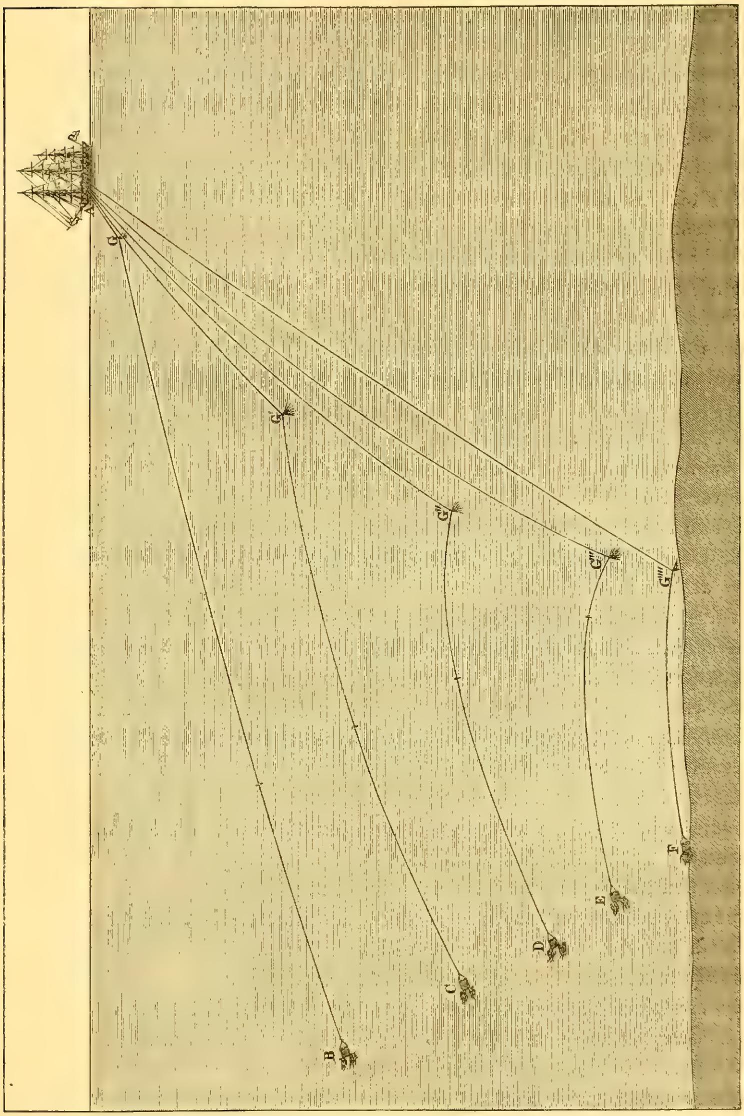


Fig. 10.—The relative positions of the Ship, the "Messenger" Weights, the "Toggle" and the Dredge, at different stages of "Paying out" from the Challenger.

described hereafter; to the other a small tackle was hooked, to haul the rope close to the ship's side when required. The dredge or trawl being ready to go over, the ship was put before the wind, and the jib hoisted, the wind being kept a little on the quarter of that side of the ship it was intended to work from, in order to drift the dredge clear of the propeller. The dredge was now triced up to the block below the accumulators, and the burton on the mainyard hauled out until the dredge plumbed the sea; it was then lowered down a fathom or two below the surface, and the rope checked, so that from the platform the tangles might be seen to trail clear of the dredge-bag. This having been satisfactorily ascertained, the rope was let go and allowed to run out freely, the ship forging slowly through the water, leaving the dredge to sink astern, and thus preventing all chance of fouling. The rope was checked occasionally to ensure its being taut from the dredge.

When from 300 to 500 fathoms had been paid out, a toggle was lashed to the rope, which was then let run until a sufficient quantity had been paid out to allow the toggle to reach the bottom were the line perpendicular. The dredge and rope then occupied the position A B, shown in fig. 6, and the ship was brought to the wind and kept stationary, or, if there were much wind, steamed slowly towards the dredge, taking care not to overrun it. A weight of $1\frac{1}{2}$ cwt. was now attached to the thimble through which the rope was rove before it was secured to the dredge chain, as mentioned above, and the weight and thimble being let go they travelled down the curve of the rope until they were brought up at the toggle. The dredge and rope by means of this additional weight now successively assumed the positions A C, A D, and A E, until finally the dredge reached the bottom at F, the weights being in the position of G′, G″, and G‴, &c. It is evident that, provided there were no surface or under-current, the dredge *must* reach the bottom with the tangles trailing fairly after it, if sufficient time had been allowed for it to sink. The surface current could always be ascertained and allowed for; when the dredge, therefore, came up foul, as it occasionally did, we could only ascribe its doing so to the influence of some under-current, which need not necessarily have been at the bottom,—or to the rope when new twisting the dredge round and round.

We found by experience that about three hours were required to sink the dredge in this manner when the depth was about 2500 fathoms. When it had reached the bottom the ship was allowed to drift broadside to the wind for a certain time, until the accumulators pointed out, by their extension and contraction, that the dredge was being dragged slowly over the ground. When the dredge fouled, the strain of the ship immediately stretched the accumulators to their utmost, the line was at once let go to prevent its carrying away, and the ship was brought head to wind and kept stationary, the rope being hove in slowly; if it continued foul, the ship was steamed ahead of and all round the supposed position of the dredge to endeavour to clear it (as a boat's anchor is cleared when jammed on a coral reef or amongst rocks); finally the dredge either got clear by the stop breaking, or by the line carrying away. Where no accident occurred, when the dredge had been on the bottom for a sufficient time—from an hour and a half to two hours—the rope was brought to the deck-engine, and the dredge brought up. We found that the strain on the line was so great that the men could not hold on to it while it was being hove in, when turns were passed round one drum only of the engine; by the arrangement already described (p. 10), by the time the rope had reached the starboard drum, the pressure was so far relieved that the men could handle it easily, and a great support was given to the bearings of the engine.

On one or two occasions, when, owing to the great depth (over 3000 fathoms), we could not spare sufficient time to allow the dredge to sink in this manner, we fastened a sounding-rod to the bottom of the dredge-bag or trawl and put 4 cwt. of detaching weights on the rod. The dredge was then let go perpendicularly, the ship being kept stationary until sufficient line had been paid out to allow the rod to reach the bottom and disengage the weights, when the ship was allowed to drift a little way, and the leads were then attached to the thimble and allowed to slide down the rope to the toggle. This is a very good way of dredging or trawling quickly in deep water.

In running a section across one of the ocean-basins at the average depth of the ocean —from 2000 to 2500 fathoms—the dredging operations on board the Challenger fell into a regular routine. Steam was got up at daybreak (we had probably been running on under sail all night), and the ship was hove-to during the morning watch and a sounding taken. The exact depth, the nature of the bottom, and the bottom temperature having been thus ascertained, and a sample of the bottom-water procured, the dredge or trawl was put over after breakfast, and the line slowly veered, in the manner described above, to about 4000 fathoms. In from two to three hours the movements of the accumulators indicated that the dredge had reached the bottom, and it was allowed, with all precautions, to drag for an hour or two. The operation of heaving-in then commenced, and continued for four hours or more, according to the resistance from the weight of the dredge or the state of the weather. When the number of 100-fathom marks on board indicated that the dredge was nearing the surface, the naturalists congregated on the bridge, and preparations were made for its reception.

Thus a single dredging operation occupied a whole day. When the dredge came up the light was usually beginning to fail, and we were sometimes obliged to use lanterns in clearing it. In hot climates it was unsafe to attempt to keep creatures over the night, they were almost sure to be half decomposed before morning; they were therefore registered and put into spirit at once, and we thus lost many opportunities of observing in detail the colours of the animals, and the structure and consistence of their fresh tissues. Animals from great depths were always brought up dead, so that we had not to regret lost opportunities of watching their movements or habits.

The Tow-Nets.—The nature and source of the deposits at present in process of formation on the bed of the ocean was one of the most interesting problems with which we had to deal, and we soon found that while over a large part of the area of the ocean the deposits consisted mainly of the hard parts of animals, the closest relation existed between the animals included in the bottom deposit of any particular area, and the fauna of the over-lying water of the same area. This observation, which we had daily opportunity of repeating and verifying, gave a special interest to the study of the fauna, principally microscopic, of the surface and of intermediate waters; and observations with the tow-net were prosecuted by Mr Murray with the utmost perseverance and care throughout the voyage, so that almost every sample of the bottom taken from the sounding-tubes is supplemented in our collection by a bottle of surface organisms from the same spot preserved in spirit; and in many cases by a series of such specimens taken from different depths.

The tow-nets were of the ordinary form, conical bags suspended from rings. The rings were made of $\frac{3}{8}$-inch round rod-iron, and were 12, 14, 16, and 18 inches in diameter. They were painted and then covered with unbleached cotton or duck, with a margin of the cloth left at one side to which the bag could be sewn. The nets were of fine book-muslin, of cotton bleached or unbleached, or of buntine. A ring 12 or 14 inches across bore a net 4 feet 6 inches long, and for wider rings the length of the net ran up to 5 feet 3 inches. The net tapered from the ring to a width of 16 inches at the bottom, into which a disk of the muslin or other material was sewn to facilitate the transfer of the contents of the bag into a glass jar. Three cords, $\frac{3}{8}$ths of an inch round, were made fast to the ring at equal distances and met 4 or 5 feet in front of the ring in a loop to which a suitable length of sounding-line was attached for dragging the net. A muslin bag was used when we were moving very slowly—less than two knots an hour—through the water; when we were going faster the stronger or more open (buntine) net was employed.

When it was wished to sink a tow-net a short way beneath the surface, a hand-lead of 12, 14, or 20 lbs. was fastened to the line a few yards in advance of the net, and the faster the ship was moving through the water the heavier was the weight used. Sometimes two or three nets were attached to one line at various distances along it, and sometimes nets were attached at different points along the dredge-rope during its descent; but these attempts to take samples of the fauna from different horizons were rarely successful, and we found that by far the best way, both at intermediate depths and at the surface, was to use a single net at the end of the line and to tow it as slowly as possible. The tow-net is most readily worked from a boat; when the ship was going more than three or four knots it was found impossible to use it with advantage. The tow-net was emptied by putting the hand as far into the bag as possible and turning the end of the bag inside out in a large glass vessel of sea-water, and shaking it well without touching its contents.

Some minute creatures are crushed and broken or lose their characteristic form, even when they are treated thus tenderly, and can only be seen in full beauty as it were accidentally. On one occasion in the Pacific, when Mr Murray was out in a boat in a dead calm collecting surface creatures, he took gently up in a spoon a little globular gelatinous mass with a red centre, and transferred it to a tube. This globule gave us our first and last chance of seeing what a Pelagic Foraminifer really is when expanded and uninjured.

The Sieves.—A number of tubs were ranged on the bridge and filled with sea-water, when the dredge or trawl was nearing the surface; two at least of these were provided with sets of sieves, so arranged that the lowest sieve fits freely into the bottom of the tub, and the three succeeding sieves fit freely one within another (fig. 11). Each sieve is provided with a pair of iron handles through which the hand can pass easily, and the handles of the largest sieve are made long, so that the whole nest can be lifted without stooping or putting the arms into the water. The upper smallest sieve is usually deeper than the others; it is made of a strong open net of brass wire, the meshes $\frac{1}{2}$ inch to a side. The second sieve is a good deal finer, the meshes $\frac{1}{4}$ inch to a side; the third is finer still, and the fourth so close as to allow the passage of mud or very fine sand only. The sieves are put into the tub and the tub filled up to the middle of the top sieve with sea-water. The top sieve is then half-filled with the contents of the dredge, and the set of sieves are gently moved up and down in the water. It is of great importance not to give any rotatory motion to the sieves in this part of the process, for such is very ruinous to fragile organisms; the sieves should be gently churned up and down whether singly or together. The result is that the rougher stones and gravel and the larger organisms are washed and retained in the upper sieve; the fine mud or sand passes through all the sieves and subsides into the bottom of the tub, while the three remaining sieves contain in graduated series the objects of intermediate size. The sieves are examined carefully in succession, and the organisms removed with a small pair of bone or brass forceps.

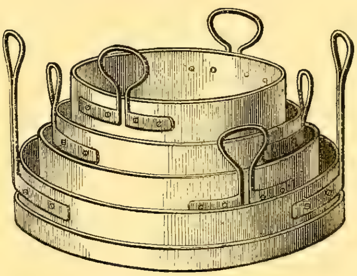


FIG. 11.—Set of Dredging Sieves.

The Work-room.—Two sets of cabins were specially built on the after part of the main-deck for the different departments of the scientific work. The chart-room, the headquarters of the naval scientific staff, was a commodious apartment on the starboard side, with ranges of shelves stocked with charts, and hydrographic, magnetic, and meteorological instruments. All the work in these departments, as well as the whole of the practical operations in dredging, sounding, and taking bottom and serial temperatures, was conducted by the naval officers.

The Naturalists' work-room corresponded with the chart-room, but on the port side, and as this was a novel addition to the equipment of a surveying ship I describe it somewhat in detail. The work-room (fig. 12) was 12 feet wide by 20 long, the height between decks 6 feet 10 inches. It was lighted by a large square port, a small scuttle, and two cupola sky-lights, and the side towards the main-deck was closed by movable glazed sashes. At either end of the room were fitted broad mahogany dressers, with knee-holes and spacious cupboards, and tiers of drawers beneath; and book-shelves and cupboards against the bulkheads above. At the back of the dressers all round were racks and holes to fit the fish globes and the bottles of various sizes in constant use, and similar racks were fitted wherever there was available space, against the ship's side. For convenience of working at sea it is impossible to have too many such racks, into which bottles may be instantly put in safety in case of the vessel suddenly rolling. Racks for test-tubes, which are simply thick slabs of mahogany drilled with deep holes to fit the tubes set as closely as possible, were fitted against the sides. Similar slabs of smaller sizes were also used for standing on the table while tubes were being filled with specimens. Some of the drawers in the dressers were fitted with racks for smaller bottles for specimens under examination, or for reagents, and others which contained forceps, tools, corks, and all the innumerable small things required for our complicated operations, were cut up by vertical partitions into small compartments to prevent their contents being shaken together. The instrument-cases had each its own compartment in the drawers and cupboards, in which they were secured by battens, and a fresh-water tank and sink occupied a space against the side bulkhead.

Long shelves, with ledges running parallel with the beams overhead, gave a great deal of stowage room, and various implements, such as harpoons, botanical vasculums, an injecting copper, &c., were conveniently suspended from the beams and deck by hooks. A large table was placed across the centre of the work-room, running right up to the port, so that two persons sitting opposite one another at the end of the table close to the port had a good light for their microscopes. The most convenient height for the table, using chiefly Hartnach's microscopes, is about 2 feet 9 inches; the microscopes were secured to the table by brass holdfasts, like those in common use on carpenters' benches; the holdfast, when brought to bear upon the back of the footpiece, holds the instrument rigidly firm; two holes were bored in the table for the holdfast, one for holding the microscope in position when in use, and the other for securing it when set aside. The centre of the table was divided by low fixed battens into oblong compartments, for micro-reagents, canada-balsam, glycerine jelly, and the paraphernalia used in examining objects with the microscope, and mounting microscopic preparations; inkstands, and drawing materials. Two large moderator lamps swung below the cupolas, movable branches for candles were screwed to the bulkheads; and for examining minute surface animals at night, when they were frequently in greatest abundance, the "Bockett" microscope lamp, made by Collins, was found most useful. Three of Hartnach's small-model microscopes with objectives 2, 4, 7, 8, and 10, were in constant use in the work-room, but one of Smith and Beck's binoculars was found more convenient for observing surface animals by reflected light. Several other microscopes by Ross, Zeiss, and other makers were available, and a number of ordinary dissecting microscopes.

The heat of the Tropics affects unfavourably many of the substances in common use

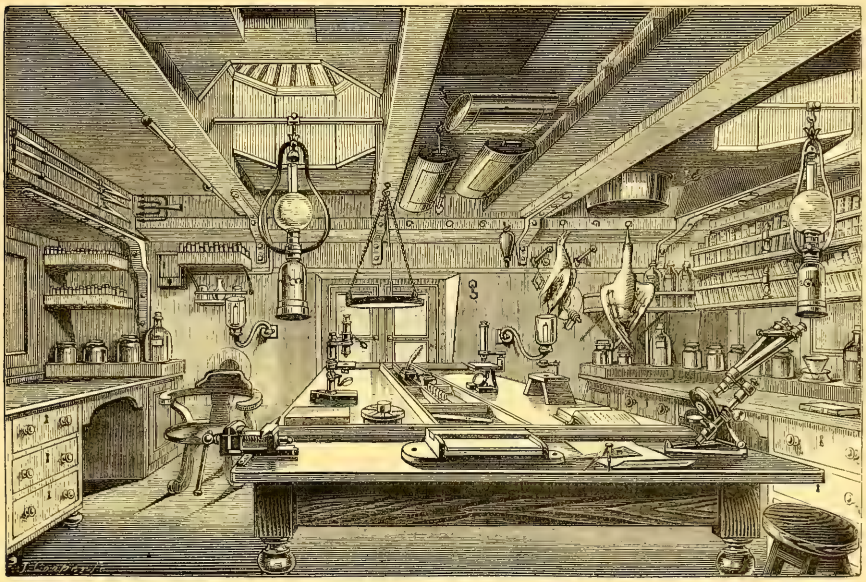


FIG. 12.—The Naturalists' Work-room.

for mounting microscopic preparations; thus glycerine jelly will scarcely set at all, but remains nearly fluid, and the different varnishes and lacs continue soft and sticky. It is unsafe to pack preparations on edge, and we find small pine wood cases, supplied by Charles Baker, High Holborn, containing each twelve horizontal trays with accommodation for six dozen slides, most suitable for storing. It is difficult to keep instruments, particularly those which are necessarily made of steel, in working order on board a ship; even with great care, they are so rapidly destroyed or lost. For this reason it is necessary to have an almost unlimited supply of those in most frequent use, such as scissors, forceps, and scalpels; reserves being rubbed over with mercurial ointment and stored away where they can be looked at from time to time.

The Deck-house.—When we got into hot weather, some of the operations carried on in the work-room, such as changing the spirit in which specimens had been steeped for some time, or skinning or preparing birds, in no way conduced to the comfort of the main-deck. A small deck-house was accordingly built abaft the screw-well, and there any processes which were likely to prove offensive was carried on under the control of Mr Murray, with Pearcy as an assistant. The deck-house became also latterly the head-quarters of the constant exercise of the tow-net, which in the hands of Mr Murray has produced such valuable results.

Preserving Media.—According to our experience, strong spirit of wine is by far the safest and most convenient medium for preserving marine animals in quantity. The ammunition was removed from the fore-magazine of the CHALLENGER, and about a hundred cylindrical iron vessels, each containing four gallons of 85 per cent. alcohol, were stowed in the racks. A cistern, holding about thirty gallons, was fitted into the nettings immediately above the work-room; a pipe led the spirit down to a tap in the work-room, and the spirit, which was under the charge of the gunner's mate, was handed up in the cylinders when required and emptied into the tank, which was, of course, kept carefully locked. The key of the spirit tap in the work-room I kept on my own bunch, and I may add, that under this simple arrangement we never had the least difficulty about spirit, although several thousand gallons passed in this way through the work-room during the voyage. Our first supply of spirit was soon exhausted, but we found no difficulty in having it renewed at all our principal stopping places.

A large number of cases of wide-mouthed bottles for preserving specimens in spirit were also stored in the magazine, and were filled as they were required. The cases were numbered and arranged in the racks in order, so that it was only necessary to give the rotation-number to the gunner's-mate in charge, and any case required was at once brought up to the work-room for inspection.

The bottles in which the greater number of the specimens were preserved were those known in the trade as "drop-bottles," manufactured for holding sweetmeats of various kinds, chiefly for exportation. They are of pale green glass, very transparent, and are closed by glass stoppers with cork rims. Three sizes were used, the diameters of the bottles being 6 inches, $4\frac{1}{2}$ inches, and $3\frac{3}{4}$ inches; with mouths $3\frac{3}{4}$, $2\frac{3}{4}$, and $1\frac{3}{4}$ inches wide respectively. The bottles were all 9 inches in height, and packed conveniently upright into cases with wooden partitions and hinged lids, and padded at the bottom with cork. These jars are extremely convenient, and are very moderate in price. 200 cases complete, containing 2300 bottles, were supplied by E. Breffit & Co., Upper Thames Street, at a cost of £70. We had also from Messrs Powell & Sons, Whitefriars Glass Works, several thousand wide-mouthed bottles, and tubes of various smaller sizes. The cases of empty bottles were taken from the racks and replaced by full ones as we proceeded. Whenever we had an opportunity, as, for example, when we reached one of our own dockyards, we sent home an instalment of full cases to the Admiralty, where they were received by the Hydrographer, and sent on to Edinburgh. They there passed into the custody of Professor Turner, F.R.S., who most kindly overhauled them, and saw that they were in good order, and the spirit sufficient, and stored them in a spare gallery in the University.

A large amount of material had been sent home from Bermuda, from Halifax, from the Cape of Good Hope, from Sydney, from Hong-Kong, and from Japan; and after the contents of the ship had been finally cleared out at Sheerness, we found, on mustering our stores, that they consisted of 563 cases, containing 2270 large glass jars with specimens in spirit of wine, 1749 smaller stoppered bottles, 1860 glass tubes, and 176 tin cases, all with specimens in spirit; 180 tin cases with dried specimens; and 22 casks with specimens in brine.

A book, which we called the "Station-book," was kept in the work-room, and whenever the ship stopped to dredge, or trawl, or make any special observation in any of our departments, a special sheet, to which a number was attached, was dedicated to the occasion, and every detail of date, position, depth, temperature, and nature of the bottom, was carefully entered as a heading, for which the form was printed at the top of the first page of each sheet. Then followed any details, and a rough list, zoologically arranged, of the animals procured.

The jars containing the animals from each station were labelled outside with the particulars of the station, and especially with its *number;* and to prevent any possible confusion, a slip of parchment, with the number written upon it with a dark pencil, was also dropped into each jar or tin. The duty of filling the station-books and carrying out these daily details devolved mainly upon Mr Moseley and Dr von Willemoes-Suhm, and I need scarcely say that the *possibility* of preparing such a report as we are now issuing is due to a great degree to the thorough efficiency with which this duty was performed.

The final packing of such delicate and brittle stores for their voyage home was a matter requiring much care and skill; it was done, in almost every case, under the direct superintendence of Mr Murray, who saw to the final labelling, and kept the reference books; and I may add that, of upwards of 5000 bottles and jars of different sizes sent from all parts of the world to be stored in Edinburgh, only about four were broken, and no specimens were lost from the spirit giving way.

Some other fluid media, such as glycerine and solutions of picric and chromic acids were employed occasionally for preserving specimens, but we never found that they were to be depended upon; and later experience has shown that objects preserved in any of these are not nearly so suitable for dissection and microscopic examination as when they are preserved in pure spirit, especially when the last change of spirit has nearly the strength of absolute alcohol. Our method usually was to plunge the animals direct from the dredge or trawl into spirit of about 84 to 85 per cent. (the ordinary rectified spirit of commerce). This, of course, became at once greatly diluted by the sea-water contained in the animals. After a few hours the specimens were sorted out and roughly examined and entered in the station-book. They were then packed in the store-bottles, a small number in each bottle, prevented from crushing one another by a loose padding of stiff paper or curled horse-hair, and the bottles filled up with 85 per cent. spirit. Most species will now keep perfectly if the bottles are not over-crowded, or the animals very deeply coloured; if, however, the specimens are of large size and contain much fluid or pigment, the spirit must be changed again, or even twice or thrice. It was a great advantage to us that we had the spirit duty-free so that we could use it pure instead of methylated. It is unpleasant and unwholesome to work much among the fumes of methyl, and I am satisfied that structure is not so perfectly preserved in methylated as in pure alcohol.

The Steam Pinnace.—Two of the CHALLENGER'S boats, the Pinnace and the Barge, were provided with engines suitable for sounding and dredging. The Barge was seldom used, but the Pinnace was found very valuable for dredging or trawling in shallow water, and in a smooth sea. She was a lifeboat 36 feet in length, with two pairs of engines, one pair for propelling her, and another for heaving in the dredge-line. The propelling engines were a pair of high-pressure direct-acting vertical engines of six horse-power (nominal), with a horizontal tubular boiler, and a disconnecting shaft and screw. At full speed the engines travelled at about 240 revolutions a minute, and on the trial for speed over the measured mile the boat averaged eight knots an hour. The dredging engines were fitted to the top of the boiler; they were a direct-acting horizontal pair, the cylinders at the after end of the boiler, and the crank-shaft forward. The shaft extended beyond the boiler on both sides, and at each end a drum was fixed. The drums were constructed with two sheaves, and to the larger or the lesser of these the dredging line was led.

THE PREPARATION OF THE REPORT, AND THE TEMPORARY AND THE FINAL DISPOSITION OF THE SPECIMENS.

When I accepted the responsibility of the scientific direction of the CHALLENGER expedition I had already considerable practical experience in such work; and I had an idea of the amount of material in marine zoology which we might hope to accumulate if we were even moderately successful. I was also well acquainted with the often unsatisfactory history of similar expeditions, as I had more than once had occasion, both in this country and abroad, to consult their fragmentary records, and to lament the loss or the confusion of their collections. It was, therefore, from the first a matter of grave consideration with me by what machinery it might be possible to keep the collection together, and to prepare a report which should justify the expense of the voyage, and bring its results in the different departments included in our instructions in a definite form within the domain of acquired knowledge.

As the scheme of dredging at extreme depths was a novel one, and there was still great uncertainty both as to the practicability of the investigation, and the amount of the probable results if it proved successful, it seemed premature to make a definite arrangement before leaving England as to the final disposal of a problematic collection. We started, accordingly, with the obvious understanding that all collections made, as well as all official journals, and all other scientific work done by the salaried members of the scientific staff were Government property, to be dealt with finally as Government might direct; and further, that on the return of the expedition means should be provided for working out and publishing the scientific results of the voyage under my direction.

In the first instance, the instructions of the Admiralty, that no publication of any portion of the results should take place during the voyage, except through my own official reports, was very definite. I thought it my duty, however, to represent strongly to their Lordships, that some of the gentlemen associated with me in the undertaking might reasonably expect to have the advantage of publishing at once any new results of value, which they might obtain in their several departments, in their own names; and it was finally conceded that it should be left to my discretion to allow the publication of what appeared to me suitable, on my own responsibility, in certain transactions and journals. Under this special sanction several important Memoirs were published by Mr Moseley and Dr v. Willemoes-Suhm in the Transactions of the Royal and Linnæan Societies.

So early as the 13th November 1874, Captain Evans, C.B., F.R.S., the Hydrographer of the Admiralty, wrote to me asking my views as to the mode of working up and publishing the scientific results of the expedition; and the temporary and ultimate disposition of the collection, of which a considerable bulk had already been sent home. The temporary arrangement was at that time the most pressing, and I quote from my reply, dated January 8, 1875 :—

When I undertook my share in this expedition, it was with the understanding that I did so specially with the view of superintending the working out of the results in the department under my direction. This I could not undertake to do if the collections passed into other hands, or were dispersed without my direct supervision. The notes and references are very complicated, prepared by different hands; and the collection would lose half its value if its arrangement and description was undertaken by any one who had not a full knowledge of its antecedents. I believe that the great reason of the comparative failure of the natural science results of former expeditions has been, that no proper or liberal arrangement has been made for the publication of the full report; when the expedition returned the interest was to a great extent over, and some other interest had taken its place; and an inadequate sum was voted which started a publication which was afterwards allowed to drop. The NOVARA expedition is an important exception, and Wilkes' expedition was in some departments worked out admirably and fully. The collections from the French expeditions usually passed into the hands of the authorities at the Jardin des Plantes. They were frequently described at great expense by Government; but much of their value was lost from their not being published at once with the fresh details by the naturalists by whom they were made. I have briefly indicated in a former letter my reasons for proposing that the whole of this collection should be sent in mass to Edinburgh. From my connection with the University I can there command space for storing the things, and assistance in having them looked after. The deep-sea collections, which I regard as of infinitely the greatest importance, are packed in tins and in cases of large glass jars; all of these are liable to injury on the passage, and Professor Turner of Edinburgh has most kindly agreed to see to them, and to have the spirit or brine renewed when necessary, and any reparable injuries repaired.

This recommendation was adopted by the authorities.

After some further correspondence, the following letter was addressed by the Secretary of the Admiralty to Captain Thomson:—

ADMIRALTY, *July* 14, 1875.

SIR,—I am commanded by My Lords Commissioners of the Admiralty to acquaint you that, as the voyage of the CHALLENGER is approaching its termination, it is desirable that they should be in possession of detailed information as to the probable expenditure which will be required after the ship pays off, for the final disposal of the Natural History specimens collected during the voyage, as well as the arrangements for the publication of an account of the Natural History portion of the proceedings of that ship.

2. You are therefore to call on Professor Wyville Thomson to report:—

First, The steps he considers desirable for the disposal and conservation of the Natural History specimens, the time to be occupied, and the number of persons he requires to assist him in that duty; also the details of the probable expenditure for that service, including salaries, for the financial year 1876–77.

Second, The measures he would propose, so far as he can foresee, for the publication of the Natural History portion of the CHALLENGER'S proceedings, with detailed explanation of the probable expenditure as above.—I am, &c., (Signed) ROBERT HALL.

Captain Thomson, R.N.,
H.M.S. CHALLENGER, Valparaiso.

Captain Thomson handed me Admiral Hall's letter in due course, and in my reply I gave an outline programme of future work, from which there has been no reason to deviate materially. Some of the minor details arranged themselves somewhat differently, but the general scheme was sanctioned by their Lordships, and has worked satisfactorily throughout.

H.M.S. CHALLENGER,
VALPARAISO, *Nov.* 22, 1875.

SIR,—In accordance with your instruction, dated 21st November, 1875, I have the honour to submit to you a report on the steps which I consider desirable for the disposal of the Natural History specimens procured during the CHALLENGER Expedition, and the measures which I would propose for the publication of the Natural History portion of our proceedings.

2. I take for granted that the first object in importance is to prepare from the journals and notes, and from the study of the collections, a complete account of the scientific results of the voyage, comparable perhaps with that which is now being published in Vienna of the results of the voyage of the Austrian frigate NOVARA; and that the other object is to put the various collections in a form in which they can be used for comparison and study, and finally to distribute them to different museums according to a given plan. I do not see that it is possible, in the present case, to separate entirely these two principal objects. The specialists who undertake the different groups must see the whole of the specimens of each group; and it is by their separating and naming allied species, and describing new forms and selecting specimens for study, that the collections will be prepared for final distribution. I do not think that the account of the voyage could be fully published and the whole matter closed in less than five years from the 1st of May 1877. During these five years the expenses might be estimated at £4000 a year, one year with another, supposing the printing to be done at the Government printing-office.

3. This ship may probably pay off in England towards the end of June 1876. As we shall be engaged with observations up to the very last, the first step must be to get the collections and notes into order, and to prepare the specimens for reference and study. This will be a heavy matter, and it will require for a time the co-operation of the whole staff, each in his own department. I would suggest that the positions of the members of the civilian staff remain as they are, and that their salaries be continued up to the end of the quarter which closes on the 31st March 1877. Besides being by far the most convenient way of winding up the practical work of the cruise, I think that so much consideration is due to the members of the civilian staff; for all of them gave up remunerative situations to join this expedition, and it is impossible for them to count upon slipping at once into equivalent positions.

4. After careful consideration I think I can undertake that the preliminary reports and journals shall be made up to the end and put into form, and the collections roughly arranged and put into a condition for distribution to experts, on the 1st of May 1877, but not before that date.

5. From the paying-off of the ship till the end of April 1877, taking the time as a whole year, I would estimate the expenses at £2800, viz.:—

The Salaries of the present Staff	£2000
The Salary of Pearcey as trained Assistant	100
Contingent Expenses, including the pay of a servant, the putting up of fittings and other carpenter's work, the purchase of a large quantity of glass jars and spirits of wine, travelling expenses, &c.	700

This is supposing that we can get accommodation free, which I believe we can. It would be about three quarters of a year; so that the actual sum would be £2100 or £2200, for I do not think the contingent account for that period would bear much reduction.

6. After the 1st May 1877, I would propose that the arrangements be put on a new footing. It will then be necessary to call in the assistance of outsiders, who are experts in the different departments. The members of the present scientific staff will be free to undertake other employment, and certain work will be put into certain men's hands, and they will be paid for what they do according to a scale for which we have sufficient precedent. I think it would be only right that those who have taken part in the expedition should be allowed the first choice of the departments which they propose to take up. . . . .

Mr Murray will report upon the nature of the Sea-bottom; . . . . but I propose that he shall be retained as a permanent Assistant Naturalist in charge of the collection; and he would not be paid for writing in addition to his salary. I am prepared to describe certain groups of Echinoderms and Sponges

7. The assistance I should require in working up the collections and publishing the results for the five years after the 1st May 1877 would be, so far as I can at present judge :—

(1) An Assistant Naturalist, to take charge of the collections, and to regulate the details of their distribution and their issue to and return from those who are working up the different branches; I would ask that Mr Murray be retained for this purpose, and his present salary be continued, with £100 a year in addition for lodging money.

(2) An Assistant to look after the correspondence and accounts, and to take the mechanical and detail part of the editing. I should ask for him a salary of £300 a year, and I should wish to have his choice and appointment in my own hands, and he would require to be a capable man of business, with an intelligent idea of Natural Science.

(3) A working Assistant; and I should ask to retain Pearcey in this capacity, at a salary of £100 a year.

(4) A contingent sum for additional assistance when required, spirits of wine and jars, travelling and petty expenses, &c., £400 a year. If the responsible charge of the arrangements remain in my hands, it will take up the whole of my time which is not occupied with my official duties in Edinburgh; and of course I cannot be expected to undertake it without sufficient remuneration to guarantee me against loss. These constant expenses being met, I think that the remainder of the £4000 would cover those of authorship and illustration.

8. I have no special views as to the ultimate distribution of the specimens. It seems evident that the full and complete series should go to the British Museum; but as it is that series which must be specially described and illustrated, I do not think that the whole can possibly reach the Museum for at least three years. In looking over the collections, it would be very desirable that a second set of duplicates of objects of public interest, not required for description, should be sent at once to the British Museum.

9. I must take this opportunity of repeating what I said in a former letter addressed to the Hydrographer, that it seems to me, considering the very close connection between those parts of the work of the expedition which have been conducted chiefly or wholly by the Naval Officers (I refer more particularly to Hydrography and Meteorology) and those parts which have been under the more special charge of the Civilian Staff, that it would make the result more satisfactory, and prevent a mass of unnecessary repetition, and possibly otherwise unavoidable discrepancy and error, if one or two of the Naval Scientific Staff were associated with us in preparing the general Report.

. . . .

(Signed) C. Wyville Thomson,
Director of the Civilian Scientific Staff.

Captain Frank T. Thomson,
H.M.S. Challenger.

On the 5th of September 1876 I received a letter from the Secretary of the Admiralty, informing me that the whole question of the arrangements connected with the publication of the Challenger Report, and the disposal of the collections, had been transferred from the Admiralty to the Treasury, and I was requested to communicate in future with that Department. I may add that since that time the grant for the publication of the CHALLENGER results has been administered directly through the Treasury and the Stationery Office; no practical difficulty whatever has arisen from this transfer, as the Treasury accepted without material change the scheme which was already in operation.

Shortly after our return I communicated with naturalists at home and abroad who had given special attention to the different sections of the marine Fauna, and requested their assistance in describing and figuring the newly-discovered species, and in discussing their zoological and palæontological relations, their geographical distribution and any other points of interest in connection with them. In the meantime my friend and fellow-worker Professor Alexander Agassiz joined me in going over the whole collection, and, with the assistance of Mr Murray, we completed the zoological arrangement, which had been roughly attempted on board, and prepared each series so that it might be readily sent to the specialist to whom it was to be intrusted. This preliminary work occupied several months, but towards the close of the first year after the return of the ship, most of the naturalists who had undertaken the description of the more important groups, including, with others, Professor Haeckel, Dr Carpenter, Mr H. B. Brady, Professor Allman, Mr Busk, Dr G. Brady, Mr Davidson, Mr Spence Bate, Professor Huxley, and Mr P. L. Sclater, had gone over the collection in our rooms in Teviot Row, and had got a general idea of its extent and scope.

When the collections of specimens of the different classes into which we had found it convenient to break up the zoological collection was ready for distribution, I printed for the use of the naturalists engaged, a track chart of the voyage; and a list of the observing Stations, giving—

1. The number by which each particular station is referred to throughout.
2. The date.
3. The exact position of the ship at noon of the day on which the observations were made.
4. The depth in fathoms (=6 English feet).
5. The bottom temperatures.
6. An abbreviation as it is given in the charts, indicating the nature of the bottom.

This list was prefaced by a short statement of the plan of working which it was proposed to adopt; and as these arrangements have as a rule answered their purpose well, I give the preamble almost in full, in the hope of its being found useful for reference on some future occasion. The list of stations, with all necessary details, is given in the Appendix to this introduction.

UNIVERSITY, EDINBURGH, *January* 2, 1877.

The special object of the CHALLENGER Exploring Expedition was to investigate the physical and biological conditions of the great ocean basins; and with this object in view, during an absence from England of three years and a half, and at intervals as nearly uniform as circumstances would permit, throughout a course of 68,890 miles, 362 observing stations were established.

The following list of these stations has been compiled for the use of those naturalists who have consented to assist in the working out of the scientific results of the expedition, with a view to their being published in an official account of the voyage. Interesting observations were made on land as opportunity occurred during the short periods of the CHALLENGER'S stay in port, and during her short visits to remote islands; but these observations were necessarily desultory and incomplete, and it has been decided to omit their consideration from the present work, and to publish such as may appear of sufficient value in the transactions of learned Societies. The official report will thus consist strictly of an account of the additions which have been made to the knowledge of the physical and biological conditions of the ocean by the expedition.

At each station the following observations were made, so far as circumstances would permit. The position of the station having been ascertained—

1. The exact depth was determined.
2. A sample of the bottom, averaging from 1 oz. to 1 lb. in weight, was recovered by means of the sounding instrument, which was provided with a tube and disengaging weights.
3. A sample of the bottom water was procured for physical and chemical examination.
4. The bottom temperature was determined by a registering thermometer.
5. At most stations a fair sample of the bottom fauna was procured by means of the dredge or trawl.
6. At most stations the fauna of the surface and of intermediate depths was examined by the use of the tow-net variously adjusted.
7. At most stations a series of temperature observations were made at different depths from the surface to the bottom.
8. At many stations samples of sea-water were obtained from different depths.
9. In all cases atmospheric and other meteorological conditions were carefully observed and noted.
10. The direction and rate of the surface current was determined.
11. At a few stations an attempt was made to ascertain the direction and rate of movement of water at different depths.

The numerical results of observations yielding such are now available in the logs, in the various reports to the Admiralty, and in the note-books and official journals of the Naval and Civilian Scientific Officers attached to the expedition.

The samples of the bottom procured by the sounding instrument were carefully preserved in tubes or in stoppered bottles, either dry or wet, with the addition of alcohol.

The samples of bottom and intermediate waters were determined as to their specific weight; in some samples the amount of carbonic acid, and in others the amount of chlorine, was determined; in others the contained gases were boiled out and sealed in tubes for future examination; and a large number of samples were reserved in stoppered bottles for analysis.

The mud and minerals and inorganic concretions brought up by the dredge or trawl were preserved in large quantity in boxes or jars for examination and analysis.

The collection of invertebrate animals is of great extent; and from most of the species being undescribed, and from the great peculiarity of the distribution of the fauna of the deep sea, it will perhaps yield the most generally interesting results.

The invertebrate animals from the deep-sea stations were, with few exceptions, placed in jars of rectified spirit, closed with stoppers smeared with a mixture of tallow and wax, covered over with bladder, and the tops painted with a black varnish. The animals of different groups were in many cases roughly selected at each dredging, and put into different jars; but frequently, in order to save jars and spirit, it was necessary to put the whole result of one dredging into one or two jars, the animals of all groups mixed. Each jar was marked outside with the locality and the number of the station; and the station number written with a black pencil on a slip of parchment, was placed *within* each jar. The collection on its arrival in this country was thus arranged geographically. It came home in excellent order.

To ensure accuracy so far as possible, the observing stations have been numbered from 1 to 354, and a number corresponding to the station is on every sample of every description, and on every record of the result of observations for every station; and the same number is carried through the whole series of journals and other books kept by the members of the Civilian Scientific Staff.

It is now our object, in preparing a scientific account of the voyage, to describe these investigations, and to give their results in detail; and to develop, as far as possible, the bearings of these results upon one another, and upon the broad problems of Physical Geography and Hydrography.

For this purpose it is necessary that the various numerical results should be reduced and tabulated; that the samples of soundings should be examined chemically and microscopically; that the samples of water and of air should be analysed; and that the animals procured by the dredge should be most carefully catalogued as to localities, and the forms new to science described.

The data for the physical and chemical work are in few hands, and these chiefly at headquarters. It is especially for the assistance of the naturalists dealing with the deep-sea fauna that these notes are drawn up.

Professor Agassiz, Mr Murray, and I, have now gone over the whole of the collection of marine invertebrate animals in spirit; and we have separated the zoological groups from one another for each station, and re-arranged the collection in zoological order. Each jar, therefore, now contains animals of one group only (*e.g.*, *Ophiurids* or *Alcyonarians*), to be described by one person. Each jar has within it a station number, which refers to the specimens which are loose in the jar; but in many cases to save space, and to lessen the number of large jars, there are in the same jar several packets done up in muslin, each packet containing animals of the same zoological group from another station, and each packet having within it its own station number.

The jars will be placed in the hands of the naturalists who undertake the description of the different groups, in their present condition; and in order to secure uniformity and the safety of the collection, they are requested—

1. To go carefully over the whole collection intrusted to them, and to select a first series, including all unique specimens; and a sufficient number of specimens of those of which there are several duplicates, to illustrate their geographical distribution; and to associate with each species a particular number, by which number that species may be always referred to afterwards—at all events, until it has been described and named. This is the collection which is to be described and figured, and it is ultimately to be placed as a collection of types in the British Museum. It will usually be desirable, for the purposes of description and illustration, to put the specimens of this first series into rectified spirit in clear glass bottles; and I will arrange in each case how the bottles are to be provided and the expense defrayed. This collection must be retained by the describer until the description of the whole is finished.

2. To select at the same time a second set, consisting of a complete series of duplicates, numbered to correspond with the numbers attached to the first series, species for species, and to pack them either in separate bottles or in packets in muslin, a number of packets together in one store bottle. This set to be returned to me for reference.

3. To pack up all the duplicates from the different stations, each species from each locality either in a separate bottle or in a muslin packet, with the station number and the number corresponding with the type specimen of the species along with it. It will greatly facilitate matters if this general duplicate collection is

returned to me along with the first series of duplicates, whenever the collection has been gone over, and the first series for description selected out.

4. For easy reference, each naturalist who undertakes the working out of a group will be provided with a large number of small vellum labels, marked thus :—

Ast.	(Asteridea.)
St.	(Station.)

and he need simply enter, *with a dark pencil*, the number which he has associated with the particular species, and the number of the station where the specimens were found; and put the label *into* the bottle or the muslin bag, as the case may be.

Special arrangements must be made in every individual case as to publication, but it is the general intention that the account of the voyage shall be in a series of volumes quarto, of the size of the Philosophical Transactions of the Royal Society. It will probably consist of—

1. Two volumes, containing—(1) such a general account of the voyage, and such hydrographic details, illustrated by charts and sections, as may be necessary for the clear comprehension of the scientific observations; and (2) a full discussion of the general results of the voyage, physical and biological. To these volumes will be appended tables of the routine observations in meteorology, &c., made during the voyage.

2. A volume containing an account of the physical and chemical observations and investigations, with a special discussion thereon. To this volume will be appended tables of analyses, tables of specific gravities, reports on the microscopical examination of minerals, &c.

3. A series of volumes, probably not less then six in number, containing a detailed account of the fauna, and plates illustrating the undescribed or imperfectly known forms.

In case of plates being required, the space available for figures on each plate is not more than 10 by 8 inches (= 25·5 by 20 centimetres). It is intended that the plates shall be, generally speaking, in lithograph; but if any form of engraving seem preferable in any case, a special arrangement may be made. Woodcuts will be given where required.

The intention at present is that the preparation of all the volumes shall go on simultaneously, and it is earnestly desired that the different parts may be done as speedily as is consistent with the utmost care and accuracy. Authors are invited to enter into any anatomical or other details which may be desirable for the full illustration of the groups in their hands; and their consideration is particularly requested of all questions bearing upon geographical distribution, and upon the relation of the deep-sea fauna to the faunæ of the later geological periods.

Authors will be at liberty to publish abstracts of the results of their work, during its progress, in the proceedings of Scientific Societies; but such communications should be made through me, or with my knowledge, and "by permission of the Lords Commissioners of the Treasury."

I am directed to report to Government, and to furnish my accounts at certain intervals; and in order that I may be able to do so, authors are requested to report progress and to render accounts and vouchers for any expenses which they may have incurred, to me quarterly; on or before the 1st of March, of June, of September, and of December.

The work has been carried on up to the present time very much according to the programme. Several Monographs are now (September 1880) completely finished, and the specimens returned and lodged in the British Museum; and most of the remaining Memoirs are in a state of greater or less progress.

The Nature and Distribution of the Fauna of the Deep Sea.

The special character of the fauna of the deep sea, so far as it is at present known, the sources from which it may have been derived, and its relations to the fauna of shallower water and of the fauna of past periods of the earth's history, will be discussed in detail in the summary of general scientific results, which will form the last volume of this report; it may be convenient, however, to give in this place a preliminary sketch of its general nature and scope; that the reader may form some idea of the relations, extent, and relative importance of the groups treated in the following memoirs, and of the conditions under which they severally occur.

The Absence of a Depth-Limit to Life.—The most prominent and remarkable biological result of the recent investigations is the final establishment of the fact, that the distribution of living beings has no depth-limit, but that animals of all the marine invertebrate classes, and probably fishes also, exist over the whole of the floor of the ocean.

My present impression is, that although life is thus universally extended, the number of species and of individuals decreases after a certain depth is reached, and that at the same time their size usually diminishes. This latter observation is not, however, true for all groups; a peculiar family of the Holothuridea, the Elpididæ (fig. 13), very widely distributed in deep water and found at the greatest depths, maintain the full dimensions of the largest of their class, and even exhibit some forms of unusual size. On two occasions in the North Pacific we brought up, from depths of 1875 and 2900 fathoms respectively, a species of *Monocaulus*, a tubularian hydroid allied to *Corymorpha*, a giant of its order, with a stem upwards of 7 feet high, and a head nearly a foot across the crown of expanded tentacles.

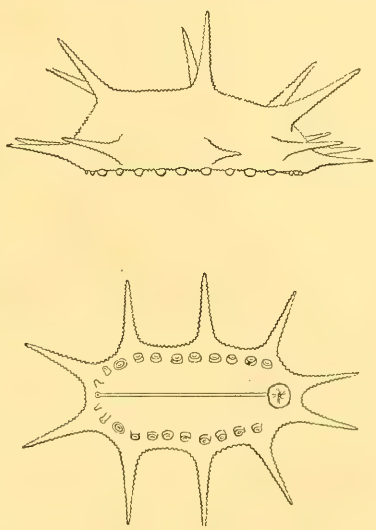


Fig. 13.—*Deima fastosum*, Théel. One of the Elpididæ.

Of the value of our present impressions on any question relating to the nature, or the relative abundance, or the relative size of the animals constituting the fauna at depths approaching 3000 fathoms, I am by no means sure. Using all precautions, and with ample power and the most complete appliances, it is extremely difficult to work at such depths either with the dredge or with the trawl. A single dredging operation takes a long time; the dredge is put over at day-break, and it is usually dark before it is recovered, so that the number of such operations must be comparatively small. It is necessary to take every precaution to keep the ship as nearly as possible in the same place, and as this can never be done absolutely, it is unsafe to run the risk of adding to what motion the dredge may already have acquired, by attempting to drag it for any distance along the ground; the consequence is, that in those cases where the dredge does reach the bottom, it probably too often sinks at once into the soft ooze and remains clogged with a single "mouthful" until it is hauled up again. Sometimes a slight excess of movement in the vessel, from a current or from wind-drift, seems to give a vibratory motion to the

FIG. 14.—*Askonema setubatense*, Kent. A Hexactinellid Sponge. One-eighth the natural size.

enormous length of rope, and to keep the dredge tripping over the ground, so that only a few things are picked up by the tangles or clinging to the outside of the net. We must, therefore, bear in mind that only an infinitesimally small portion of the floor of the ocean at depths over 2500 fathoms has yet been explored.

The Abyssal Fauna.[1]—Whatever may be the case at the extreme depths referred to,

[1] It has not been thought necessary, for the present at all events, to alter the name of the deepest zone of distribution of marine animals from that proposed by Edward Forbes. Although Forbes often expressed the belief that animal life occupied only a comparatively narrow belt round the shore, and that the bottom of the deep sea was azoic, still I think there can be no doubt that the population of his abyssal zone, in the "Boreal Sea" for example, was really a mixture of the fauna of the *infra-median* zone, with some of the true abyssal forms rising into shallower water with the isotherm of 35° F., and that he had therefore got a glimpse as it were of the van-guard of the abyssal fauna.—[Map of the Distribution of Marine Life. By Professor Edward Forbes, F.R.S. Keith Johnston's Physical Atlas, 2d edition.]

there can be no doubt that at depths which may be regarded as of comparatively easy access, say a little above 2000 fathoms, the fauna is sufficiently varied. The table on pages 36 and 37, taken from the "Station-book" gives the number of occurrences of representatives of the principal groups of marine animals at the fifty-two stations at which we dredged or trawled successfully at depths greater than 2000 fathoms during the voyage. All the groups marked with a cross were represented, having been observed and noted when the trawl or dredge came up; it is very probable that when the detailed lists are completed we shall find that many, particularly of the smaller forms, have been omitted. The occurrence of fishes, of cephalopods, and of decapod crustaceans must be taken with a reservation, as it was not always possible to determine whether they were taken on the bottom, or above it during the hauling in of the net.

Fig. 15.—*Hyalonema sieboldi*, Gray. A Hexactinellid Sponge (much reduced).

The abyssal fauna would seem, however, to attain its fullest development in a zone of depth between 600, and 1000 or 1200 fathoms; between these depths where the nature of the material of the bottom is suitable, there is the greatest abundance of Hexactinellid Sponges, of the characterestic deep-sea Alcyonarians, of Stalked Crinoids and Sea-urchins allied to *Asthenosoma* and *Salenia*, of the Elpididæ among the Holothuroidea, and of other special types. From 1200 or 1500 fathoms downwards, the fauna, although becoming apparently more scanty, maintains much the same character; and it seems to bear to the richer band at its upper limit somewhat the same relation as to derivation and mixing, which the fauna of the *infra-median* zone of Forbes at 60 to 100 fathoms bears to the *median* zone.

It would appear that round all coasts, except, perhaps, those within or bordering upon the Arctic and Antarctic regions, at a depth of from 100 to 200 fathoms the extension

TABLE Showing the Relative frequency of the occurrence of the principal Groups of Marine Animals at Fifty-two Stations at which Dredging or Trawling was carried to a depth greater than 2000 fathoms.

	Station 7, 2125 fathoms.	Station 5, 2740 fathoms.	Station 9, 3150 fathoms.	Station 20, 2975 fathoms.	Station 29, 2700 fathoms.	Station 40, 2675 fathoms.	Station 54, 2650 fathoms.	Station 61, 2850 fathoms.	Station 63, 2750 fathoms.	Station 64, 2750 fathoms.	Station 68, 2175 fathoms.	Station 69, 2200 fathoms.	Station 89, 2400 fathoms.	Station 101, 2500 fathoms.	Station 104, 2400 fathoms.	Station 131, 2275 fathoms.	Station 134, 2025 fathoms.	Station 137, 2550 fathoms.	Station 160, 2600 fathoms.	Station 165, 2600 fathoms.	Station 181, 2440 fathoms.	Station 198, 2150 fathoms.	Station 206, 2100 fathoms.	Station 215, 2500 fathoms.	Station 216, 2000 fathoms.	Station 223, 2325 fathoms.
Pisces . .						+			+				+	+	+			+			+	+				
Cephalopoda .																										
Gastropoda . .													+		+				+							
Lamellibranchiata		+							+						+			+	+			+			+	
Brachiopoda .																			+	+		+			+	
Gephyrea . .								+	+										+							
Pycnogonida .																										
Decapoda . .					+	+	+	+			+			+	+			+		+	+	+	+	+		+
Schizopoda . .												+														
Edriophthalmata .											+			+								+				
Cirripedia . .													+		+				+			+			+	
Annelida . .				+			+	+	+	+				+	+				+	+						
Tunicata . .										+				+												
Polyzoa . .		+								+	+		+	+	+				+	+					+	
Holothuroidea .								+					+	+	+				+						+	
Echinoidea . .							+										+		+							
Ophiuroidea .							+	+		+			+		+				+		+	+			+	
Asteroidea . .	+												+					+		+		+				+
Crinoidea . .																			+							+
Hydromedusæ .									+													+				
Zoantharia . .									+		+					+			+		+				+	
Alcyonaria . .	+												+	+					+	+	+					
Porifera . .								+			+			+					+	+	+	+			+	

TABLE Showing the Relative frequency of the occurrence of the principal Groups of Marine Animals at Fifty-two Stations at which Dredging or Trawling was carried to a depth greater than 2000 fathoms.

	Station 226, 2300 fathoms.	Station 230, 2425 fathoms.	Station 241, 2300 fathoms.	Station 244, 2900 fathoms.	Station 248, 2900 fathoms.	Station 252, 2740 fathoms.	Station 253, 3125 fathoms.	Station 264, 3000 fathoms.	Station 271, 2425 fathoms.	Station 272, 2600 fathoms.	Station 274, 2750 fathoms.	Station 276, 2350 fathoms.	Station 281, 2385 fathoms.	Station 285, 2375 fathoms.	Station 286, 2335 fathoms.	Station 289, 2550 fathoms.	Station 291, 2250 fathoms.	Station 293, 2025 fathoms.	Station 298, 2225 fathoms.	Station 299, 2160 fathoms.	Station 318, 2040 fathoms.	Station 325, 2650 fathoms.	Station 332, 2200 fathoms.	Station 333, 2025 fathoms.	Station 346, 2350 fathoms.	Station 348, 2450 fathoms.
Pisces .				+					+	+		+		+	+		+			+	+	+	+			+
Cephalopoda .																		+					+			
Gastropoda .			+						+											+		+				
Lamellibranchiata			+	+					+											+		+				
Brachiopoda .		+		+					+											+						
Gephyrea . .			+		+				+											+						
Pycnogonida .																			+	+						
Decapoda . .		+		+						+			+	+		+	+		+		+	+				
Schizopoda .						+																+	+			
Edriophthalmata			+										+						+	+						
Cirripedia . .				+																+						
Annelida . .			+	+	+		+			+				+	+	+			+	+		+		+		
Tunicata . .			+																+							
Polyzoa . .							+		+								+	+		+		+	+	+	+	
Holothuroidea .			+	+	+				+			+	+						+	+		+			+	
Echinoidea . .			+	+	+				+	+										+						
Ophiuroidea .			+							+				+					+	+		+	+	+	+	
Asteroidea . .				+		+						+			+	+			+	+		+			+	
Crinoidea . .				+																						
Hydromedusæ .																	+			+						
Zoantharia . .			+	+								+			+			+		+		+	+			
Alcyonaria .			+	+			+	+	+						+			+	+	+				+		
Porifera . .			+		+		+	+	+		+	+	+		+	+	+	+	+	+		+	+	+		+

seawards of those forms which have occupied a continuous series of successive belts from the shore, virtually ceases; and that in the succeeding belt where the influence of the climate of the region, derived from solar heat or from surface currents, is nearly lost, the

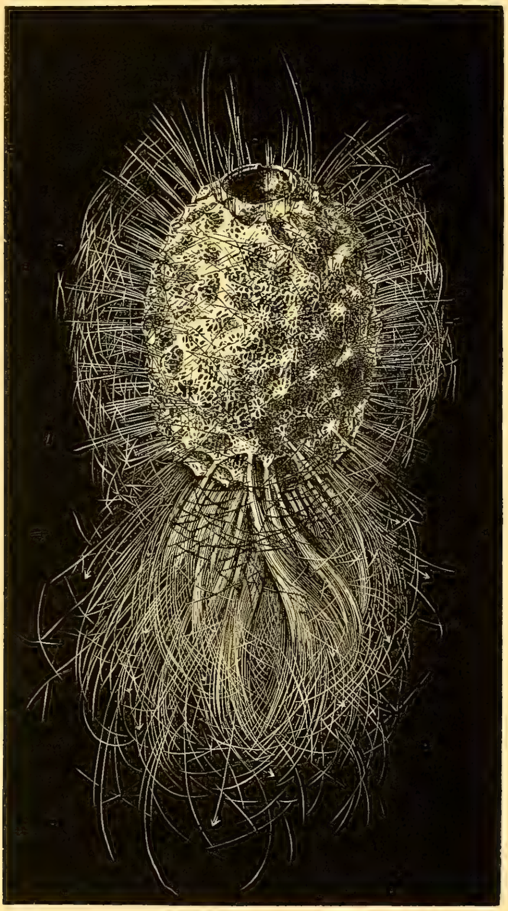


FIG. 16.—*Rossella velata*, Wy. T. A Hexactinellid Sponge (natural size).

number of animal species is at least greatly reduced. It has now been shown that an entirely azoic belt does not exist.

The distribution of the fauna of shallow water depends, like that of the land, chiefly upon climate and upon facilities for immigration; and consequently along with the land the zones of shore-life are broken up into regions and provinces, more or less definitely characterised by predominating groups of inhabitants. It is thus allowable and convenient to speak of the littoral fauna of the Australian or of the Indian region, or of the Antillean or Mascarene province. These regions and provinces are somewhat more sharply defined in the *littoral* and *circum-littoral*, than they are in the *median* and *infra-median* zones, and the distribution of the genera of marine invertebrates which form the fauna of the shore belts, is as a rule much wider and more general than that of the animal forms, vertebrate and invertebrate, which inhabit the contiguous continents and islands. This probably arises from several causes; conditions which are nearly similar, are much more continuous in the sea than they are on the land, and there are fewer definite barriers to distribution; variations of climate are more extreme, and more immediate in their physiological effect in air than they are even in shallow water; and the means and opportunity of diffusion of aquatic animals are as a rule much greater, seeing that most marine animals pass a longer or shorter period of their lives as minute free-swimming larvæ, and while in that condition are borne along and scattered by tides and currents. Mr Wallace states that "about forty-eight" out of upwards of eighty "families of marine mollusca are cosmopolitan, ranging over both hemispheres, and in cold as well as warm seas. About fifteen are restricted to the warmer seas of the globe; but several of these extend from Norway to New Zealand, a distribution which may be called universal, and only two or three are absolutely confined to tropical seas."[1] Our information on this matter is still far from complete, but there is little doubt that the generalisation is in the main true, and that it applies with equal or even greater force to other classes of the shallow water fauna.

In temperate and tropical seas, at a depth of from 400 to 500 fathoms, the number of species begins to increase, and the number of individuals usually rises immensely; but although many genera which occur in the *median* and *infra-median* shore-zones pass down to great depths, the *facies* of the abyssal fauna is not that of a mere extension of the fauna of the shore-belts into deeper water; it gives rather the effect of a specific fauna deriving a marked individuality from the abundance of certain conspicuous forms which are for the most part special; and which would appear to have been derived from a genetic source different from that of the shore fauna.

The abyssal fauna occupies the floor of the vast lake-like expanse of comparatively still water, which fills the bed of the ocean from depths of 500 or 600 fathoms to the bottom. Throughout the region occupied by the abyssal fauna the physical conditions which have the most immediate influence upon the distribution of animal life are very uniform, their variations occurring within narrow limits. Even at its more moderate depths the temperature is but little affected by direct solar radiation, and is consequently

[1] The Geographical Distribution of Animals, by Alfred Russel Wallace, vol. ii. p. 537, London, Macmillan & Co., 1876.

almost uniform throughout the year. At depths of from 800 to 1200 fathoms the constant temperature may average about 40° F., and at depths of 2000 fathoms and upwards the thermometer usually indicates a minimum of 35°, while in certain restricted areas only it sinks to a degree or so below the freezing-point. The range of the thermometer throughout the whole of the abyssal region does not, therefore, as a rule exceed 6° or 8° F. As we pass into higher latitudes, north and south, the temperature-conditions of the abyssal region gradually rise towards the surface, until, in the seas of Northern Scandinavia and Labrador, the temperature of the whole mass of water, from 100 fathoms downwards, has a mean temperature of about 36° F. Of all circumstances, a uniformity of temperature seems to favour most the extension of animal species, so that while many forms characteristic of the *infra-median* zone occur in the lists of the Scandinavian naturalists, from depths of from 100 to 200 fathoms, there is likewise a general extension upwards of the Gorgoniæ, the Isids, the Corals, the Elpididæ, and other groups belonging to the true abyssal fauna; and, still further north, abyssal forms, as, for example, *Rhizocrinus* among the Lofoten Islands, follow the cold water almost to the shore.

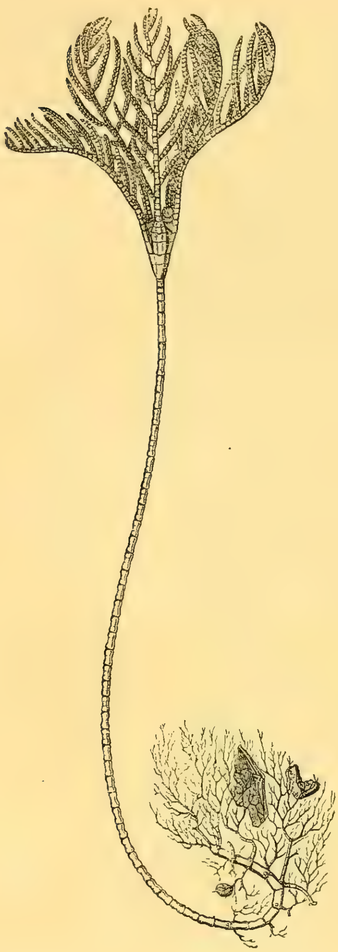


FIG. 17.—*Rhizocrinus lofotensis*, M. Sars.

So far as we can judge, direct sunlight does not penetrate to great depths, and consequently in deep-sea animals the eyes are often absent, or they are atrophied by disuse; or, as in the case of many crustaceans, the organs in the position of the eyes are modified to perform some other function. In some cases, at moderate depths, where a certain amount of light may still be supposed to penetrate, the eyes are large and clear, exaggerated apparently to catch its last feeble rays. Many deep-sea animals are slightly, and some are vividly, phosphorescent. It is difficult to imagine what the object or the effect of this faint illumination may be; but, at all events, the light does not seem to be sufficiently stimulating to maintain organs of vision in a state of functional activity.

The conditions of pressure at great depths are very extraordinary. Pressure increases at the rate of about 1 ton on the square inch for each thousand fathoms of increasing depth; so that the inhabitants of the floor of the ocean at its average depth of about 2500 fathoms, sustain a pressure of $2\frac{1}{2}$ tons on each square inch of surface, compared with the 14 lbs. of atmospheric pressure sustained by the inhabitants of the upper earth. Sea-water is, however, almost incompressible, so that its density at 2500 fathoms is scarcely perceptibly increased. At a depth of a mile, under a pressure of about 159 atmospheres, sea-water, according to the formula given by Jamin, is compressed by the $\frac{1}{144}$th of its volume. Any free air suspended in the water, or contained in any compressible tissue of an animal, would be reduced, at a depth of 2500 fathoms, to a mere fraction of its bulk; but an organism permeable throughout, and supported through and through and on all sides by incompressible fluids at the same pressure, need not necessarily be incommoded by that amount of pressure. We have been long familiar, chiefly through the researches of the late Professor Michael Sars, with a long list of animals of all the marine invertebrate orders living at depths of from 300 to 400 fathoms, and consequently subject to a pressure of 1120 lbs. on the square inch; and off the coast of Portugal there is a great fishery of sharks (*Centroscymnus cœlolepis*, Boc. and Cap.) carried on beyond that depth.

Other physical conditions, such as the specific gravity (salinity) of the water, the relative proportions of the dissolved salts, the total amount of gases dissolved in the water, and the relative proportions of free oxygen and carbondioxide, vary slightly in different parts of the ocean and at different depths; but although such differences are often valuable in tracing the source from which the water occupying a certain area or stratum is derived, they apparently never occur to such an extent as to affect animal life.

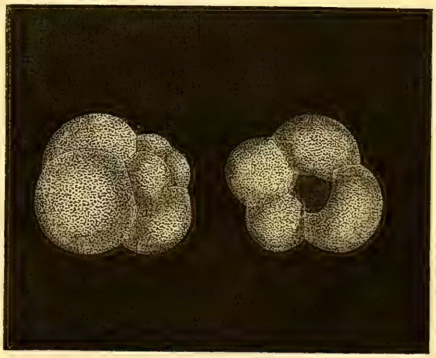


FIG. 18.—*Globigerina bulloides*, D'Orb.

The Nature of the Bottom.—The element next in importance to temperature in regulating the distribution of the abyssal fauna is the nature of the bottom. Two kinds of sediment, very different in their character, may be said broadly to cover the area inhabited by the abyssal fauna. The first of these, the now well-known *Globigerina Ooze*, is a fine calcareous deposit, somewhat resembling the chalk of the Cretaceous period in its microscopic character, and composed to a great extent of the shells, more or less broken or decomposed, of pelagic Foraminifera, chiefly of the genera *Globigerina*, *Orbulina*, *Pulvinulina*, *Pullenia*, and *Sphæroidina*—the two latter in smaller proportions. The ooze contains everywhere, in addition to the foraminifera which form its bulk, a quantity of mineral matter consisting of fragments of pumice, minute particles of felspar, particles and crystals of other minerals due to the disintegration of volcanic rocks, such as sanidine, augite, hornblende, quartz, leucite, and magnetite, and rounded concretions of a mixture of the peroxides and protoxides of manganese and iron. The globigerina ooze is essentially a calcareous deposit, so that it affords abundant material for the calcareous shells and skeletons of animals inhabiting the region where it is being laid down. The foraminifera belonging to the group of which the ooze is composed live only on and near the surface, and are in all cases dead when they reach the bottom, as we have satisfied ourselves by the careful observations of several years. They still contain, however, a quantity of organic matter in the shell-chambers, and incorporated in the substance of the shell; and they, consequently, afford sufficient food for many groups of abyssal animals which are nourished entirely by passing the ooze through the alimentary tract. The globigerina ooze is accordingly a deposit favourable to the support of animal life, and it is probably partly due to this circumstance that the abyssal fauna appears to attain its maximum in the shallower depths at which the ooze occurs.

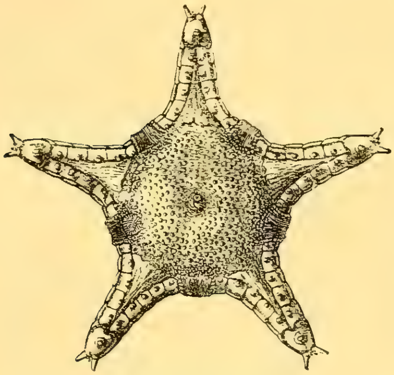


FIG. 19.—*Porcellanaster ceruleus*, Wy. T.

At depths greater than 2000 fathoms the carbonate of lime of the shells of *Globigerina* is removed by the excess of carbondioxide in the sea-water ; the mineral matter assumes a larger proportion in relation to the lime of the shells ; the ooze becomes gradually darker, effervescing less freely with acid ; until at length it gives place to a more or less homogeneous "red clay." The distribution of these two great formations may be broadly defined thus :—The "globigerina ooze" covers the ridges and elevated plateaus in the ocean, and generally occupies a belt at depths down to 2000 fathoms round the shores, outside the belt of shore deposits ; and the "red clay" covers the floor of the deeper depressions. An intermediate band of what we have called "grey ooze" occurs at depths averaging perhaps from 2100 to 2300 fathoms. At one time I believed that the red clay consisted almost entirely of the insoluble "ash" of the falling organisms left after the whole of the calcic carbonate had been removed. My colleague, Mr Murray, has studied very carefully the distribution of volcanic débris over the floor of the ocean, and it is his opinion that the "red clay" is formed chiefly by the decomposition of volcanic minerals. In this view I am now inclined to agree with him, though I still believe that a large amount of the molecular inorganic matter which is abundant in the red clay deposits must be due to the silicates of alumina and iron which we know exist in appreciable quantity both in the hard and soft parts of marine animals. The greatest extent of the "red clay" area is probably in the Pacific, where the average depth of the ocean basin is considerably greater than it is in the Atlantic or the Indian Ocean.

The red clay is not so favourable to the development of animal life as the globigerina-ooze, and a large proportion of the animals living on a red clay bottom belong to groups which secrete but little calcic carbonate in their tests or other hard parts, such as the arenaceous Foraminifera, Hexactinellid Sponges, Holothurideans, and tube-forming Annelids.

The Uniformity of the Abyssal Fauna.—The CHALLENGER during her long cruise passed over an extended area under very varied surface conditions. From the circumstances of her voyage it was impossible to examine any one locality fully, but enough was done to enable us to gain a sufficient idea of the general distribution of the more conspicuous animals living on the bottom of the sea, to justify the con-

FIG. 20.—*Aërope rostrata*, WY. T. One of the abyssal irregular urchins.

clusion that, at depths below 500 to 600 fathoms, a fauna exists of extreme uniformity, which it is impossible as yet to break up into regions or provinces on zoological grounds. Apparently all the classes and most of the leading orders of marine invertebrata are fully represented, but their representation is not in the same relative proportions as in the lesser depths with which we have been hitherto acquainted.

Some groups such as the Gastropoda and the Lamellibranchiata among the Mollusca, which are such abundant and characteristic elements of the faunæ of the shore-belts, are scarce and comparatively insignificant, while some families, of which we have hitherto known only rare and stunted examples, chiefly from the Boreal province, show a large number of conspicuous genera and species, and give a marked character to the abyssal fauna, which is consequently very recognisable. The extent of the area which

Fig. 21.—Forms of the *Phæodaria.*

is covered by this fauna is enormous, but the number of genera and species which it includes does not seem to be inexhaustible. After the first year of the Challenger's voyage, during which the Atlantic had been crossed and recrossed, we had a very good idea beforehand what would be the general appearance of the group of animals forming the contents of the trawl or dredge. Through the Indian Ocean and down to the Antarctic Circle, through the seas of Australia and Polynesia, and in the South and North Pacific, the general character of the fauna was the same. The same species were often repeated, but more frequently, especially at Stations at great distances from one another, the species were different, but were markedly representative; that is to say, they bore to one another a close genetic relation.

Perhaps among the groups which, on account of their speciality, their abundance, and their universal diffusion, may be reckoned the more characteristic of the abyssal fauna, are an order of rhizopods closely allied to the true Radiolaria, described by Professor Hæckel under the name Phæodaria. To this order are referred, with others, a family of extremely graceful forms like highly ornamented and beautifully sculptured Foraminifera with silicious tests,—the Challengeridæ. The Phæodaria are free-swimming, and inhabit the cold water of the abyssal area. The Hexactinellidæ (figs. 14, 15, 16), an order of sponges unknown in shallow water, are very abundant at all depths in the abyssal region. The Hexactinellidæ are extremely common in the Chalk and Greensand, represented chiefly by the Ventriculites, and occur not uncommonly, represented by existing genera such as *Hyalonema* (fig. 15), in beds of the Carboniferous and Silurian periods. Some of the recent species, *Euptectella aspergillum* (Owen), and *Aphrocallistes bocagei* (Wright), are among the most delicate and beautiful of living organisms; the genus *Umbellula* and several other characteristic Pennatulidæ; several fine new species of the Crinoid genus *Pentacrinus*, so abundant in the blue clays of the Lias; and species of the genera *Rhizocrinus* (fig. 17), *Bathycrinus*, and *Hyocrinus*, crinoids

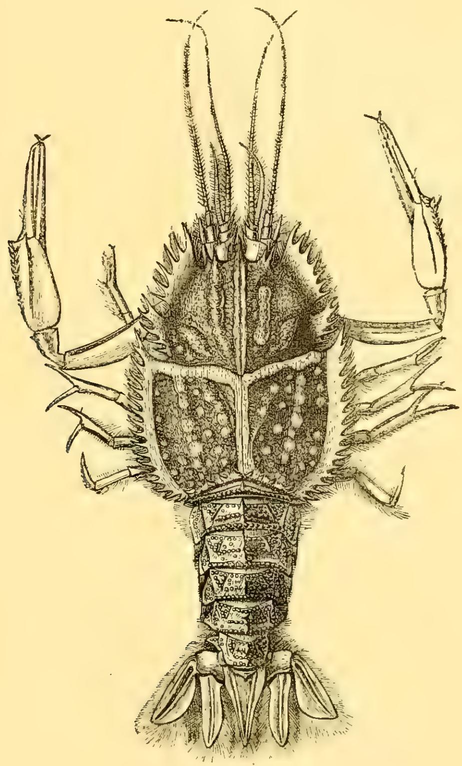


FIG. 22.—*Polycheles crucifer*, v. W.-S.

having few affinities with familiar living animals, but nearly related to the Apiocrinidæ of Jurassic times; a series of star-fishes related more or less nearly to the genera *Archaster*, *Porcellanaster*, and *Hymenaster*, genera rich in species and recalling many fossil forms; species of the genera *Porocidaris* and *Salenia;* what turns out to be a large and prominent family of regular urchins, the Echinothuridæ, long known only by an obscure fossil from the Chalk; and a remarkable group of irregular urchins, clustering round the genus *Pourtalesia,* and recalling such cretaceous forms as *Infulaster*, *Holaster*, *Micraster*, and *Ananchytes*. The curious group of HOLOTHURIDEA, the Elasmopoda, to which I have already referred. A large family of Crustacea having a strong general resemblance to the fossil genus *Eryon* (fig. 22), and a group of gigantic schizopods, such as *Petalophthalmus* and *Gnathophausia*. The fishes include many marvellous and grotesque species, chiefly referable to the Ophidiidæ, the Macruridæ, and the Scopelidæ (fig. 24).

We have already seen that the fauna of shallow water is roughly mapped out into zoological areas; resembling, and to a certain extent following the land in this respect. A fauna so uniform and so continuous as that of the abyssal region cannot be directly derived from the faunæ of the marine Provinces, which form its littoral fringe, even although these are somewhat laxly defined. It has all the appearance of having been derived from a genetic source dating much further back than the minor oscillations which have from time to time during the latest geological periods produced great changes of level in the land, sufficient to raise effective barriers to distribution, and to produce local changes of climate and changes of level in the sea-bottom to a considerable, if to a much more limited, degree.

The question therefore remains to be solved, and it is one of the highest interest, whence, and from what genetic source is this uniform and apparently independent fauna derived?

The Source of the Abyssal Fauna.—I suppose I am now entitled to regard the view as widely accepted by geologists, that the age of the most obvious depressions in the crust of the earth, which are now filled by the sea, is much greater than we were at one time led to believe. I long ago expressed the opinion that the primary meridional grooves of the earth's crust dated from its original cooling; whether this be so or not, there seems to be sufficient evidence that all changes of level since the close of the Palæozoic period are in direct relation to the present coast-lines.

There does not seem to be a shadow of reason for supposing that the gently undulating plains, extending for over a hundred millions of square miles at a depth of 2500 fathoms beneath the surface of the sea, and presenting like the land their local areas of secular elevation or depression, and their centres of more active volcanic disturbance, were *ever* raised, at all events in mass, above the level of the sea; such an arrangement, indeed, is inconceivable. If, then, such a condition did not at any time exist, a continuous ocean must always have extended over the greater part of the earth's surface, and must have occupied continuously any secular areas of depression due to the assumption by the world of its present physical features.

Without entering into the vexed question of recurrent glacial epochs, there is certainly no evidence from palæontology that the temperature conditions of the sea at depths beyond a thousand fathoms were at any time greatly different from those of the present day. During the Silurian period, as now, and extending continuously from that early time to the present day, a continuous ocean with a mean bottom temperature oscillating about the freezing-point, has in all probability covered the greater part of the earth. During all this time an abyssal fauna, of whose existence we have evidence in

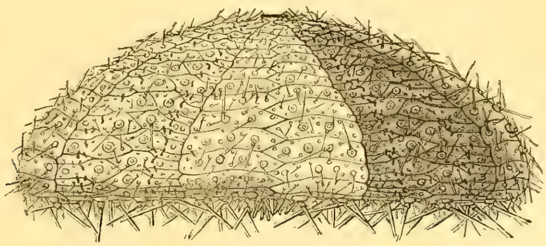


FIG. 23.—*Phormosoma uranus*, WY. T. One of the Echinothuridæ.

every rescued page of geological history, must have migrated continuously, becoming slowly changed during the lapse of immeasurable time with the slightly altering phases in the distribution of sea and land. It seems only natural that migration through so great a lapse of time, over an area under such uniform conditions, should have become at length universal, and that a singularly uniform fauna should have been the result.

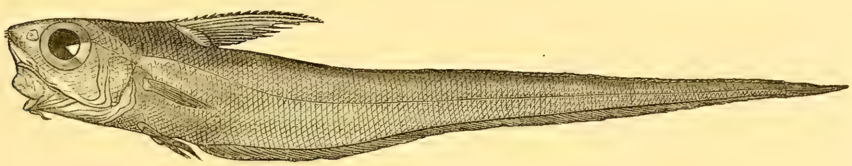


FIG. 24.—*Coryphænoides.* A deep-sea fish belonging to the Macruridæ.

Although the cold water which occupies the deeper portions of the ocean-basins is comparatively still, it is by no means entirely so, and its movement, although almost secular in its slowness, has a most important influence in securing the permanence of its own temperature, and in maintaining the uniformity of its fauna and determining the direction of the migration of the animals included therein.

A cold indraught passes from the polar seas northwards and southwards over the bed of the ocean. This we can scarcely doubt, for in all parts of the world where deep temperature-soundings have been taken, from the Polar circles to the equator, the temperature sinks with increasing depth; and it is lower at the bottom than the normal temperature of the crust of the earth, an evidence that a constantly renewed supply of cold water is cooling down the surface of the crust, which, being a bad conductor, does not transmit heat with sufficient rapidity to affect perceptibly the temperature of the cold indraught. It is probable that in winter, in those parts of the Polar seas which are not directly influenced by warm currents, the whole column of water from the surface to the bottom is reduced to the lowest temperature which it will bear without freezing, and is thus an ample source of the coldest water of the highest specific gravity.

From the fact that the water of the ocean is much more extensively cooled down in the southern than in the northern polar regions, and probably from other causes, it appears that at present the northward movement of the cold under-flow is much in excess of the movement to the southward, and the present development of the abyssal fauna has the general effect of being derived from a southern source.

It seems probable for several reasons, the most obvious of these being that no Classes nor Orders, and but few Families and Genera, are met with in the abyssal regions which do not likewise occur in shallower water, that the original direction of the migration of marine animals is from the shore seawards.

At present the temperature conditions of the shore belts meet those of the abyssal regions in the Polar seas only. A path is thus indicated by which a passage may more readily take place from shallower into deeper water. The causes which determine the under-flow of water from the poles northwards and southwards, although they may vary from time to time in energy, are not temporary; and it seems likely that, during the lapse of later geological time, new blood has been infused into the fauna of the abyssal regions by occasional drafts from the shallower water of the Polar zones.

All these questions are of the highest interest. They will be discussed more fully in the volume of this report which contains a general summary of the scientific results. In the meantime, I hazard these few remarks as an indication of the direction in which our researches would seem to lead.

General Conclusions.—I think that the data already in our hands warrant our provisional acceptance of the following general conclusions :—

I. There is no depth-limit to animal life in the ocean. All the classes of marine invertebrata which are found in shallower water, and some groups of fishes occur under otherwise favourable circumstances at the greatest depths. Judging from our present information, we should be inclined to believe that animals decrease in number, in variety, and usually also in size, at extreme depths.

II. Temperature is the supreme condition which determines the distribution of marine animals. Except in certain "enclosed seas," where the distribution of temperature is abnormal, an *abyssal fauna* occupies an *abyssal region,* extending from depths of 500 or 600 fathoms to the bottom. The normal temperature of this region ranges from 32° F. to 40° F. as an extreme upper limit which is rarely exceeded. Towards the northern and southern Polar areas the isotherm of the mean temperature of 36° F. rises towards the surface, and we find in the seas of Scandinavia and Kerguelen Island, at moderate depths, a mixture of abyssal types, with the fauna of what Professor Edward Forbes defined as the *infra-median* zone.

III. Pressure and the absence of light appear to affect animals to a certain extent. No differences exist in the composition or the comparative salinity of the sea-water of the abyssal region, or in the amount, or the proportion, or the nature of the gases dissolved in it, to affect animal life.

IV. The abyssal fauna is very special, and remarkably uniform throughout the enormous area over which it extends. It is characterised by the abundance and variety of certain conspicuous invertebrate groups, which are either unrepresented or play a very subordinate part in the shallow-water faunæ.

V. In all probability the depressions in the crust of the earth which now form the great ocean basins date from an early geological epoch, and, consequently, during the period occupied by the deposition of the Jurassic, the Cretaceous, and the Tertiary formations at least, the greater part of the surface of the earth has been covered by a sea. As the physical conditions of the world have apparently remained during that time much the same, there seems to be no special reason to doubt that the mean depth of the sea has been throughout about 2500 fathoms, and the temperature of its abyssal region 32° to 40° F., as at the present day.

VI. The belts of shallower water, whose history during the Jurassic, the Cretaceous, and the Tertiary periods is known to us through local upheavals, slow or rapid, which have brought almost a continuous series of their records into view, show a fauna, different certainly from the shallow-water fauna of the present day, but comparable with it in every respect. The records of the abyssal fauna of these past times are naturally more scanty, seeing that they are still mostly beneath the sea; but occasional disturbances have given sufficient evidence that the abyssal region of the ocean has been inhabited throughout.

VII. The existing abyssal fauna, including many characteristic animal forms, of which the few mentioned above are perhaps among the most striking, does not appear to bear as a fauna any direct genetic relation to the faunæ of shallower water, and seems to be to a great degree independent of the distribution of temperature, due to direct solar radiation or to surface currents.

VIII. The recent abyssal fauna has a relation to the deep water fauna of the Oolite, the Chalk, and the Tertiary formations, so close that it is difficult to suppose it in the main other than the same fauna which has been subjected to a slow and continuous change under slightly varying circumstances according to some law, of the nature of which we have not as yet the remotest knowledge.

It has been discovered within the last few years through a series of investigations, of which the circumnavigating voyage of the CHALLENGER is the most extensive, that one-half of the surface of the earth forms, at a certain depth below the surface of the sea, a continuous region under very uniform conditions, which are not unfavourable to the existence, nor to the moderate development of animal life. This region is peopled by a fauna, not certainly of extreme poverty, and very special in its nature; its specialty consisting mainly in its great uniformity and in the prevalence of certain types. There is every reason to believe that the existing physical conditions of this area date from a very remote period, and that the present fauna of the deep-sea may be regarded as being directly descended from faunæ which have successively occupied the same deep-sea. In the meantime, changes involving lesser depths have been accompanied by the appearance and disappearance of the land and shallow-water faunæ of the Jurassic, the Cretaceous, and the Tertiary periods. That the present abyssal fauna is the result of progressive change there can be no room for doubt; but it would seem that in this case the progress has been extremely slow, and that it has been brought about almost in the absence of those causes,—such as minor and local oscillations of the crust of the earth producing barriers, and affecting climate,—on which we are most inclined to depend for the modification of faunæ.

The discovery of the abyssal fauna, accordingly, seems to have given us an opportunity of studying a fauna of extreme antiquity, which has arrived at its present condition by a slow process of evolution from which all causes of rapid change have been eliminated. A careful study of such an assemblage of forms must in time do much to throw light upon many difficult problems of distribution. Even now, with the vaguest outline only before us, derived from a single line of scattered soundings, I am prepared to admit a strong personal impression upon two points.

I believe that the study of the abyssal fauna, revealing many delicate chains of structural affinity linking the fauna of the present with that of the past, brings into prominence a new mass of facts, morphological, ontological, and palæontological, in powerful support of the doctrine of Evolution. On the other hand, it seems to me that in this, as in all cases in which it has been possible to bring the question, however remotely, to the test of observation, the character of the abyssal fauna refuses to give the least support to the theory which refers the evolution of species to extreme variation guided only by natural selection. Species are just as distinctly marked in the abyssal fauna as elsewhere, each species varying within its definite range as each species appears to have varied at all times, past and present. If all the species living on the floor of the ocean were, and had always been, in a state of instability, acted upon by external influences, and perpetually passing by insensible gradations into other species, it seems certain that the general impression drawn from a fauna such as that of the abyssal region must have been one of indefiniteness and transition. This is not the case. Transition forms, linking species so closely as to cause a doubt as to their limit, are rarely met with. There is usually no difficulty in telling what a thing is.

APPENDIX TO THE INTRODUCTION TO THE ZOOLOGICAL REPORTS.

TABLE showing the POSITIONS of the SOUNDINGS obtained in H.M.S. Challenger; the Temperature and Specific Gravity of the Surface and Bottom Water; and the Stations where Serial Temperatures, Trawlings, or Dredgings were procured.

(In the present volume, and in the second volume of the Zoological Series, there are some small discrepancies between the bottom temperatures entered in the body of the Reports and those in the Tables. This is owing to our having adopted at first a system of correction whose accuracy we were afterwards led to doubt. In the Tables the temperatures are recorded as they were taken, without correction.—C. WY. T.)

Number of Sounding.	Distinguishing Number of Station.	Date. 1872–3.	Latitude.	Longitude.	Depth in Fathoms.	Nature of Bottom.	Temperature of the Sea-water.		Specific Gravity of Sea-water at 60° F. Distilled water at 39°=1.		Trawling or Dredging.	Serial temperatures were obtained at the stations marked *	Plans on which the Station is shown.
							Bottom	Surface	Bottom.	Surface.			
			NORTH. ° ′ ″	WEST. ° ′ ″			°	°					
1	I	December 30	41 58 0	9 42 0	1125	Globigerina ooze.	...	...	...	...	Dredged.		2
2	Ia	January 1	40 25 0	9 38 30	325	Hard ground.	52·0	57·0	...	...	...		3
3	Ib	,, 1	40 24 0	9 45 0	730	Hard ground.	49·0	57·0	...	...	...		3
4	Ic	,, 1	40 23 0	9 43 0	950	Hard ground.	...	57·0	...	...	Dredged.		3
5	Id	,, 2	39 55 0	10 5 0	1975	Mud.	...	57·0	...	...	Dredged.		3
6	II	,, 13	38 10 0	9 14 0	470	Globigerina ooze.	...	57·0	...	...	Dredged.		3
7	IIa	,, 13	38 5 0	9 39 0	1270	Mud.	...	57·0	...	...	Dredged.		3
8	IIb	,, 14	38 31 0	9 31 0	84	Mud.	...	57·0	...	...	...		3
9	IIc	,, 14	38 28 0	9 35 0	280	Mud.	...	57·0	...	...	...		3
10	IId	,, 14	38 26 0	9 38 0	560	Mud.	52·0	57·5	...	...	...		3
11	IIe	,, 14	38 22 30	9 44 0	1290	Mud.	...	57·0	...	...	...		3
12	IIf	,, 14	38 14 25	9 49 42	1475	Mud.	37·5	57·5	...	...	...		3
13	IIg	,, 14	38 9 43	9 48 0	1380	Mud.	38·0	57·5	...	...	...		3
14	IIh	,, 14	37 56 0	10 8 0	1800	Mud.	37·0	57·0	...	...	...		3
15	IIj	,, 15	37 1 45	9 23 45	1000	Mud.	39·5	59·5	...	...	...		3
16	IIk	,, 15	36 58 50	9 14 20	525	Mud.	54·0	60·0	...	...	Dredged.	*	3
17	III	,, 15	37 2 0	9 14 0	900	Globigerina ooze.	...	60·0	...	...	Dredged.		3
18	IV	,, 16	36 25 0	8 12 0	600	Mud.	...	60·0	...	...	Both.		2 & 3
19	V	,, 28	35 47 0	8 23 0	1090	Mud.	38·5	61·0	...	...	Trawled.	*	2
20	Va	,, 29	36 13 0	10 7 0	2500	...	...	59·0	...	...	...		2 & 3
21	VI	,, 30	36 23 0	11 18 0	1525	Globigerina ooze.	36·0	58·0	...	...	Trawled.		2 & 3
22	VII	,, 31	35 20 0	13 4 0	2125	Mud.	37·0	60·0	...	...	Trawled.		2
23	VIIa	February 1	34 4 0	14 18 0	2250	Mud, sand.	37·0	61·0	...	...	...		2
24	VIIb	,, 2	32 43 0	15 52 0	2225	Mud, sand.	37·0	63·0	...	...	...		2
25	VIIc	,, 2	32 21 0	16 24 0	670	Coral.	46·8	63·0	...	...	...		4
26	VIId	,, 2	32 16 0	16 28 0	1150	Sand, mud.	...	64·0	...	...	...		4
27	VIIe	,, 2	32 20 15	16 32 0	930	Sand, mud.	43·5	63·5	...	...	...		4
28	VIIf	,, 2	32 27 0	16 40 30	1500	Sand, mud.	...	63·0	...	...	Trawled.		4
29	VIIg	,, 3	32 32 45	16 48 0	1150	Sand, mud.	39·0	63·0	...	...	...		4
30	VIIh	,, 3	32 35 0	16 51 0	790	Sand, mud.	45·0	62·8	...	...	...		4
31	VIIj	,, 3	32 36 15	16 53 15	490	Sand, mud.	...	63·0	...	...	...		4
32	VIIk	,, 6	29 19 0	16 38 0	1975	Mud.	36·2	62·5	...	...	...		2 & 5
33	VIIl	,, 10	28 28 0	16 12 30	278	Mud.	...	64·0	...	...	...		5
34	VIIm	,, 10	28 28 0	16 10 0	630	Mud.	45·0	64·0	...	...	...		5
35	VIIn	,, 10	28 30 30	16 3 30	975	Mud.	41·0	64·0	...	...	...		5
36	VIIo	,, 10	28 33 0	16 4 0	560	Mud, sand.	45·5	64·0	...	...	...		5
37	VIIp	,, 10	28 35 0	16 5 0	78	Coral.	...	64·0	...	...	Dredged.		5
38	VIIq	,, 10	28 38 0	16 5 0	179	Rock.	...	64·0	...	...	...		5
39	VIIr	,, 10	28 41 0	16 6 0	640	Mud.	45·8	64·0	...	...	...		5
40	VIIs	,, 10	28 45 0	16 7 0	1390	Mud.	38·5	63·0	...	...	...		5

Number of Sounding.	Distinguishing Number of Station.	Date. 1873.		Latitude.	Longitude.	Depth in Fathoms.	Nature of Bottom.	Temperature of the Sea-water.		Specific Gravity of Sea-water at 60° F. Distilled water at 39°=1.		Trawling or Dredging.	Serial temperatures were obtained at the stations marked *	Plans on which the Station is shown.
								Bottom	Surface	Bottom.	Surface.			
				NORTH. ° ′ ″	WEST. ° ′ ″			°	°					
41	VIIt	February	11	28 42 0	17 8 0	1750	Mud.	37·5	63·0	...	...	...		5
42	VIIu	,,	11	28 20 0	17 34 0	1340	Sand.	38·5	65·0	...	...	...		5
43	VIIv	,,	11	27 58 0	17 39 0	1620	Mud.	37·5	65·0	...	...	...	*	5
44	VIII	,,	12	28 3 15	17 27 0	620	Mud, shells.	...	64·5	...	...	Dredged.	*	5
45	1	,,	15	27 24 0	16 55 0	1890	Globigerina ooze.	36·8	64·5	1·02652	1·02731	Dredged.	*	5 & 6
46	2	,,	17	25 52 0	19 22 0	1945	Globigerina ooze.	36·8	67·0	1·02604	1·02742	Dredged.	*	6
47	3	,,	18	25 45 0	20 14 0	1525	Rock.	37·0	65·0	...	1·02722	Dredged.		6
48	4	,,	19	25 28 0	20 22 0	2220	...	...	66·0	...	1·02723	...	*	6
49	5	,,	21	24 20 0	24 28 0	2740	Red clay.	37·0	68·0	1·02747	1·02756	Dredged.	*	6
50	6	,,	23	23 14 0	28 22 0	2950	Red clay.	37·0	69·2	1·02748	1·02762	...		6
51	7	,,	24	23 23 0	31 31 0	2750	Red clay.	36·9	68·0	1·02614	1·02765	...		6
52	8	,,	25	23 12 0	32 56 0	2700	Red clay.	37·0	67·0	1·02617	1·02775	Dredged.	*	6
53	9	,,	26	23 23 0	35 11 0	3150	Red clay.	36·8	69·0	1·02657	1·02781	Dredged.		6
54	10	,,	28	23 10 0	38 42 0	2720	Red clay.	36·5	71·0	1·02757	1·02778	...	*	6
55	11	March	1	22 45 0	40 37 0	2575	Grey ooze.	36·5	72·2	1·02629	1·02772	Dredged.	*	6
56	12	,,	3	21 57 0	43 29 0	2025	Globigerina ooze.	36·9	73·0	1·02646	1·02765	Dredged.		6
57	13	,,	4	21 38 0	44 39 0	1900	Globigerina ooze.	36·8	72·0	1·02699	1·02780	Dredged.	*	6
58	14	,,	5	21 1 0	46 29 0	1950	Globigerina ooze.	36·8	74·0	...	1·02758	Trawled.		6
59	15	,,	6	20 49 0	48 45 0	2325	Globigerina ooze.	36·2	72·5	1·02621	1·02772	...	*	6
60	16	,,	7	20 39 0	50 33 0	2435	Grey ooze.	36·2	74·0	1·02754	1·02778	Dredged.		6
61	17	,,	8	20 7 0	52 32 0	2385	Grey ooze.	36·5	74·0	...	1·02777	...	*	6
62	18	,,	10	19 41 0	55 13 0	2650	Red clay.	36·0	74·0	1·02626	1·02740	Dredged.	*	6
63	19	,,	11	19 15 0	57 47 0	3000	Red clay.	35·5	75·0	1·02623	1·02739	...		6
64	20	,,	12	18 56 0	59 35 0	2975	Red clay.	36·0	75·0	1·02732	1·02739	Dredged.	*	6
65	21	,,	13	18 54 0	61 28 0	3025	Red clay.	35·5	76·0	1·02690	1·02697	...		6
66	22	,,	14	18 40 0	62 56 0	1420	Globigerina ooze.	38·4	76·0	...	1·02710	Trawled.	*	6 & 7
67	23	,,	15	18 24 0	63 28 0	450	Globigerina ooze.	...	76·0	...	1·02702	Dredged.		7
68	23a	,,	15	18 26 0	63 31 15	460	Globigerina ooze.	...	76·0	...	...	Dredged.		7
69	23b	,,	15	18 28 0	63 35 0	590	Globigerina ooze.	...	76·0	...	...	Dredged.		7
70	24	,,	25	18 38 30	65 5 30	390	Coral mud.	...	76·0	...	1·02714	Dredged.		7
71	24a	,,	25	18 43 30	65 5 0	625	Coral mud.	...	76·0	...	...	Dredged.		7
72	25	,,	26	19 41 0	65 7 0	3875	Grey ooze.	...	76·0	1·02647	1·02702	Dredged.	*	6 & 7
73	26	,,	27	21 26 0	65 16 0	2800	Grey ooze.	...	76·0	1·02600	1·02713	...		6
74	27	,,	28	22 49 0	65 19 0	2960	Grey ooze.	36·2	75·5	1·02607	1·02720	...	*	6
75	28	,,	29	24 39 0	65 25 0	2850	Red clay.	36·3	75·0	1·02616	1·02719	Dredged.	*	6
76	29	,,	31	27 49 0	64 59 0	2700	Red clay.	36·4	72·0	1·02615	1·02746	Dredged.	*	6
77	30	April	1	29 5 0	65 1 0	2600	Red clay.	36·5	72·0	1·02780	1·02741	...		6
78	31	,,	3	31 24 0	65 0 0	2475	Grey ooze.	36·5	69·5	1·02653	1·02731	...		6
79	32	,,	3	31 49 0	64 55 0	2250	Grey ooze.	36·7	68·0	1·02608	...	...		6 & 8
80	32a	,,	3	32 1 0	64 51 0	1820	Grey ooze.	...	68·0	...	...	...		8
81	32b	,,	3	32 10 0	64 52 0	950	Grey ooze.	...	68·0	...	...	...		8
82	32c	,,	4	32 17 30	64 39 5	780	Coral mud.	...	67·0	...	...	...		8
83	32d	,,	4	32 19 0	64 40 0	380	Coral mud.	...	67·0	...	...	...		8
84	32e	,,	4	32 19 30	64 40 35	120	Coral mud.	...	67·5	...	...	Dredged.		8
85	32f	,,	4	32 20 40	64 38 15	125	Rock.	...	67·5	...	...	...		8
86	32g	,,	4	32 21 25	64 37 15	265	Rock.	...	68·0	...	...	Dredged.		8
87	33	,,	4	32 21 30	64 35 55	435	Coral mud.	...	68·0	...	...	Dredged.		8
88	33a	,,	21	32 31 10	64 42 55	175	Sand.	...	67·2	...	...	...		8
89	33b	,,	21	32 32 30	64 46 0	640	Sand.	...	67·2	...	...	...		8
90	34	,,	21	32 33 55	64 52 18	1370	Coral mud.	...	67·2	...	...	...		8
91	35a	,,	22	32 39 0	65 6 0	2450	Coral mud.	36·5	67·8	...	1·02714	...		8
92	35b	,,	22	32 26 0	65 9 0	2100	Coral mud.	36·5	68·0	...	...	...		8
93	35c	,,	22	32 15 0	65 8 0	1950	Mud.	...	68·0	...	...	...		8
94	36	,,	22	32 7 25	65 4 0	30	Coral.	...	67·5	...	...	Dredged.		8
95	37	,,	24	32 18 0	65 38 0	2650	Grey ooze.	36·5	68·0	...	...	Dredged.	*	8 & 9
96	38	,,	25	33 3 0	66 32 0	2600	Grey ooze.	36·5	70·0	...	1·02729	...	*	9
97	39	,,	27	34 3 0	67 32 0	2850	Grey ooze.	36·5	65·0	...	1·02704	...	*	9
98	40	,,	28	34 51 0	68 30 0	2675	Grey ooze.	...	69·5	...	1·02702	Dredged.		9
99	41	,,	29	36 5 0	69 54 0	None.	...	...	65·0	...	1·02708	...	*	9
100	42	,,	30	35 58 0	70 35 0	2425	Grey ooze.	36·8	65·0	1·02671	1·02697	...	*	9

Number of Sounding.	Distinguishing Number of Station.	Date. 1873.	Latitude.	Longitude.	Depth in Fathoms.	Nature of Bottom.	Temperature of the Sea-water. Bottom	Temperature of the Sea-water. Surface	Specific Gravity of Sea-water at 60° F. Distilled water at 39°=1. Bottom.	Specific Gravity of Sea-water at 60° F. Distilled water at 39°=1. Surface.	Trawling or Dredging.	Serial temperatures were obtained at the stations marked *	Plans on which the Station is shown.
			NORTH. ° ′ ″	WEST. ° ′ ″			°	°					
101	43	May 1	36 23 0	71 46 0	2600	...	36·8	75·0	...	1·02675	...	*	9
102	44	,, 2	37 25 0	71 40 0	1700	Grey ooze.	36·2	56·5	...	1·02538	Dredged.	*	9
103	45	,, 3	38 34 0	72 10 0	1240	Mud.	37·2	49·5	...	1·02504	Dredged.	*	9
104	46	,, 6	40 17 0	66 48 0	1350?	Mud.	37·2	40·0	...	1·02407	Dredged.		9
105	47	,, 7	41 14 0	65 45 0	1340	Mud.	...	42·0	...	1·02422	Dredged.		9
106	48	,, 8	43 4 0	64 5 0	51	Rock.	...	38·0	...	...	Dredged.		9
107	49	,, 20	43 3 0	63 39 0	85	Stones, gravel.	35·0	40·5	1·02406	1·02357	Dredged.	*	9
108	50	,, 21	42 8 0	63 39 0	1250	Grey ooze.	38·0	45·0	1·02538	1·02453	Dredged.	*	9
109	51	,, 22	41 19 0	63 12 0	2020	Grey ooze.	36·0	59·0	1·02588	1·02625	...	*	9
110	52	,, 23	39 44 0	63 22 0	2800	Grey ooze.	36·2	67·2	1 02702	1·02719	...	*	9
111	52a	,, 24	38 16 0	63 17 0	None.	...	...	73·0	...	...	...	*	9
112	53	,, 26	36 30 0	63 40 0	2650	Grey ooze.	36·3	73·0	1·02700	1·02714	...	*	9
113	54	,, 27	34 51 0	63 59 0	2650	Grey ooze.	...	70·5	...	1·02721	Trawled.	*	9
114	55	,, 28	33 20 0	64 37 0	2500	Grey ooze.	...	70·5	...	1·02716	...	*	9
115	55a	,, 28	32 46 0	64 39 0	1775	Grey ooze.	36·2	70·5	...	...	...		8 & 9
116	55b	,, 29	32 7 35	64 53 45	1325	Grey ooze.	...	72·0	...	...	Dredged.		8
117	56	,, 29	32 8 45	64 59 35	1075	Grey ooze.	38·2	72·5	...	...	Dredged.		8
118	56a	,, 29	32 10 45	64 58 20	506	...	...	72·5	...	...	Dredged.		8
119	57	,, 30	32 11 7	65 3 20	690	...	...	72·5	...	...	...		8
120	57a	,, 30	32 9 30	65 7 35	1250	Grey ooze.	...	73·0	...	...	Dredged.		8
121	57b	,, 30	32 9 45	65 10 50	1575	Grey ooze.	...	73·0	...	...	Trawled.	*	8
122	58	June 13	32 37 0	64 21 0	1500	Grey ooze.	37·2	73·5	...	...	...		6 & 8
123	59	,, 14	32 54 0	63 22 0	2360	Grey ooze.	36·3	74·0	1·02650	1·02726	...	*	6
124	60	,, 16	34 28 0	58 56 0	2575	Grey ooze.	36·2	71·5	1·02711	1·02715	Trawled.	*	6
125	61	,, 17	34 54 0	56 38 0	2850	Grey ooze.	36·2	71·0	...	1·02713	Trawled.	*	6
126	62	,, 18	35 7 0	52 32 0	2875	Grey ooze.	36·4	70·0	1·02715	1·02722	...	*	6
127	63	,, 19	35 29 0	50 53 0	2750	Grey ooze.	...	71·0	1·02619	1·02726	Trawled.		6
128	64	,, 20	35 35 0	50 27 0	None.	Grey ooze.	...	75·0	...	...	Dredged.	*	6
129	65	,, 21	36 33 0	47 58 0	2700	Grey ooze.	36·2	72·5	1·02605	1·02727	...	*	6
130	66	,, 22	37 24 0	44 14 0	2750	Grey ooze.	36·5	70·0	1·02630	1·02716	...	*	6
131	67	,, 23	37 54 0	41 44 0	2700	Grey ooze.	36·3	70·0	1·02619	1·02700	...	*	6
132	68	,, 24	38 3 0	39 19 0	2175	Grey ooze.	36·2	70·0	1·02617	1·02694	Trawled.		6
133	69	,, 25	38 23 0	37 21 0	2200	Grey ooze.	36·2	71·0	...	1·02718	Trawled.	*	6
134	70	,, 26	38 25 0	35 50 0	1675	Globigerina ooze.	...	70·0	...	1·02714	Trawled.		6
135	71	,, 27	38 18 0	34 48 0	1675	Globigerina ooze.	36·8	71·0	1·02670	1·02700	Trawled.	*	6
136	72	,, 28	38 34 0	32 47 0	1240	Globigerina ooze.	37·8	71·0	...	1·02724	...	*	6
137	73	,, 30	38 30 0	31 14 0	1000	Globigerina ooze.	39·4	69·0	1·02693	...	Dredged.	*	6&10
138	74	July 1	38 22 0	29 37 0	1350	Globigerina ooze.	...	69·8	...	...	...		6&10
139	75	,, 2	38 38 0	28 28 30	450	Sand.	...	70·0	...	...	Dredged.		10
140	76	,, 3	38 11 0	27 9 0	900	Globigerina ooze.	40·0	70·0	1·02691	1·02701	Dredged.	*	10
141	77	,, 4	37 52 0	26 26 0	750	Rock.	...	69·2	1·02679	1·02688	...		10
142	78	,, 10	37 26 0	25 13 0	1000	Globigerina ooze.	...	71·0	...	...	Dredged.	*	10
143	79	,, 11	36 21 0	23 31 0	2025	Globigerina ooze.	35·9	71·5	...	...	Dredged.	*	6
144	80	,, 12	35 3 0	21 25 0	2660	Globigerina ooze.	36·6	71·0	1·02604	1·02714	...	*	6
145	81	,, 13	34 11 0	19 52 0	2675	Globigerina ooze.	37·0	71·0	...	1·02715	...		6
146	82	,, 14	33 46 0	19 17 0	2400	Globigerina ooze.	36·6	70·7	1·02699	1·02717	...	*	6
147	83	,, 15	33 13 0	18 13 0	1650	Globigerina ooze.	37·0	71·0	1·02629	1·02746	Dredged.		6
148	84	,, 18	30 38 0	18 5 0	None.	...	...	71·0	...	1·02733	...	*	6
149	85	,, 19	28 42 0	18 6 0	1125	Volcanic sand.	...	69·2	...	1·02739	Dredged.	*	6 & 5
150	86	,, 21	25 46 0	20 34 0	2300	Globigerina ooze.	36·6	71·0	1·02631	...	...		6
151	87	,, 21	25 49 0	20 12 0	1675	Rock.	...	72·0	...	1·02573	Dredged.		6(st.3)
152	88	,, 22	23 58 0	21 18 0	2300	Globigerina ooze.	36·4	72·0	1·02625	1·02762	...	*	6
153	89	,, 23	22 18 0	22 2 0	2400	Globigerina ooze.	36·6	73·5	...	1·02727	Trawled.	*	6
154	90	,, 24	20 58 0	22 57 0	2400	Globigerina ooze.	36·5	74·0	1·02652	1·02695	...	*	6
155	91	,, 25	19 4 0	24 6 0	2075	Globigerina ooze.	36·5	74·0	1·02698	1·02717	...	*	6
156	92	,, 26	17 54 0	24 41 0	1975	Globigerina ooze.	...	74·7	...	1·02709	Dredged.	*	6
157	93	,, 27	17 12 45	24 55 45	1070	Mud.	...	75·0	...	...	...		11
158	93a	,, 27	17 3 30	24 53 0	1000	Mud.	...	75·0	...	1·02708	...		11
159	93b	,, 27	16 59 15	24 57 45	465	Sand.	43·5	75·0	...	...	...		11
160	93c	,, 27	16 57 15	25 1 0	52	Coral.	...	76·0	...	...	...		11

Number of Sounding.	Distinguishing Number of Station.	Date. 1873.	Latitude.	Longitude.	Depth in Fathoms.	Nature of Bottom.	Temperature of the Sea-water.		Specific Gravity of Sea-water at 60° F. Distilled water at 39°=1.		Trawling or Dredging.	Serial temperatures were obtained at the stations marked *	Plans on which the Station is shown.
							Bottom	Surface	Bottom.	Surface.			
			NORTH. ° ′ ″	WEST. ° ′ ″									
161	93d	August 5	16 55 45	25 3 45	103	Coral.	...	78·0	...	...	...		11
162	93e	,, 5	16 52 15	25 6 45	85	Coral, shells.	...	78·0	...	...	...		11
163	93f	,, 5	16 50 0	25 8 0	260	Sand, mud.	...	78·0	...	...	...		11
164	93g	,, 5	16 46 0	25 10 0	675	Sand, mud.	...	78·0	...	...	...		11
165	94	,, 5	16 42 0	25 12 0	1150	Mud.	...	78·0	...	...	...		11
166	95	,, 10	13 36 0	22 49 0	2300	Globigerina ooze.	36·5	79·0	1·02618	1·02692	...	*	12
167	96	,, 11	12 15 0	22 28 0	None.	...	...	78·7	...	1·02663	...	*	12
168	97	,, 13	10 25 0	20 30 0	2575	Globigerina ooze.	36·6	78·0	1·02615	1·02623	...	*	12
169	98	,, 14	9 21 0	18 28 0	1750	Globigerina ooze.	36·7	78·2	1·02619	1·02618	Dredged.	*	12
170	99	,, 15	7 53 0	17 26 0	None.	...	...	78·0	...	1·02612	...	*	12
171	100	,, 16	7 1 0	15 55 0	2425	...	...	79·0	...	1·02625	...	*	12
172	101	,, 19	5 48 0	14 20 0	2500	Mud.	36·4	79·2	...	1·02645	Trawled.	*	12
173	102	,, 21	3 8 0	14 49 0	2450	Grey ooze.	36·4	78·0	1·02606	1·02601	...	*	12
174	103	,, 22	2 52 0	17 0 0	2475	Grey ooze.	36·0	77·0	...	1·02632	...	*	12
175	104	,, 23	2 25 0	20 1 0	2500	Grey ooze.	36·6	78·0	1·02611	1·02613	Trawled.	*	12
176	105	,, 24	2 6 0	22 53 0	2275	Grey ooze.	36·0	78·0	...	1·02617	...	*	12
177	106	,, 25	1 47 0	24 26 0	1850	Globigerina ooze.	36·6	78·8	...	1·02628	Trawled.	*	12
178	107	,, 26	1 22 0	26 36 0	1500	Globigerina ooze.	37·9	78·8	...	1·02626	Trawled.		12
179	108	,, 27	1 10 0	28 23 0	1900	Globigerina ooze.	36·8	78·0	...	1·02651	...		12
180	109	,, 28	0 55 38	29 22 35	104	Globigerina ooze.	...	77·7	...	...	Dredged.		13
181	109a	,, 29	0 54 43	29 23 32	475	Gravel.	...	78·0	...	...	...		13
182	109b	,, 29	0 54 55	29 22 17	510	Hard ground.	...	76·5	...	...	...		13
183	109c	,, 29	0 56 23	29 22 15	780	Mud.	...	76·5	...	...	...		13
184	109d	,, 29	0 56 4	29 25 2	1425	Globigerina ooze.	...	77·0	...	...	...		13
185	110	,, 30	0 9 0	30 18 0	2275	Globigerina ooze.	34·8	77·5	1·02614	1·02677	...	*	12
			SOUTH.	WEST.									
186	111	,, 31	1 45 0	30 58 0	2475	Globigerina ooze.	33·7	78·0	...	1·02692	...		12
187	112	September 1	3 33 0	32 16 0	2200	Globigerina ooze.	34·0	78·0	1·02613	1·02679	...	*	12&14
188	113	,, 1	3 40 45	32 22 0	1010	Rock.	37·5	78·0	...	...	...		14
189	113a	,, 1	3 47 0	32 24 30	25	...	...	78·0	...	...	...		14
190	113b	,, 3	3 50 30	32 30 0	400	Rock.	...	78·0	...	...	...		14
191	113c	,, 3	3 54 0	32 36 15	525	Rock.	...	78·0	...	...	...		14
192	114	,, 3	3 58 0	32 42 0	820	Rock.	...	78·0	...	...	...		14
193	115	,, 3	4 2 0	32 47 0	2150	Globigerina ooze.	...	78·0	...	...	...		14
194	116	,, 4	5 1 0	33 50 0	2275	Globigerina ooze.	34·3	78·0	1·02619	1·02635	...	*	12
195	117	,, 6	5 56 0	34 45 0	1375	Mud.	...	78·0	...	1·02697	...		12
196	117a	,, 6	6 4 0	34 51 0	500	Mud.	...	78·0	...	...	...		15
197	118	,, 8	7 28 0	34 2 0	2050	Mud.	35·2	77·5	...	...	...		12&15
198	119	,, 8	7 39 0	34 12 0	1650	Mud.	37·2	77·5	...	1·02760	...	*	12&15
199	120	,, 9	8 37 0	34 28 0	675	Mud.	...	78·0	...	1·02752	Trawled.		12&15
200	121	,, 9	8 28 0	34 31 0	500	Mud.	...	78·0	...	...	Trawled.		15
201	122	,, 10	9 5 0	34 50 0	350	Mud.	...	77·5	...	...	Trawled.		15
202	122a	,, 10	9 10 0	34 52 0	120	Sand, coral.	...	77·5	...	...	Trawled.		15
203	122b	,, 10	9 9 0	34 53 0	32	Sand, coral.	...	77·5	...	...	Trawled.		15
204	122c	,, 10	9 10 0	34 49 0	400	Mud.	...	77·5	1·02679	1·02752	Trawled.		15
205	123	,, 11	10 9 0	35 11 0	1715	Mud.	37·0	77·5	...	1·02681	...		12&15
206	124	,, 11	10 11 0	35 22 0	1600	Mud.	...	77·5	...	...	Trawled.		15
207	125	,, 12	10 46 0	36 2 0	1200	Mud.	...	77·0	1·02749	1·02759	...		15
208	126	,, 12	10 46 0	36 8 0	770	Mud.	...	77·0	...	...	Trawled.		12&15
209	126a	,, 12	10 45 0	36 9 0	700	Mud.	...	77·0	...	...	Trawled.		15
210	127	,, 13	11 42 0	37 3 0	1015	Mud.	38·5	77·0	...	1·02759	...		12&15
211	128	,, 14	13 6 0	38 7 0	1275	Mud.	...	76·5	...	...	...		12&15
212	129	,, 30	20 13 0	35 19 0	2150	Red clay.	34·2	74·0	...	1·02767	Dredged.	*	16
213	130	October 3	26 15 0	32 56 0	2350	Red clay.	34·7	69·0	1·02716	1·02713	Trawled.	*	16
214	131	,, 6	29 35 0	28 9 0	2275	Globigerina ooze.	34·6	65·0	...	1·02675	Trawled.	*	16
215	132	,, 10	35 25 0	23 40 0	2050	Globigerina ooze.	35·0	58·0	1·02590	1·02619	...	*	16
216	133	,, 11	35 41 0	20 55 0	1900	Globigerina ooze.	35·4	58·0	1·02587	1·02627	Trawled.	*	16
217	134	,, 14	36 12 0	12 16 0	2025	Globigerina ooze.	36·0	53·5	1·02583	1·02616	Dredged.	*	16
218	135	,, 15	37 1 50	12 19 10	360	Rock.	...	53·5	...	...	...		17
219	135a	,, 16	37 16 50	12 45 15	75	Coral.	...	54·0	...	...	Dredged.		17
220	135b	,, 17	37 22 30	12 33 0	465	Coral.	...	53·5	...	...	...		17

Number of Sounding.	Distinguishing Number of Station.	Date. 1873-4.	Latitude.	Longitude.	Depth in Fathoms.	Nature of Bottom.	Temperature of the Sea-water. Bottom	Surface	Specific Gravity of Sea-water at 60° F. Distilled water at 39°=1. Bottom.	Surface.	Trawling or Dredging	Serial temperatures were obtained at the stations marked *	Plans on which the Station is shown.
			SOUTH. ° ′ ″	WEST. ° ′ ″			°	°					
221	135c	October 17	37 25 30	12 28 30	110	...	...	54·0	...	...	Dredged.		17
222	135d	„ 17	37 25 0	12 30 30	72	...	...	54·0	...	...	Dredged.		17
223	135e	„ 18	37 21 0	12 22 30	1000	Shells.	...	53·5	...	...	Dredged.	*	17
224	135f	„ 18	37 14 45	12 20 15	1100	Rock.	...	53·5	...	...	Dredged.		17
225	135g	„ 18	37 10 50	12 18 30	550	Rock.	...	54·0	...	...	Dredged.		17
226	136	„ 20	36 43 0	7 13 0	2100	Rock.	35·2	54·0	1·02590	1·02616	Dredged.	*	16
			SOUTH.	EAST.									
227	137	„ 23	35 59 0	1 34 0	2550	Red clay.	34·5	56·1	1·02584	1·02636	Dredged.	*	16
228	138	„ 25	36 22 0	8 12 0	2560	Red clay.	35·1	56·2	1·02580	1·02631	...	*	16
229	139	„ 27	35 35 0	16 9 0	2325	Grey ooze.	34·1	56·2	1·02581	1·02613	...	*	16
230	140	„ 28	35 0 0	17 57 0	1250	Grey ooze.	...	59·0	...	1·02625	...	*	16
231	141	December 17	34 41 0	18 36 0	98	Sand, gravel.	49·5	66·5	...	...	Dredged.	*	18
232	142	„ 18	35 4 0	18 37 0	150	Sand.	47·0	65·5	1·02662	1·02669	Dredged.		18
233	143	„ 19	36 48 0	19 24 0	1900	Globigerina ooze.	35·6	73·0	1·02611	1·02663	Dredged.	*	18
234	144	„ 24	45 57 0	34 39 0	1570	Globigerina ooze.	35·8	43·0	1·02524	1·02518	...	*	18
235	144a	„ 26	46 48 0	37 49 30	69	Grey sand.	...	41·0	...	...	Dredged.		19
236	145	„ 27	46 43 0	38 4 30	140	Grey sand.	...	41·0	...	1·02518	Dredged.		19
237	145a	„ 27	46 41 0	38 10 0	310	Grey sand.	...	41·5	...	...	Dredged.		19
238	146	„ 29	46 46 0	45 31 0	1375	Globigerina ooze.	35·6	43·0	1·02578	1·02513	Trawled.	*	18
239	147	„ 30	46 16 0	48 27 0	1600	Globigerina ooze.	34·2	41·0	1·02552	1·02516	Trawled.	*	18
		1874.											
240	147a	January 1	46 45 0	50 42 0	600	Grey mud.	...	42·0	...	1·02506	...		20
241	148	„ 3	46 47 0	51 37 0	210	Rock, shells.	...	41·0	...	1·02507	Dredged.		20
242	148a	„ 3	46 53 0	51 52 0	550	Rock.	...	41·0	...	...	Dredged.		20
243	149	„ 9	49 8 0	70 12 0	20	Dark mud.	...	...	...	...	Dredged.		21
244	149a	„ 14	49 8 0	70 9 0	40	Mud.	...	...	...	...	Dredged.		21
245	149b	„ 17	49 28 0	70 30 0	25	Mud.	...	40·5	...	...	Dredged.		21
246	149c	„ 19	49 32 0	70 0 0	60	Mud.	...	...	...	...	Dredged.		21
247	149d	„ 20	49 28 0	70 13 0	28	Mud.	...	41·0	...	...	Dredged.		21
248	149e	„ 21	49 37 0	70 16 0	30	Mud.	...	...	...	...	Dredged.		21
249	149f	„ 27	48 55 0	69 31 0	95	Mud.	...	41·7	...	1·02540	Dredged.		21
250	149g	„ 29	48 50 0	69 18 0	110	Mud.	...	40·2	...	...	Dredged.		21
251	149h	„ 29	48 45 0	69 14 0	127	Mud.	...	39·8	...	...	Dredged.		21
252	149j	„ 29	48 43 0	69 15 0	105	Mud.	...	39·0	...	...	Dredged.		21
253	149k	„ 29	48 40 0	69 6 0	45	Mud.	...	39·0	...	...	Dredged.		21
254	150	February 2	52 4 0	71 22 0	150	Rock.	35·2	37·5	...	1·02515	Dredged.	*	18
255	151	„ 7	52 59 30	73 33 30	75	Mud.	...	36·2	...	1·02519	Dredged.		22
256	152	„ 11	60 52 0	80 20 0	1260	Diatom ooze.	...	34·5	1·02562	1·02515	Trawled.	*	23
257	153	„ 14	65 42 0	79 49 0	1675	Mud.	...	29·5	1·02570	1·02419	Dredged.	*	23
258	154	„ 19	64 37 0	85 49 0	1800	Mud.	...	32·0	1·02530	1·02462	...	*	23
259	155	„ 23	64 18 0	94 47 0	1300	Mud.	...	31·0	...	...	Dredged.		23
260	156	„ 26	62 26 0	95 44 0	1975	Diatom ooze.	...	33·0	1·02517	1·02511	Trawled.	*	23
261	157	March 3	53 55 0	108 35 0	1950	Diatom ooze.	32·1	37·2	1·02560	1·02511	Trawled.	*	24
262	158	„ 7	50 1 0	123 4 0	1800	Globigerina ooze.	33·5	45·0	1·02555	1·02524	Trawled.	*	24
263	159	„ 10	47 25 0	130 22 0	2150	Globigerina ooze.	34·5	51·5	1·02563	1·02564	Trawled.	*	24
264	160	„ 13	42 42 0	134 10 0	2600	Red clay.	33·9	55·0	1·02569	1·02570	Trawled.	*	24
265	161	April 1	38 22 30	144 36 30	33	Sand.	...	63·5	...	1·02573	Trawled.		25
266	162	„ 2	39 10 30	146 37 0	38	Sand.	...	63·2	...	1·02633	Dredged.		25
267	163	„ 4	36 57 0	150 34 0	2200	Grey ooze.	34·5	72·0	1·02606	1·02657	...	*	25
268	163a	„ 4	36 59 0	150 20 0	150	Mud.	...	71·0	...	...	Dredged.		25
269	163b	June 3	33 51 15	151 22 15	35	Rock.	63·0	69·0	...	...	Dredged.		26
270	163c	„ 12	33 55 0	151 35 0	85	Shells.	62·2	67·5	...	1·02650	...		26
271	163d	„ 12	33 57 30	151 39 15	120	Hard sand.	...	68·0	...	...	...		26
272	163e	„ 12	34 0 15	151 44 15	290	Hard sand.	...	70·2	...	...	...		26
273	163f	„ 12	34 3 15	151 51 30	650	Grey ooze.	40·8	70·2	...	...	...		26
274	164	„ 12	34 8 0	152 0 0	950	Grey ooze.	36·5	69·5	...	1·02656	...		26
275	164a	„ 13	34 9 0	151 55 0	1200	Grey ooze.	...	70·2	...	...	...		26
276	164b	„ 13	34 13 0	151 38 0	410	Grey ooze,	...	69·0	...	1·02642	Trawled.		26
277	164c	„ 13	34 19 0	151 31 0	400	Grey ooze.	40·0	67·0	...	...	Dredged.	*	26
278	164d	„ 14	34 3 0	152 20 0	2100	...	...	67·5	...	...	...		26&27

Number of Sounding.	Distinguishing Number of Station.	Date. 1874.	Latitude.	Longitude.	Depth in Fathoms.	Nature of Bottom.	Temperature of the Sea-water. Bottom	Temperature of the Sea-water. Surface	Specific Gravity of Sea-water at 60° F. Distilled water at 39°=1. Bottom.	Specific Gravity of Sea-water at 60° F. Distilled water at 39°=1. Surface.	Trawling or Dredging.	Serial temperatures were obtained at the stations marked*	Plans on which the Station is shown.
			SOUTH. ° ′ ″	EAST. ° ′ ″			°	°					
279	164e	June 16	34 27 0	154 57 0	2550	...	...	64·0	...	1·02648	...	*	27
280	165	„ 17	34 50 0	155 28 0	2600	Red clay.	34·5	64·5	1·02618	1·02645	Dredged.		27
281	165a	„ 19	36 41 0	158 29 0	2600	Red clay.	34·4	62·5	...	1·02643	...	*	27
282	165b	„ 21	37 53 0	163 18 0	1975	Globigerina ooze.	34·7	59·5	1·02627	1·02621	...	*	27
283	165c	„ 22	38 36 0	166 39 0	1100	Globigerina ooze.	36·4	58·2	1·02595	1·02616	...	*	27
284	166	„ 23	38 50 0	169 20 0	275	Globigerina ooze.	50·8	58·5	1·02670	1·02629	Trawled.	*	27
285	166a	„ 23	38 57 0	170 10 45	350	...	...	58·5	...	...	...		27
286	166b	„ 23	39 8 0	170 43 0	400	Globigerina ooze.	...	58·5	...	...	...		27
287	166c	„ 24	39 21 0	171 28 0	400	Grey ooze.	...	58·0	...	...	...		27
288	167	„ 24	39 32 0	171 48 0	150	Grey ooze.	...	58·5	...	1·02620	Trawled.		27
289	167a	„ 27	41 4 0	174 19 0	10	Mud.	...	51·5	...	1·02592	Dredged.		...
290	168	July 8	40 28 0	177 43 0	1100	Grey ooze.	37·2	57·2	1·02588	1·02626	Trawled.	*	27
291	169	„ 10	37 34 0	179 22 0	700	Grey ooze.	40·0	58·2	1·02597	1·02638	Trawled.	*	27
			SOUTH.	WEST.									
292	170	„ 14	29 55 0	178 14 0	520	Rock, stones.	43·0	65·0	...	1·02647	Trawled.	*	27
293	170a	„ 14	29 45 0	178 11 0	630	Rock, stones.	39·5	65·2	...	...	Trawled.		27
294	171	„ 15	28 33 0	177 50 0	600	Rock.	39·5	66·5	...	1·02682	Trawled.		27
295	171a	„ 17	25 5 0	172 56 0	2900	Red clay.	34·3	72·0	1·02632	1·02650	...	*	27
296	172	„ 22	20 58 0	175 9 0	18	Coral.	...	75·0	...	...	Dredged.		28
297	172a	„ 22	20 56 0	175 11 0	240	Sand.	...	75·0	...	1·02651	Dredged.		28
			SOUTH.	EAST.									
298	173	„ 24	19 9 35	179 41 50	315	Coral.	...	76·0	...	1·02650	Dredged.		29
299	173a	„ 24	19 9 32	179 41 55	310	Coral.	...	77·0	...	...	Trawled.		29
300	174	August 3	19 6 0	178 14 20	140	Coral mud.	...	77·0	...	...	...		30
301	174a	„ 3	19 6 32	178 16 20	160	Coral mud.	...	77·0	...	...	...		30
302	174b	„ 3	19 6 45	178 17 0	255	Globigerina ooze.	...	77·7	...	...	Trawled.		30
303	174c	„ 3	19 7 50	178 19 35	610	Globigerina ooze.	39·0	78·0	...	...	Trawled.	*	30
304	174d	„ 3	19 5 50	178 16 20	210	Globigerina ooze.	...	77·7	...	...	Dredged.		30
305	175	„ 12	19 2 0	177 10 0	1350	Red clay.	36·0	77·5	1·02645	1·02661	Trawled.	*	27
306	176	„ 15	18 30 0	173 52 0	1450	Red clay.	36·2	77·5	1·02633	1·02647	...	*	27
307	177	„ 18	16 45 0	168 7 0	130	Volcanic sand.	...	78·7	...	1·02637	Dredged.		27
308	178	„ 19	16 47 0	165 20 0	2650	Red clay.	35·8	79·0	...	1·02636	...	*	27
309	179	„ 21	15 58 0	160 48 0	2325	Red clay.	36·0	79·0	1·02608	1·02644	...	*	27
310	180	„ 24	14 7 0	153 43 0	2450	Red clay.	36·0	80·0	1·02618	1·02627	...	*	27
311	181	„ 25	13 50 0	151 49 0	2440	Red clay.	35·8	80·0	1·02600	1·02663	Trawled.		27
312	182	„ 27	13 6 0	148 37 0	2275	Grey ooze.	35·8	78·5	1·02598	1·02632	...	*	27
313	183	„ 28	12 42 0	146 46 0	1700	Grey ooze.	36·0	78·0	1·02610	1·02643	...	*	27
314	184	„ 29	12 8 0	145 10 0	1400	Grey ooze.	36·0	77·5	1·02627	1·02643	Trawled.	*	27
315	185	„ 31	11 35 25	144 2 0	135	Sand, shells.	...	77·0	...	1·02648	Dredged.		27
316	185a	„ 31	11 36 20	144 1 50	150	Sand, shells.	...	77·0	...	...	Dredged.		27
317	185b	„ 31	11 38 15	143 59 38	155	Sand, shells.	...	77·0	...	...	Dredged.		27
318	186	September 8	10 30 0	142 18 0	8	Coral, sand.	...	77·2	...	...	Dredged.		31
319	187	„ 9	10 36 0	141 55 0	6	Coral, sand.	...	77·7	...	1·02703	Dredged.		31
320	188	„ 10	9 59 0	139 42 0	28	Mud.	...	78·5	...	1·02616	Both.		31
321	189	„ 11	9 36 0	137 50 0	25	Mud.	...	79·0	1·02548	1·02566	Trawled.		31
322	190	„ 12	8 56 0	136 5 0	49	Mud.	...	79·2	...	1·02561	Trawled.		31
323	191	„ 23	5 41 0	134 4 30	800	Mud.	39·5	82·2	...	1·02515	Trawled.	*	31&32
324	191a	„ 24	5 26 0	133 19 0	580	Mud.	40·7	81·5	1·02596	1·02600	...	*	31&32
325	192	„ 26	5 49 15	132 14 15	140	Mud.	...	82·0	...	1·02609	Trawled.		32
326	193	„ 28	5 24 0	130 37 15	2800	Mud.	38·0	83·5	1·02583	1·02587	...	*	31
327	194	„ 29	4 34 0	129 57 30	200	Volcanic detritus.	...	83·0	...	...	Dredged.		33
328	194a	„ 29	4 31 0	129 57 20	360	Volcanic detritus.	...	82·5	...	...	Trawled.		33
329	195	October 3	4 21 0	129 7 0	1425	Grey ooze.	38·0	82·0	1·02585	1·02622	Trawled.		31
330	196	„ 13	0 48 30	126 58 30	825	Rock.	36·9	83·0	1·02603	1·02580	Trawled.		31
			NORTH.	EAST.									
331	197	„ 14	0 41 0	126 37 0	1200	Mud.	35·9	82·5	1·02613	1·02546	...	*	31
332	198	„ 20	2 55 0	124 53 0	2150	Red clay.	38·9	85·0	1·02607	1·02562	Trawled.	*	31
333	199	„ 22	5 44 0	123 34 0	2600	Red clay.	38·6	83·0	1·02557	1·02568	...	*	31
334	200	„ 23	6 47 0	122 28 0	250	Mud.	...	85·5	...	1·02556	Trawled.		31
335	201	„ 26	7 5 0	121 48 0	82	Stones, gravel.	...	83·0	...	1·02536	Trawled.		31

Number of Sounding.	Distinguishing Number of Station.	Date. 1874–5.	Latitude.	Longitude.	Depth in Fathoms.	Nature of Bottom.	Temperature of the Sea-water. Bottom	Temperature of the Sea-water. Surface	Specific Gravity of Sea-water at 60° F. Distilled water at 39°=1. Bottom.	Specific Gravity of Sea-water at 60° F. Distilled water at 39°=1. Surface.	Trawling or Dredging.	Serial temperatures were obtained at the stations marked *	Plans on which the Station is shown.
			NORTH. ° ′ ″	EAST. ° ′ ″			°	°					
336	202	October 27	8 32 0	121 55 0	2550	Grey ooze.	50·5	83·0	1·02582	1·02506	...	*	31
337	203	,, 31	11 6 0	123 9 0	20	Mud.	...	85·0	...	...	Trawled.		31
338	204	November 2	12 28 0	122 15 0	705	Mud.	...	84·0	...	1·02540	...		31
339	204a	,, 2	12 43 0	122 9 0	100	Mud.	...	84·0	1·02588	1·02543	Trawled.		31
340	204b	,, 2	12 46 0	122 10 0	115	Mud.	...	84·0	...	...	Trawled.		31
341	205	,, 13	16 42 0	119 22 0	1050	Grey ooze.	37·0	82·0	1·02596	1·02524	Trawled.	*	31
		1875.											
342	206	January 8	17 54 0	117 14 0	2100	Red clay.	36·5	75·2	1·02575	1·02550	Trawled.	*	31
343	207	,, 16	12 21 0	122 15 0	700	Mud.	51·6	80·0	1·02573	1·02533	Trawled.	*	31
344	208	,, 17	11 37 0	123 31 0	18	Mud.	...	81·0	...	1·02533	Trawled.		31
345	209	,, 22	10 14 0	123 54 0	95	Mud.	71·0	81·0	...	...	Both.		31
346	210	,, 25	9 26 0	123 45 0	375	Mud.	54·1	80·2	...	...	Both.	*	31
347	210a	,, 26	9 15 0	124 38 0	185	Mud.	57·1	80·7	...	1·02535	...		31
348	211	,, 28	8 0 0	121 42 0	2225	Grey ooze.	50·5	81·0	1·02565	1·02590	...	*	31
349	212	,, 30	6 54 0	122 18 0	10	Sand.	...	83·0	...	...	Both.		31
350	213	February 8	5 47 0	124 1 0	2050	Red clay.	38·8	83·0	1·02583	1·02494	Trawled.	*	31
351	214	,, 10	4 33 0	127 6 0	500	Globigerina ooze.	41·8	80·5	1·02580	1·02568	Dredged.	*	31
352	215	,, 12	4 19 0	130 15 0	2550	Red clay.	35·4	81·8	1·02587	1·02616	Trawled.	*	31
353	216	,, 16	2 46 0	133 58 0	1675	Globigerina ooze.	35·4	82·8	1·02606	1·02590	...	*	31
354	216a	,, 16	2 56 0	134 11 0	2000	Globigerina ooze.	35·4	82·8	1·02587	...	Trawled.		31
			SOUTH.	EAST.									
355	217	,, 22	0 39 0	138 55 0	2000	Grey ooze.	35·2	83·0	1·02616	1·02537	...	*	31
356	218	March 1	2 33 0	144 4 0	1070	Globigerina ooze.	36·4	84·0	1·02588	1·02554	Trawled.	*	31
357	219	,, 10	1 54 0	146 39 40	150	Mud.	...	84·0	...	1·02592	Trawled.		34
358	220	,, 11	0 42 0	147 0 0	1100	Globigerina ooze.	36·2	83·8	1·02578	1·02599	Trawled.	*	31
			NORTH.	EAST.									
359	221	,, 13	0 40 0	148 41 0	2650	Red clay.	35·4	83·8	...	1·02645	...	*	31
360	222	,, 16	2 15 0	146 16 0	2450	Red clay.	35·2	82·8	1·02584	1·02652	...	*	31
361	223	,, 19	5 31 0	145 13 0	2325	Globigerina ooze.	35·5	82·0	1·02594	1·02615	Trawled.	*	31
362	224	,, 21	7 45 0	144 20 0	1850	Globigerina ooze.	35·4	81·2	1·02582	1·02601	Dredged.	*	31
363	225	,, 23	11 24 0	143 16 0	4475	Radiolarian ooze.	35·2	80·2	1·02592	1·02585	...	*	31
364	226	,, 25	14 44 0	142 13 0	2300	Red clay.	35·5	79·0	...	1·02612	Trawled.	*	31
365	227	,, 27	17 29 0	141 21 0	2475	Red clay.	35·2	79·2	...	1·02586	...	*	31
366	228	,, 29	19 24 0	141 13 0	2450	Red clay.	35·2	80·2	...	1·02598	...	*	31
367	229	April 1	22 1 0	140 27 0	2500	Red clay.	35·2	78·5	...	1·02629	Trawled.	*	31
368	230	,, 5	26 29 0	137 57 0	2425	Red clay.	35·5	68·5	...	1·02613	Trawled.	*	31
369	231	,, 9	31 8 0	137 8 0	2250	Grey ooze.	35·2	64·0	1·02585	1·02548	...	*	31
370	232	May 12	35 11 0	139 28 0	345	Sandy mud.	41·1	64·2	...	1·02543	Both.	*	35
371	233	,, 17	34 39 0	135 14 0	8	Mud.	...	62·3	...	...	Dredged.		35
372	233a	,, 19	34 38 0	135 1 0	50	Sand.	...	62·6	...	...	Dredged.		35
373	233b	,, 26	34 18 0	133 35 0	15	Mud.	...	66·3	...	1·02362	Trawled.		35
374	233c	,, 28	34 18 0	133 21 0	12	Mud.	59·9	66·8	...	1·02384	Trawled.	*	35
375	234	June 3	32 31 0	135 39 0	2675	Grey ooze.	35·8	69·5	...	1·02550	...	*	35
376	235	,, 4	34 7 0	138 0 0	565	Mud.	38·1	73·0	1·02566	1·02560	Trawled.	*	35
377	236	,, 5	34 58 0	139 29 0	775	Mud.	37·6	66·5	1·02552	1·02565	Trawled.		35
378	236a	,, 5	34 59 0	139 31 0	420	Mud.	...	66·5	...	...	Trawled.	*	35
379	237	,, 17	34 37 0	140 32 0	1875	Mud.	35·3	73·0	1·02563	1·02577	Trawled.	*	35&36
380	238	,, 18	35 18 0	144 8 0	3950	Red clay.	35·0	70·5	1·02565	...	...	*	36
381	239	,, 19	35 18 0	147 9 0	3625	Red clay.	35·1	70·2	1·02575	1·02581	...	*	36
382	240	,, 21	35 20 0	153 39 0	2900	Red clay.	34·9	64·8	...	1·02561	Trawled.	*	36
383	241	,, 23	35 41 0	157 42 0	2300	Red clay.	35·1	69·2	1·02562	1·02580	Trawled.	*	36
384	242	,, 24	35 29 0	161 52 0	2575	Red clay.	35·1	68·5	1·02566	1·02596	...	*	36
385	243	,, 26	35 24 0	166 35 0	2800	Red clay.	35·0	71·0	...	1·02569	Trawled.	*	36
386	244	,, 28	35 22 0	169 53 0	2900	Red clay.	35·3	70·5	1·02576	1·02575	Trawled.	*	36
387	245	,, 30	36 23 0	174 31 0	2775	Red clay.	34·9	69·0	1·02560	1·02561	...	*	36
388	246	July 2	36 10 0	178 0 0	2050	Grey ooze.	35·1	73·0	1·02580	1·02576	Trawled.	*	36
			NORTH.	WEST.									
389	247	,, 3	35 49 0	179 57 0	2530	Red clay.	35·2	73·0	1·02573	1·02581	...	*	36
390	248	,, 5	37 41 0	177 4 0	2900	Red clay.	35·1	69·2	...	1·02578	Trawled.	*	36
391	249	,, 7	37 59 0	171 48 0	3000	Red clay.	35·2	65·2	1·02546	1·02544	...	*	36

Number of Sounding.	Distinguishing Number of Station.	Date. 1875.	Latitude.	Longitude.	Depth in Fathoms.	Nature of Bottom.	Temperature of the Sea-water. Bottom	Surface	Specific Gravity of Sea-water at 60° F. Distilled Water at 39°=1. Bottom.	Surface.	Trawling or Dredging.	Serial temperatures were obtained at the stations marked *	Plans on which the Station is shown.
			NORTH. ° ′ ″	WEST. ° ′ ″			°	°					
392	250	July 9	37 49 0	166 47 0	3050	Red clay.	35·0	65·0	1·02574	1·02566	Trawled.	*	36
393	251	„ 10	37 37 0	163 26 0	2950	Red clay.	35·1	65·0	1·02577	1·02528	...	*	36
394	252	„ 12	37 52 0	160 17 0	2740	Red clay.	35·3	65·0	1·02573	1·02540	Trawled.	*	36
395	253	„ 14	38 9 0	156 25 0	3125	Red clay.	35·1	67·7	1·02575	1·02508	Dredged.	*	36
396	254	„ 17	35 13 0	154 43 0	3025	Red clay.	35·0	72·0	1·02537	1·02576	Trawled.	*	36
397	255	„ 19	32 28 0	154 33 0	2850	Red clay.	35·0	74·0	1·02578	1·02618	...	*	36
398	256	„ 21	30 22 0	154 56 0	2950	Red clay.	35·2	74·0	1·02575	1·02644	Dredged.	*	36
399	257	„ 23	27 33 0	154 55 0	2875	Red clay.	34·9	76·5	1·02589	1·02620	...	*	36
400	258	„ 24	26 11 0	155 12 0	2775	Red clay.	35·2	77·0	1·02539	1·02605	...	*	36
401	259	„ 26	23 3 0	156 6 0	2225	Red clay.	34·9	77·0	1·02588	1·02584	...	*	36
402	260	„ 27	21 11 0	157 27 0	310	Hard ground.	44·0	76·8	1·02550	1·02575	Trawled.	*	37
403	261	August 12	20 18 0	157 14 0	2050	Red clay.	35·2	78·5	1·02574	1·02598	...	*	37
404	262	„ 20	19 12 0	154 14 0	2875	Volcanic sand.	35·2	77·5	1·02579	1·02597	...	*	38
405	263	„ 21	17 33 0	153 36 0	2650	Red clay.	35·1	77·5	1·02558	1·02603	Trawled.	*	38
406	264	„ 23	14 19 0	152 37 0	3000	Red clay.	35·2	77·5	1·02610	1·02586	Trawled.	*	38
407	265	„ 25	12 42 0	152 1 0	2900	Red clay.	35·0	79·2	1·02566	1·02580	Dredged.	*	38
408	266	„ 26	11 7 0	152 3 0	2750	Radiolarian ooze.	35·1	80·0	1·02595	1·02597	...	*	38
409	267	„ 28	9 28 0	150 49 0	2700	Radiolarian ooze.	35·0	80·0	1·02590	1·02506	...	*	38
410	268	„ 30	7 35 0	149 49 0	2900	Radiolarian ooze.	34·8	81·0	1·02580	1·02586	...	*	38
411	269	September 2	5 54 0	147 2 0	2550	Red clay.	35·2	81·2	1·02587	1·02612	Dredged.	*	38
412	270	„ 4	2 34 0	149 9 0	2925	Globigerina ooze.	34·6	79·5	1·02591	1·02634	...	*	38
			SOUTH.	WEST.									
413	271	„ 6	0 33 0	151 34 0	2425	Globigerina ooze.	35·0	78·7	1·02601	1·02672	Trawled.	*	38
414	272	„ 8	3 48 0	152 56 0	2600	Radiolarian ooze.	35·1	79·0	1·02646	1·02662	Trawled.	*	38
415	273	„ 9	5 11 0	152 56 0	2350	Radiolarian ooze.	34·5	80·7	...	1·02650	...	*	38
416	274	„ 11	7 25 0	152 15 0	2750	Radiolarian ooze.	35·1	80·2	...	1·02667	Trawled.	*	38
417	275	„ 14	11 20 0	150 30 0	2610	Red clay.	35·0	80·0	1·02618	1·02690	...	*	38
418	276	„ 16	13 28 0	149 30 0	2350	Red clay.	35·1	80·0	1·02603	1·02641	Trawled.	*	38
419	277	„ 17	15 51 0	149 41 0	2325	Red clay.	35·1	79·0	1·02590	1·02592	...	*	38
420	278	„ 18	17 12 0	149 43 0	1525	Mud.	36·5	79·5	1·02575	1·02710	...	*	38
421	279	October 2	17 30 26	149 33 45	420	Mud.	...	79·0	...	...	...		39
422	279a	„ 2	17 29 53	149 34 0	590	Mud.	...	79·0	...	...	...		39
423	279b	„ 2	17 29 38	149 34 7	620	Mud.	...	79·0	...	...	...		39
424	279c	„ 2	17 29 11	149 34 32	680	Mud.	...	79·0	...	...	Trawled.	*	39
425	280	„ 4	18 40 0	149 52 0	1940	Globigerina ooze.	35·3	77·2	1·02639	1·02719	Trawled.	*	38
426	281	„ 6	22 21 0	150 17 0	2385	Red clay.	34·9	74·5	1·02637	1·02690	Trawled.	*	38
427	282	„ 7	23 46 0	149 59 0	2450	Red clay.	35·1	73·2	1·02593	1·02682	...	*	38
428	283	„ 9	26 9 0	145 17 0	2075	Red clay.	35·4	68·5	1·02590	1·02640	...	*	38
429	284	„ 11	28 22 0	141 22 0	1985	Globigerina ooze.	35·1	68·0	...	1·02639	Trawled.	*	38
430	285	„ 14	32 36 0	137 43 0	2375	Red clay.	35·0	65·0	1·02580	1·02627	Trawled.	*	38
431	286	„ 16	33 29 0	133 22 0	2335	Red clay.	34·8	63·0	1·02570	1·02614	Trawled.	*	38
432	287	„ 19	36 32 0	132 52 0	2400	Red clay.	34·7	57·8	1·02564	1·02587	...	*	38
433	288	„ 21	40 3 0	132 58 0	2600	Red clay.	34·8	54·5	1·02563	1·02557	...	*	38
434	289	„ 23	39 41 0	131 23 0	2550	Red clay.	34·8	54·5	1·02567	1·02527	Trawled.	*	38
435	290	„ 25	39 16 0	124 7 0	2300	Red clay.	34·9	52·5	1·02549	1·02532	...	*	38
436	291	„ 27	39 13 0	118 49 0	2250	Red clay.	34·6	53·0	1·02552	1·02550	Trawled.	*	38
437	292	„ 29	38 43 0	112 31 0	1600	Globigerina ooze.	35·2	53·2	1·02561	1·02533	Trawled.	*	38
438	293	November 1	39 4 0	105 5 0	2025	Red clay.	34·4	53·7	1·02572	1·02524	Trawled.	*	38
439	294	„ 3	39 22 0	98 46 0	2270	Red clay.	34·6	57·5	...	1·02513	...	*	38
440	295	„ 5	38 7 0	94 4 0	1500	Red clay.	35·3	58·5	1·02565	1·02536	Trawled.	*	38
441	296	„ 9	38 6 0	88 2 0	1825	Globigerina ooze.	35·3	59·8	1·02544	1·02535	Trawled.	*	38
442	297	„ 11	37 29 0	83 7 0	1775	Globigerina ooze.	35·5	57·0	1·02565	1·02543	Trawled.	*	38
443	298	„ 17	34 7 0	73 56 0	2225	Grey ooze.	35·6	59·0	...	1·02535	Trawled.	*	38
444	299	December 14	33 31 0	74 43 0	2160	Grey ooze.	35·2	62·0	1·02568	1·02533	Trawled.	*	40
445	300	„ 17	33 42 0	78 18 0	1375	Globigerina ooze.	35·5	62·5	1·02545	1·02530	Trawled.	*	40
446	301	„ 22	37 29 0	84 2 0	None.	...	...	59·5	...	1·02541	...	*	40
447	302	„ 28	42 43 0	82 11 0	1450	Globigerina ooze.	35·6	55·0	1·02562	1·02531	Trawled.	*	40
448	303	„ 30	45 31 0	78 9 0	1325	Globigerina ooze.	36·0	54·8	1·02564	1·02487	...	*	40
449	304	„ 31	46 53 15	75 12 0	45	Sand.	...	57·2	...	1·02292	Dredged.		41

Number of Sounding.	Distinguishing Number of Station.	Date. 1876.	Latitude.	Longitude.	Depth in Fathoms.	Nature of Bottom.	Temperature of the Sea-water. Bottom	Temperature of the Sea-water. Surface	Specific Gravity of Sea-water at 60° F. Distilled Water at 39°=1. Bottom.	Specific Gravity of Sea-water at 60° F. Distilled Water at 39°=1. Surface.	Trawling or Dredging.	Serial temperatures were obtained at the stations marked *	Plans on which the Station is shown.
			SOUTH. ° ′ ″	WEST. ° ′ ″			°	°					
450	305	January 1	47 47 0	74 47 0	165	Mud.	...	55·5	1·02520	1·02250	...		41
451	305a	,, 1	47 48 30	74 47 0	125	Mud.	...	55·0	...	...	Trawled.		41
452	305b	,, 1	47 48 0	74 46 0	160	Mud.	...	55·0	...	...	Trawled.		41
453	306	,, 2	48 17 0	74 33 0	565	Mud.	...	57·0	...	...	...		41
454	306a	,, 2	48 27 0	74 30 0	345	Mud.	46·0	57·5	1·02516	...	Trawled.	*	41
455	307	,, 4	49 24 30	74 23 30	140	Mud.	...	53·0	1·02465	...	Trawled.		41
456	308	,, 5	50 8 30	74 41 0	175	Mud.	...	51·7	...	...	Trawled.		41
457	309	,, 8	50 56 0	74 15 0	40	Mud.	47·0	50·5	1·02418	...	...		41
458	309a	,, 8	50 56 0	74 14 0	140	Mud.	...	50·5	1·02448	...	Trawled.		41
459	310	,, 10	51 27 30	74 3 0	400	Mud.	46·5	50·5	1·02450	...	Trawled.		41
460	311	,, 11	52 45 30	73 46 0	245	Mud.	46·0	50·0	1·02454	...	Trawled.		41
461	312	,, 13	53 37 30	70 56 0	9	Mud.	...	47·8	...	1·02229	Dredged.		...
462	313	,, 20	52 20 0	67 39 0	55	Sand.	47·8	48·2	1·02439	1·02440	Trawled.		41&42
463	314	,, 21	51 35 0	65 39 0	70	Sand.	46·0	48·0	1·02472	1·02469	Trawled.		42
464	314a	,, 22	51 24 0	61 46 0	110	Hard ground.	41·8	49·0	1·02502	1·02486	Trawled.	*	42
465	315	,, 26	51 40 0	57 50 0	12	Sand, gravel.	...	50·0	...	...	Dredged.		...
466	316	February 3	51 32 0	58 6 0	4	Mud.	...	51·2	...	...	Dredged.		...
467	317	,, 8	48 37 0	55 17 0	1035	Hard ground.	35·7	46·7	1·02528	1·02525	Trawled.	*	42
468	318	,, 11	42 32 0	56 29 0	2040	Grey ooze.	33·7	57·5	1·02584	1·02525	Trawled.	*	42
469	319	,, 12	41 54 0	54 48 0	2425	Grey ooze.	32·7	59·5	1·02553	1·02559	...	*	42
470	320	,, 14	37 17 0	53 52 0	600	Hard ground.	37·2	67·5	1·02544	1·02530	Trawled.	*	42
471	321	,, 25	35 2 0	55 15 0	13	Mud.	...	73·5	...	...	Trawled.		...
472	322	,, 26	35 20 0	53 42 0	21	Shells.	...	71·5	...	1·02291	Trawled.		16
473	323	,, 28	35 39 0	50 47 0	1900	Grey ooze.	33·1	73·5	1·02650	1·02680	Trawled.	*	16
474	324	,, 29	36 9 0	48 22 0	2800	Grey ooze.	32·6	71·5	1·02610	1·02612	Trawled.	*	16
475	325	March 2	36 44 0	46 16 0	2650	Grey ooze.	32·7	70·8	1·02591	1·02682	Trawled.	*	16
476	326	,, 3	37 3 0	44 17 0	2775	Grey ooze.	32·7	67·8	1·02580	1·02494	...	*	16
477	327	,, 4	36 48 0	42 45 0	2900	Grey ooze.	32·8	70·2	1·02623	1·02639	...	*	16
478	328	,, 6	37 38 0	39 36 0	2900	Grey ooze.	32·9	68·0	...	1·02578	...		16
479	329	,, 7	37 31 0	36 7 0	2675	Grey ooze.	32·3	64·5	1·02582	1·02610	...	*	16
480	330	,, 8	37 45 0	33 0 0	2440	Grey ooze.	32·7	64·2	1·02607	1·02627	...	*	16
481	331	,, 9	37 47 0	30 20 0	1715	Globigerina ooze.	35·4	64·5	1·02591	1·02628	Trawled.	*	16
482	332	,, 10	37 29 0	27 31 0	2200	Globigerina ooze.	34·0	64·0	1·02585	1·02612	Trawled.	*	16
483	333	,, 13	35 36 0	21 12 0	2025	Globigerina ooze.	35·3	67·0	1·02591	1·02619	Trawled.	*	16
484	334	,, 14	35 45 0	18 31 0	1915	Globigerina ooze.	35·8	68·5	1·02612	1·02611	Trawled.	*	16
485	335	,, 16	32 24 0	13 5 0	1425	Globigerina ooze.	37·0	73·5	1·02594	1·02674	Dredged.	*	16
486	336	,, 18	27 54 0	13 13 0	1890	Globigerina ooze.	36·5	76·0	1·02600	1·02707	...	*	16
487	337	,, 19	24 38 0	13 36 0	1240	Globigerina ooze.	37·2	77·0	1·02650	1·02718	Dredged.	*	16
488	338	,, 21	21 15 0	14 2 0	1990	Globigerina ooze.	36·3	76·5	...	1·02762	Dredged.	*	16
489	339	,, 23	17 26 0	13 52 0	1415	Globigerina ooze.	37·2	76·0	1·02580	1·02768	...	*	16
490	340	,, 24	14 33 0	13 42 0	1500	Hard ground.	37·6	77·2	1·02610	1·02763	...	*	16
491	341	,, 25	12 16 0	13 44 0	1475	Hard ground.	38·2	79·0	1·02616	1·02722	...	*	16
492	342	,, 26	9 43 0	13 51 0	1445	Globigerina ooze.	37·5	80·0	1·02619	1·02732	...	*	16
493	343	,, 27	8 3 0	14 27 0	425	Coral.	40·3	80·8	1·02622	1·02700	Dredged.	*	43
494	344	April 3	7 54 20	14 28 20	420	Hard ground.	...	82·0	...	1·02672	Dredged.		43
495	345	,, 4	5 45 0	14 25 0	2010	Globigerina ooze.	36·8	82·8	1·02620	1·02648	...	*	12
496	346	,, 6	2 42 0	14 41 0	2350	Globigerina ooze.	34·0	82·7	1·02641	1·02642	Dredged.	*	12
497	347	,, 7	0 15 0	14 25 0	2250	Globigerina ooze.	36·2	82·0	1·02603	1·02657	...	*	12
			NORTH.	WEST.									
498	348	,, 9	3 10 0	14 51 0	None.	...	...	84·0	...	1·02602	...	*	12(st102)
499	349	,, 10	5 28 0	14 38 0	None.	...	...	83·5	...	1·02636	...	*	12
500	350	,, 11	7 33 0	15 16 0	None.	...	...	84·0	...	1·02640	...	*	12
501	351	,, 12	9 9 0	16 41 0	None.	...	...	81·8	...	1·02671	...	*	12
502	352	,, 13	10 55 0	17 46 0	None.	...	...	77·7	...	1·02672	...	*	12
503	353	May 3	26 21 0	33 37 0	2965	Red clay.	37·6	70·7	1·02715	1·02774	...	*	6
504	354	,, 6	32 41 0	36 6 0	1675	Globigerina ooze.	37·8	70·0	1·02665	1·02735	...	*	6

NOTICE.

ACCORDING to the arrangement sanctioned by H. M. Stationery Office and explained in the Preface, the following six Memoirs have been bound in a temporary volume, without reference to their subjects; in the order in which they were ready, letterpress and plates together, for the binder.

I regret that the first Memoir, that by Mr Thomas Davidson on the Brachiopoda, is not much longer. I am greatly surprised that so many casts of the dredge in deep water, extending over so long a course, should have added so few novelties to this curious group. I only wish it had been in our power to put thousands more into Mr Davidson's skilful and generous hands.

I had hoped also that Dr v. Kölliker might have found time to undertake a larger share of the work; we must only congratulate ourselves on having received, even to a limited extent, the assistance of so high an authority.

Dr George Brady, having completed his valuable account of the Ostracoda, has kindly undertaken the description of the Copepoda of the Expedition; an arduous task, on account of the constant use which was made of the tow-net.

I am glad to be able to say that Professor Turner's interesting Memoir on the Whales is only an instalment, and is to be followed by a description of the Seals, and of the Human remains.

Before we left England, Dr Kitchen Parker told me that he was anxious to procure a series of the embryos of a Chelonian reptile, to enable him to make a study of the development of the head in that peculiar type. When we called at Ascension, as it was the breeding season of the Green Turtle, we made a considerable collection of the young, and Mr Moseley prepared a series of embryos, taken from the egg in different stages. These were handed to Dr Parker; he found, however, that one or two developmental stages were still wanting to complete the necessary material. I accordingly applied to the Admiralty to give instructions to the medical officer in charge at Ascension, to procure an additional supply of specimens; and I have to thank their Lordships for the readiness with which they acceded to this request. Dr Maclean, who had been one of the medical officers on board the Challenger, happened to be stationed at Ascension at the time, and he brought an amount of knowledge and goodwill to the task which soon supplied our wants. I am glad that one of Dr Parker's important Memoirs should form part of our Report.

In regard to the Challenger Expedition, shore-fishes were much in the position of land birds or mammals, or other groups which lay beyond our special province. At most of the ports where we remained for any length of time there were numerous European residents, and opportunities were ample for supplying museums at home at a small cost. It was, therefore, only when we stopped for a time at remote places, such as St Paul's Rocks or the Admiralty Islands, that we took special pains to bring together as many fishes as possible. The collection of shore-fishes is accordingly comparatively small. Owing to the successful use of the deep-sea trawl during the voyage, and the attention which has been paid to the matter by Mr Murray, the pelagic and abyssal fishes form one of the most interesting parts of our collection. This series will also be described by Dr Günther.

The Memoirs which appear in this temporary volume are naturally among the shorter and more easily prepared. Some of the more important monographs are in type, and almost ready for publication; while a few others, some of which will each occupy two entire volumes, cannot be finished for some time.

C. Wy. T.

THE

VOYAGE OF H.M.S. CHALLENGER.

ZOOLOGY.

REPORT on the BRACHIOPODA dredged by H.M.S. Challenger during the years 1873–1876. By THOMAS DAVIDSON, F.R.S., F.L.S., F.G.S., V.P.P.S., &c.[1]

AT the request of Professor Sir Wyville Thomson, F.R.S., I have undertaken the examination, description, and illustration of the Brachiopoda dredged during the Challenger Expedition.

Very little seems to have been known with respect to recent Brachiopoda before the middle of the last century; and even during the period extending from 1750 to 1800, the information relating to the recent species was, with some exceptions, meagre and often unsatisfactory.

A Brachiopod, until within the last fifty years, was considered a great rarity in all collections, and no one could boast of possessing more than a very limited number of species and specimens. Much uncertainty was also felt as to their nature, and the position they should occupy among the Invertebrata. They were generally supposed to be referable to the genus *Anomia*, and were very quaintly described by some of the earlier naturalists; several more serious and better informed observers appeared soon after 1753, such as Linnæus, Pennant, Müller, Lamanon, Pallas, Poli, Grundler, and a few others, who were able, in a measure, to prepare the way for the important discoveries reserved for the more favoured naturalists of the present century.

[1] Since the publication of my short paper, On the Brachiopoda dredged by H.M.S. Challenger, in the Proceedings of the Royal Society, vol. xxvii. p. 428, May 1878, some few more specimens have been found among the Mollusca obtained during that expedition, which has necessitated some little additions and alterations to the general results (see Appendix). The Latin ending of some of the specific names has likewise been slightly altered. I may also mention that a complete series of the Brachiopoda described in this report numbering 345 specimens, has, at Sir Wyville's request, been selected by myself, and handed over to the authorities of the British Museum by Sir Wyville Thomson. I desire likewise to tender to Sir Wyville Thomson my sincere thanks for the courteous manner with which he has afforded me every assistance within his power, also to Mr John Murray, the Rev. R. Boog Watson, Dr Gwyn Jeffreys, Mr Dall, M. Perrier, Dr Günther, and others.

The animal of the Brachiopod had attracted the attention of Pallas in 1766, Pennant in 1773, Grundler in 1774, Müller in 1776, Poli in 1791, Lamanon and Cuvier in 1797; but no regular anatomical dissections had been executed, and these observations seemed, in a great measure, to be limited to the labial appendages, mantle, and some other minor details. This most important inquiry was, however, subsequently admirably followed out by such excellent zoologists and anatomists as Cuvier,[1] R. Owen,[2] Huxley,[3] Vogt,[4] Macdonald,[5] Hancock,[6] Gratiolet,[7] De Lacaze-Duthiers,[8] King,[9] E. Deslongchamps,[10] and others,[11] to whose works the reader is referred, as it would not be possible in the limited space devoted to the description of the species dredged by the Challenger Expedition to write a treatise on the history of the class, or to refer to the fossil genera and species, which vastly outnumber those inhabiting the existing seas.

Restricting ourselves, therefore, to the recent species, we may observe that the correct knowledge we now possess with respect to their geographical and bathymetrical distribution is mainly due to the numerous governmental and private dredging expeditions carried out during the last forty years. Before that period very few reliable data were in

[1] Cuvier.—Sur l'animal de la *Lingule anatine*, Memoires du Muséum, vol. i., 1802.

[2] R. Owen.—On the Anatomy of the Brachiopoda, Trans. Zool. Soc., vol. i., communicated in 1833. Sur l'appareil de la circulation chez les Mollusques de la classe des Brachiopodes, Annales des Sciences Nat., 3d ser.; Zoologie, vol. iii., Acad. des Sciences, 1845, and in Davidson's British Fossil Brachiopoda, Introduction.

[3] T. Huxley.—Contributions to the Anatomy of the Brachiopoda, Annals and Mag. of Nat. Hist., vol. xiv., 2d ser., Oct. 1854.

[4] Vogt.—Anatomie der *Lingula anatina*, 1845.

[5] Macdonald.—On the Physiology of the Pallial Sinuses of the Brachiopoda, Trans. Linn. Soc., vol. xxiii., 1862.

[6] A. Hancock.—On the Organisation of the Brachiopoda, Phil. Trans., vol. cxlviii., 1858.

[7] P. Gratiolet.—Recherches pour servir à l'Histoire des Brachiopodes, Journal de Conchyliologie, Oct. 1857–1860.

[8] De Lacaze-Duthiers.—Histoire naturelle des Brachiopodes vivants de la Méditerranée, Annales des Sciences Naturelles, Zoologie, vol. xv., 1861.

[9] W. King.—On Some Characters of the Living *Lingula anatina*, Annals and Mag. of Nat. Hist., July 1873.

[10] E. Deslongchamps.—Recherches sur l'organisation du manteau chez lez Brachiopodes articulés, Caen, 1864.

[11] Semper.—Vascular System of *Lingula*, &c., Zeitschrift für wissenschaftliche Zool., vol. ii., 1859, and vol. xiv., 1864. S. P. Woodward.—A Manual of the Mollusca, 1856. E. Morse.—The Brachiopoda: a Division of Annelida, Am. Journ. of Science and Art, vol. for 1870. On the Oviducts and Embryology of *Terebratulina*, vol. iv., 1872. On the Systematic Position of the Brachiopoda, Proc. of Boston Soc. of Nat. Hist., vol. xv., 1873. Embryology of *Terebratulina*, Mem. Boston Soc. of Nat. Hist., vol. ii. On the Early Stages of *T. septentrionalis*, Mem. Boston Soc. Nat. Hist., vol. ii., 1869. F. Müller.—Early Stages of Certain Brachiopoda, Reichert und du Bois-Reymond's Archiv, 1860, and in Wiegmann's Archiv, 1861; see also Annals and Mag. of Nat. Hist., 3d ser., vol. viii. p. 505. Steenstrup.—Proc. Royal Danish Academy, 1847. Kowalevsky.—On the Embryology of *Argiope*, *Thecidium*, and *Terebratulina* (written in the Russian language), 1873; also A. Agassiz.—Silliman's American Journal of Science and Art, 3d ser., 1874. Hérouard.—Sur les courants de nutrition des Brachiopodes, Ann. des Sciences Phys. et Chim., 3d ser., t. xiv., and Journal de Conchyliologie, 1877. Davidson.—British Fossil Brachiopoda, Introduction, 1853. What is a Brachiopod? Geol. Mag., 1877, &c., &c. Dall.—Report on the Brachiopoda, obtained by the U. S. Survey Ex., Bull. Mus. Comp. Zool., 1877, and other papers. W. B. Carpenter.—On the Microscopic Structure of Shells, Brit. Assoc. Rep., 1843; On a Peculiar Arrangement of the Sanguiferous System in *Terebratula*, &c., Proc. of Royal Soc., vol. vii., 1854; and in Davidson's Brit. Foss. Brach., Pal. Soc., 1853. W. King.—On the Histology of the Test of the Class *Palliobranchiata*, Trans. Royal Irish Academy, vol. xxiv., 1867. J. Gwyn Jeffreys.—British Conchology. Oscar Schmidt.—Die neuesten Untersuchungen über die Brachiopoden. Halle, Zeitschr. Gesammt. Naturw., Bd. iii., 1854, pp. 325–333. E. Suess.—Über die Wohnsitze der Brachiopoden,—Wien, Sitz. Ber., Bd. xxxvii., 1859, pp. 185–248.

our possession; and as these dredging expeditions proceed, the more will our knowledge become extended.

The admirable report of Prof. E. Forbes On the Mollusca and Radiata of the Ægean Sea, published by the British Association for the Advancement of Science in 1843, shadowed forth the important results that might be obtained by well conducted and equipped expeditions; but even now we are wanting in information with respect to the bathymetrical distribution of some twenty-six or twenty-eight of the known living species. In his excellent memoir, Über die Wohnsitze der Brachiopoden, 1859, Professor E. Suess recapitulates all the then known data respecting the geographical distribution of Brachiopoda and the depths at which they live; since then our knowledge has been very considerably extended, and it has become evident from direct observation that the Brachiopoda are widely but sparingly distributed over the depths of the sea, though, of course, they are more numerous both in species and individuals at depths of less than 500 fathoms; they are also much localised, and prefer rocky, stony, and coralline sea-bottoms to soft or muddy ones.

The entire collection of Brachiopoda brought home by the Challenger Expedition, numbering several hundred specimens, was placed in my hands by Sir Wyville Thomson on the 11th of August 1877. The specimens were in an excellent state of preservation, and had been put into bottles of spirit, with a correct indication of the stations, latitude, longitude, depth, bottom-temperature, and the nature of the sea-bed whence they had been obtained. Thus, reliable and invaluable data accompanied each specimen, which I have in every instance reproduced in the pages of this Report. Sometimes only one specimen of a species had been dredged at a station, while at other times two or more species or specimens were brought to the surface. It must, however, be noted that, in addition to the 361 dredging stations included in the printed list of observing stations, the naturalists of the Challenger dredged very often in shallow water.

We learn from the printed instructions that, throughout a course of 68,890 miles, the dredge was put down at some 361 stations, and Brachiopoda were brought up thirty-eight or thirty-nine times only. Although the number of Brachiopoda brought home was great, not more than thirty-one species are represented. The greatest depth at which any living Brachiopod was obtained was 2900 fathoms; the greatest depth dredged being on one occasion 4575 fathoms.

The ranges of depth at which the Challenger species of Brachiopoda occurred were as follows:—

Shore or low water to 10 fathoms, .	*Waldheimia flavescens*, Lamarck.
... ...	*Kraussina lamarckiana*, Dav.
2 to 10 fathoms, . .	*Magasella cumingi*, Dav.
... .	*Lingula anatina*, Lamarck.
... .	*Megerlia sanguinea*, Chemnitz.
5 to 15 fathoms, . .	*Magasella flexuosa*, King.

25 to 30 fathoms, . . .	*Terebratella dorsata*, Gmelin.
38 to 49 „ . . .	*Terebratulina cancellata*, Koch.
49 . „ . . .	*Discina stella*, Gould.
51 to 150 „ . . .	*Terebratulina caput-serpentis*, var. *septentrionalis*, Couthouy.
70 to 75 „ . . .	*Megerlia truncata*, Lin.
70 to 75 „ . . .	*Argiope decollata*, Chemnitz.
82 . „ . . .	*Terebratulina*, sp. (?) (Philippine Islands).
82 to 102 „ . . .	*Terebratella*, sp. (?), perhaps *T. frielii*.
100 . „ . . .	*Platydia anomioides*, Scacchi.
100 to 150 „ . . .	*Waldheimia kerguelenensis*, Dav.
120 . „ . . .	*Mergerlia willemöesi*, Dav.
120 to 600 „ . . .	*Terebratula uva*, Broderip.
150 . „ . . .	*Terebratula vitrea*, var. *minor*, Philippi.
150 . „ . . .	*Kraussina pisum*, Lamarck.
150 . „ . . .	*Rynchonella nigricans*, var. *pixydata*, R. B. Watson, M.S.
210 . „ . . .	*Terebratula moseleyi*, Dav.
350 . „ . . .	*Terebratulina cailleti*, Crosse.
390 . „ . . .	*Terebratulina wyvillii*, Dav.
390 . „ . . .	*Magasella incerta*, Dav.
420 . „ . . .	*Terebratula cubensis*, Pourtales.
600 . „ . . .	*Terebratulina murrayi*, Dav.
1340 . „ . . .	*Terebratella frielii*, Dav.
1875 . „ . . .	*Terebratula* or *Terebratulina* (?) *dalli*, Dav.
1850 . „ . . .	*Megerlia* (?) *incerta*, Dav.
1850 to 2425 „ . . .	*Discina atlantica*, King.
1035 to 2900 „ . . .	*Terebratula wyvillii*, Dav.
1900 . „ . . .	*Terebratula* (?) undeterminable fragments.
2160 . „ . . .	*Waldheimia wyvillii*, Dav.

The following table shows approximately how many times Brachiopoda were dredged at certain depths :—

99	dredgings in depths of from	1 to 500	fathoms, . .	21, 22, or 23 times.
30	„ „	501 to 1000	„ . .	4 „
47	„ „	1001 to 1500	„ . .	5 „
47	„ „	1501 to 2000	„ . .	4 „
93	„ „	2001 to 2500	„ . .	3 „
83	„ „	2501 to 3000	„ . .	3 (at 2600 and 2900 f.).
5	„ „	3001 to 3500	„ . .	None.
5	„ „	3501 to 4000	„ . .	None.
None	„ „	4001 to 4500	„ . .	None.
1	„ „	4501 to 4575	„ . .	None.

Thus it becomes apparent that Brachiopoda do not, as far as our experience goes, generally abound in depths exceeding 500 or 600 fathoms; for out of 125 dredgings, in depths of from 1 to 600 fathoms, Brachiopoda were brought up twenty-two or twenty-three times; while in depths varying from 600 to 2900 fathoms they were obtained about sixteen times. The depths for some of the species, however, were different in localities not visited by the Challenger, as recorded in the general list. In order to obtain some approximate data as to the depths Brachiopoda are at present known to inhabit, it will be desirable to append a list of all the known recent species, with an indication of all their respective depths.

In 1852 I published in the Annals and Magazine of Natural History a sketch of a classification of recent Brachiopoda based upon internal organisation, giving a list of all the recent species then known. Similar and revised lists were subsequently published in 1859 by Professor E. Suess, in 1861 by Lovell Reeve and myself, and in 1870 and 1873 by Mr W. H. Dall. In the revised list here appended the range of depth of the European and North Atlantic species has been given me by Dr J. Gwyn Jeffreys, F.R.S., to whom science is so much indebted for his great exertions in promoting those important private and public dredging expeditions from which so many valuable results have been obtained, and for the numerous able reports he has published relating to the same. The approximate ranges in depth at which the larger number of Brachiopoda have been found are in our possession, but of the following no information is given by the original authors, and later researches have not revealed it. It is to be hoped that future dredging expeditions will supply the deficiencies.

Terebratula (?) *malvinæ*, D'Orb. I have never seen.
Terebratulina radiata, Reeve. A common Korean species.
Terebratulina (?) *patagonica*, Gould.
Waldheimia raphælis, Dall. Said to be from Japan.
Terebratella bouchardi, Dav. Probably a synonym of another species.
Terebratella rubiginosa, Dall.
Terebratella (?) *algoensis*, Sow. A doubtful species.
Terebratella (?) *labradorensis*, Sow. A doubtful species.
Terebratella (?) *lamanoni*, Schrenk. A doubtful species.
Magasella crenulata, Sow.
Magasella lævis, Dall.
Magasella suffusa, Reeve. A doubtful species.
Kraussina rubra, Pallas.
Kraussina cognata, Chemnitz. A doubtful species.
Kraussina atkinsoni, T. Woods.
Kraussina capensis, Adams and Reeve.
Bouchardia (?) *fibula*, Reeve. One specimen known, perhaps a large *M. cumingi.*
Rynchonella grayi, Woodward. One specimen known.
Discina antillarum, D'Orb. Probably a synonym of *D. striata.*
Lingula exusta, Reeve.
Lingula hians, Swainson.
Lingula hirundo, Reeve.
Lingula reevii, Dav. = *L. ovalis*, Reeve.
Lingula adamsi, Dall.
Glottidia audebardi, Brod.

It is more than probable that a certain number of the so-termed species recorded in our general list, with respect to which our information is insufficient and unsatisfactory, will hereafter require to be expunged, or placed among the synonyms of some of those forms of which the specific claims have been definitely established. No permanent list of either recent or fossil species can at present be tabulated; but in order that the desired result may ultimately be attainable, it is necessary from time to time to lay before the public the progress that has been achieved in the right direction, pointing out at the same time the unavoidable deficiencies in our knowledge. The ranges in depth recorded in our list are even now sufficient to warrant us in arriving at certain general inductions. Thus, for the sake of argument, we will put down the number of recorded species and named varieties at nominally 135—viz., 125 so-termed species, and 11 named varieties—a number which will certainly have to be hereafter reduced. As nothing is known respecting the ranges of depth of some 25 or 26 so-called species, of which we have given a list, the number upon which we may venture to generalise would be about 107.

In approximate numbers we find—

From shore to 500 fathoms, some	98 species.
Or named varieties; 12 of these range up to 100 fathoms or less.	
From 501 to 1000 fathoms, ...	16 ,,
Of these only one, *Discina atlantica*, would range from 690 to 2400 fathoms.	
From 1001 to 1500 fathoms, ...	6 ,,
Of these, *Terebratula wyvillii* ranges from 1035 to 2900 fathoms, the greatest depth at which any species has been found.	
From 1501 to 2000 fathoms, ...	4 ,,
From 2001 to 2900 fathoms, ...	3 ,,

Thus, out of 107 species or named varieties, some 57, or about half the known species, were dredged at a depth of under 100 fathoms; 20 to 25 at low-water mark, or from 5 to 10 fathoms; and the remainder at about 50 or 60 fathoms. These facts indicate that the greater bulk of known species live at comparatively small or moderate depths, few in depths ranging up to 500 fathoms, and that Brachiopoda are specifically rare at depths varying from 500 to 2900 fathoms. It must, however, in fairness be noted that the number of deep-sea dredgings is small when compared with those made in seas of moderate depths; and, consequently, that a proportionally larger number of species may be hereafter expected when a larger area of the oceanic abysses has been explored. I do not, however, anticipate that the general results will much alter the conclusions formulated in the preceding pages. It is also evident that some species are capable of existing at a great variety of depth; for instance—

Platydia anomioides is recorded from	40 to 600	fathoms.
Rhynchonella psittacea ,,	10 to 690	,,
Terebratula vitrea ,,	5 to 1456	,,
Discina atlantica ,,	600 to 2425	,,
Terebratula wyvillii ,,	1035 to 2900	,,

The animal of the same species of Brachiopod is, moreover, capable of existing at different depths without any observable modification in shape and character. It has also been clearly ascertained that the Brachiopoda, although widely distributed, are very much localised, and usually occur in great numbers in their respective haunts. If we examine the nature of the sea-bottom from which the Challenger specimens were obtained, we find that they were dredged eleven times from sea-bottoms composed of rock and clay, twice from stones and gravel, three times from sand, and twelve times from soft bottoms composed of mud, globigerina, or grey ooze; but, as previously stated, as a rule, they prefer rocky bottoms and coral reefs. Brachiopoda are also found clustering together in vast numbers, adhering to one another by their peduncles, or massed together, one above the other, till they sometimes form a living aggregation of considerable breadth and thickness, as is the case with *Discina lamellosa, D. lævis,* and other species. The young shell is even very often found attached to the peduncle of its neighbour, but according to Morse and other zoologists who have made the embryology of the class their special study, the fry before becoming attached swims, or whirls head foremost by means of the vibratile cilia covering the body. *Lingula* and *Glottidia*, it is well known, abound in particular haunts, and live at about half-tide mark, and partly buried in mud at depths varying from 3 or 4 inches from the surface to 7, 10, 17, and 60 fathoms; but the ranges of depth of six or seven of the species are still unknown.[1]

Observations connected with the living animal are especially needed, but these can only be made when the animal is brought up alive and placed for some time in jars of sea-water.

It is somewhat remarkable that the Challenger Expedition failed to obtain, with the exception of *Lingula anatina* and one example of *Megerlia sanguinea*, any of those brilliantly coloured species which abound in many localities; but to compensate for this deficiency several remarkable new forms were dredged, such as *Terebratula wyvillii* and *Terebratulina wyvillii,* this last being the finest and largest species of the sub-genus *Terebratulina* hitherto discovered, either in the recent or fossil condition.

[1] In his paper on Japanese *Lingulæ* in the American Journal of Science and Arts, vol. xv., 1878, Professor E. Morse observes that his studies of *Lingula* have brought out many points new to science. The discovery of auditory capsules in the class of Brachiopoda is one of the most important. These organs he determined in a species of *Lingula*, and their position and general appearance recall the auditory capsules as figured by Claparède in certain tubicolous annelids. He has also cleared up many of the obscure points in regard to the circulation, and is prepared to maintain the absence of anything like a pulsatory organ, the circulation being entirely due to ciliary action. Mr Morse also described some of the habits of *Lingula*. While partially buried in the sand the anterior border of the pallial membranes contract in such a way as to leave three large oval openings, one in the centre and one on each side. The bristles, which are quite long in this region of the animal, arrange themselves in such a way as to continue these openings into funnels, and entangle the mucus which escape from the animal. These funnels have firm walls, a continual current is seen passing down the side funnels, and escaping by the central one. They bury themselves very quickly in the sand, and the peduncle agglutinates a sand tube. They attach themselves by means of this tube to the bottom of dishes in which they are confined.

Before describing the various species dredged by the Challenger Expedition, it may be as well to mention that the Brachiopoda have been divided by Bronn into two great groups termed *Apygia* and *Pleuropygia*. Professor King, considering these to be inadmissible on certain grounds, substituted the name *Clistenterata* for the first group, on account of its including animals that are destitute of an anal aperture; and the term *Tretenterata* for the second, as it embraces animals provided with this opening. The former division contains species which have their valves articulated, and belong to the following genera and sub-genera—*Terebratula, Terebratulina, Waldheimia, Terebratella, Magasella, Laqueus, Megerlia, Kraussina, Bouchardia, Platydia, Argiope, Cistella, Gwynia, Thecidium, Rhynchonella*, and *Atretia*, among the recent forms. The latter division comprises species with unarticulated valves, such as *Lingula, Glottidia, Discina, Discinisca*, and *Crania*. Some very important modifications in the animal connected with these divisions, especially in what relates to the muscular system, are fully detailed in the anatomical memoirs to which we have already referred.

Long experience has shown that the subdivision of the large family TEREBRATULIDÆ into different genera and sub-genera, is not only necessary but fully warranted by the important differences assumed by the animal as well as by its skeleton or the calcified support of the labial appendages. It is, therefore, my firm belief that we are justified in maintaining *Waldheimia* as a distinct genus or section from *Terebratula*, just as much as to maintain *Terebratella* as distinct from *Terebratula* or *Waldheimia*. I, consequently, regret not being able to agree with my distinguished friend, Dr Gwyn Jeffreys, who seems inclined to unite the two first-named genera under the single name *Terebratula*, nor can I coincide with his statement (Proc. Zool. Soc., April 1878, p. 398):—"It is notorious that *Terebratulina* and *Waldheimia* gradually pass one into another, as well as into the main or typical genus *Terebratula*." My long study of the group would lead me to a completely different opinion, for not only are the differences presented between the animals of *Terebratula* and *Waldheimia* very great, but the characters of their loops are equally distinct. In *Terebratula* the loop is very short and simple, as is likewise the case in *Terebratulina*, while in *Waldheimia*, as so well shown by Herman Friele and by Mr Jeffreys himself, it has to go through a very complicated series of changes in the process of its development prior to attaining its full-grown and final condition, namely, that of a long, simple reflected loop. It also supports the principal branches of the labial appendages throughout their entire length, which is not the case in *Terebratula* or *Terebratulina*. There exists also in the dorsal valve of *Waldheimia*, a median septum which is not present in *Terebratula*, and which is a constant help to the Palæontologist, enabling him, without seeing the interior of the shell, or its animal, to distinguish in the fossil condition species that belong to *Waldheimia*; a dark median longitudinal line being generally observable through the thickness of the shell, and extending from the umbo to about one-third of its length. This is never seen in either *Terebratula* or *Terebratulina.* There are, likewise, important differences between the two genera in the shape of the cardinal process and hinge-plate. The characters of a genus must be taken from the full-grown animal and its shell, and not from its immature condition, for, prior to its having attained its real and final character, it has to pass through various and gradual changes. No one would describe a frog from its young or larva, or when the tadpole presented a fish-like form, without feet or legs, nor would the zoologist describe the animal or the loop of a fully-developed *Waldheimia* from its early stages of development. Dr Jeffreys adopts *Terebratella* as a distinct genus, while he considers *Waldheimia* as only a sub-genus of *Terebratula.* In my opinion the differences between *Waldheimia* and *Terebratula* are even greater than those separating *Terebratella* from *Waldheimia.*

In vol. iii. of the Geologist (p. 441, 1860), Mr Charles Moore made some observations On the Development of the Loop of *Terebratella,* having previously submitted for my inspection, opinion, and illustration, several examples of a small species he had discovered in the Oolites of Hampton Cliff, near Bath. I made the enlarged drawings which were subsequently badly reproduced in pl. xiii. of that periodical. Mr Moore's observations and my illustrations proved that a certain modification of the loop takes place prior to its having attained its final and full-grown condition. In a subsequent paper by Mr C. J. A. Meyer, entitled On the Development of the Loop and Septum in *Terebratella* (Geol. Mag., vol. v. p. 268, 1868), the author dissents from the views expressed by Mr C. Moore, and adds : "With regard, therefore, to the attachment or non-attachment of the loop *at different ages of the shell* in the sections *Waldheimia, Terebratella,* &c., the rule appears to be that the loops are either constantly attached to the septum, as in *Terebratella, Megerlia,* &c., or constantly free, as in *Waldheimia;*" but this is a mistaken view. Dr S. P. Woodward and I observed in 1853, that a modification in the development of the loop of the sub-genus *Terebratulina* took place from the young to the adult, for we showed that when quite young, and up to a certain age, the loop was very short and simple as in *Terebratula,* but that with age it was rendered annular by the gradual union of the oral processes. The subject was, however, in 1875, seriously taken into consideration by Herman Friele,[1] when he pointed out that the skeleton of *Waldheimia cranium,* Möll., and *Waldheimia septigera,* Lovén, underwent a peculiar change, that the apophysary system exhibited a much more complicated construction at an early stage of growth, than at that of maturity. In a subsequent paper, illustrated by six well-drawn plates, H. Friele continues his investigations on this important question,[2] and states: "Having resumed the study of *Waldheimia,* I have become satisfied that my description given of the young state of the apophysary system

[1] Bidrag til Vestlandets Mollusk fauna, Christiania, Videnskabs-Selskabets Forhandlinger.

[2] The Development of the Skeleton in the Genus *Waldheimia,* Archiv for Mathematik og Naturvidenskab. Christiania, 1877.

and its development was, in the main, correct, *i.e.*, the apophysis of *Waldheimia* is at an early stage fastened in a threefold manner; firstly, the lamellæ are connected to the hinge-plate by the crura; secondly, the lamellæ are connected with a septum; and, finally, the reflected part of the loop is connected with the lamellæ and the septum by two vertical walls placed close together; as the shell is enlarged the loop expands in breadth, the united lamellæ split from below backward, dissolve connection with the septum, and the lateral walls vanish. In this representation, no correction is to be made; but, besides being now enabled to proceed one step further into the development, I can also replace my earlier simple drawings by better and more complete illustrations." Herr Friele then proceeds to describe in detail each modification assumed by the loop from its complicated condition up to its simple adult form in which it is attached only by its crura to the hinge-plate. He adds: "The history of the development of the Brachiopoda has until recently been very little known, and it was not till 1871 and 1873 that Prof. Morse published a complete description of that of *Terebratulina septentrionalis*, Couth.[1] By comparing the manner in which the formation of the apophysary system takes place in the latter, with the above described in *Waldheimia*, an essential difference is observed. *Terebratulina* proceeds with deviation direct towards the form that characterises the genus; *Waldheimia*, on the contrary, forms first a very complicated loop, and passes then to a more simple construction.

In the Proceedings of the Zoological Society for 1878, Dr Gwyn Jeffreys corroborates the observations of H. Friele, and I have likewise perceived from the Challenger material that a similar development of the loop, as that observed in *Wald. cranium* and *W. septigera*, takes place in *Wald. kerguelenensis* and *W. flavescens*, and that this is probably the rule in every species of the genus. A similar modification of the loop takes place in *Wald. lenticularis*, a species nearly related to *Wald. kerguelenensis*.

I also question very much whether *Magasella*, Dall, is a good genus or even subgenus. From the study of a series of the so-termed *Magasella evansi*, I am convinced that this last is only the young stage of *Terebratella cruenta*, and it is probable that in the young of *Terebratella* the septum was comparatively much larger and more elevated than it became afterwards in the adult form. These important questions and investigations, relative to the development of the loop in different genera, are, as it were, a new study, which, when properly followed up, will eventually lead to the most important results. It will now, therefore, be very desirable to obtain and examine large series of specimens of the same species, at different stages of growth (as has been done by H. Friele for *W. cranium* and *W. septigera*), a study that will repay those naturalists who may be able to procure the necessary material.

[1] Early Stages of *Terebratulina septentrionalis*, &c., Mem. of the Boston Soc. of Nat. Hist., vol. ii. parts 1 and 3.

Catalogue of the recent Species of Brachiopoda at present known, with indication of the Habitats and Range of Depth at which each Species has been found.

A point of interrogation has been placed before uncertain or not sufficiently determined species or varieties, and an asterisk before those dredged by the Challenger Expedition. The hitherto ascertained depth of the habitat of each species is given in fathoms in the left-hand column.

Class BRACHIOPODA, Cuvier.

Clistenterata, King.

Genus *Terebratula*, Llhwyd.

Loop small and simple, attached to hinge plate only; no septum in dorsal valve.

Depth in Fathoms.		
5 to 1456	*Terebratula vitrea*, Born, 1780. *Anomia vitrea*, Born, Mus. Vind., p. 119.	Mediterranean, Capo di Gata, &c.; off Coast of Tunis; Vigo Bay; Coast of Portugal; Adventure Bank, &c. *Fossil:* South Italy; Sicily; Morea (Pliocene).
40 to 1000	**Terebratula vitrea*, var. *minor*, Philippi, Moll. Sicil., 1836, = *T. affinis*, Calcara, 1845. It is often difficultly distinguishable from the young shell of *T. vitrea*.	Off Jan Mayen Island (363 fms., *Ter. arctica*, Friele, MS.); Mediterranean, Adriatic, and Ægean Sea; Bay of Naples; off Coast of Tunis; off Azores (1000 fms.); Josephine Bank; near Culebra Island; off Cape of Good Hope, &c. *Fossil:* Sicily, South of Italy.
55 to ?	*Terebratula vitrea*, var. *davidsoni*, A. Adams, Proc. Zool. Soc., p. 314, pl. xix. fig. 30, 1867, &c. Dr Gwyn Jeffreys considers this to be identical with *T. vitrea* (?).	Japan.
292 to 994	*Terebratula vitrea*, var. (?) *sphenoidea*, Philippi, Moll. Sicil., vol. ii. p. 67, pl. xviii. fig. 6, 1844, is, according to Dr Gwyn Jeffreys, a var. of *T. vitrea*. See Proc. Zool. Soc., 1878; but there is a marked difference in the shape of the loop.	Coast of Portugal ("Porcupine" Ex., 1870). *Fossil:* Sicily, South of Italy.
(?)	(?) *Terebratula vitrea*, var. *cernica*, Crosse, Journ. Conchyl., vol. xxi. p. 285, 1873, and vol. xxii. p. 75, pl. i. fig. 3, 1874. Very little is known of this species. Only one specimen is recorded. It is, perhaps, a variety of *T. vitrea* or of *T. cubensis*, but not of *T. uva*.	Mauritius (Lienard).
100–420	**Terebratula cubensis*, Pourtales, Bull. Mus. Comp. Zool., vol. i. p. 109, 1867. Its loop differs from that of *T. vitrea*, but is not unlike that of *T. sphenoidea*.	West Coast of Cuba, near Havana; Florida Reefs; Ascension.

210	**Terebratula moseleyi*, Dav., Proc. Zool., vol. xxvii. p. 436, 1878.	West of Kerguelen Island.
500–600	*Terebratula subquadrata*, Jeff., Proc. Zool. Soc., p. 402, pl. xxii. fig. 4, 1878.	Setubal, Coast of Portugal (Kent, 1870).
10 to 600	**Terebratula uva*, Brod., Proc. Zool. Soc., p. 142, pl. 22, fig. 2, 1833. Varies a good deal.	Gulf of Tchuantepec, Guatemala, 10–12 fms. (Brod.); Twofold Bay; off Buenos Ayres; off Heard Island.
1035 to 2900	**Terebratula wyvillii*, Dav., Proc. Roy. Soc., vol. xxvii. p. 436, 1878. A very remarkable, widely-spread, and abundant deep-sea species.	Near South Australia; off Falkland Islands; off Valparaiso, &c. (see description of species).
1875 to (?)	**Terebratula*(?) *dalli*, Dav., Proc. Roy. Soc., vol. xxvii. p. 437, 1878. One only specimen known, with loop broken, but it belongs to either *Terebratula* or to the sub-genus *Terebratulina*.	Off Yeddo, Japan.
	(?) *Terebratula malvinæ*, D'Orb., Voy. Amér. meré., vol. v. p. 674, pl. 85, figs. 27–29, 1847. I have never been able to obtain a sight of this small and very uncertain species. It is not to be found in the Jardin des Plantes collection, where it was sought for by Prof. Perrier. It is very uncertain whether it belongs to the genus *Terebratula*.	Falkland Islands (?), (Iles Malouines, D'Orb.)

Sub-genus *Terebratulina*, D'Orbigny.

Loops short and simple, attached to the hinge plate; in the adult condition rendered annular by the union of the oral processes.

390	**Terebratulina wyvillii*, Dav., Proc. Roy. Soc., vol. xxvii. p. 436, 1878. The largest and finest species of the sub-genus hitherto discovered either in the recent or fossil condition. Two specimens known.	Off Culebra Island, N.W. of St Thomas, West Indies (Challenger Expedition).
30 to 40	**Terebratulina cancellata*, Koch., in Küster's Conchyl. Cab., vol. vi. p. 36, pl. 2^b, figs. 11–13. A well-marked species.	West Australian Coast, east of Moncœur Island.
(?)	*Terebratulina radiata*, Reeve, Conch. Icon., pl. iii. fig. 7, 1871. This seems to be a good species; depth wanted.	Gulf of Korea.
About 100	*Terebratulina* (*Agulhasia*) *davidsoni*, King, Annals and Mag. of Nat. Hist., 4th ser., vol. vii. p. 111, pl. xi. figs. 1–8, 1871. This species, according to Dr Gwyn Jeffreys and Mr Dall should be referred to *Terebratulina*. It has the loop of *Terebratulina*, but its beak is very large and remarkable.	Agulhas Bank, South Africa. Mr Layard informed Dr Gwyn Jeffreys that this small species was got in near 100 fathoms, near Cape Town, on fishermen's lines, attached to coral, and not far from the coast.
0 to 1180	*Terebratulina caput-serpentis*, Lin., *Anomia caput-serpentis* Lin. Syst. Nat., ed. xii. 1767 = *Terebratulina cornea*, D'Orb. = *pubensis*, Lin. = *Terebratulina aurita*, Flem. = *Terebratulina costata*, Lowe = *Terebratulina striata*,	Spitzbergen and Davis Straits; North-East European Seas; Oban and off Cumbrae Islands, Loch

	Leach = *Terebratulina Grevillei*, T. Woods = *Terebratulina marginata*, Risso. = *Terebratulina quadrata*, Risso. = *Anomia retusa*, Lin. = *Delthyris spatula*, Menke.	Torridon, Scotland; off Belfast; off Finisterre and Croix de Gavie; Morbihan; Cape Breton, opposite southern extremity of Dep. des Landes, France; Adventure Bank, off Guetaria, Spain; N.E. coast of Jamaica; Korea; Australia. *Fossil:* Upper Tertiaries, Coralline Crag, Scotland; Scandinavia; Belgium; South Italy; Azores.
50 to 130	*Terebratulina caput-serpentis*, var. *mediterranea*, Jeff., Proc. Zool. Soc., 1878. This seems to be a well-marked variety.	Mediterranean. *Fossil:* Sicily, South of Italy.
51 to 130	**Terebratulina caput-serpentis*, var. *septentrionalis*, Couthouy, Boston Journ. Nat. Hist., vol. ii. p. 55, 1838. By some malacologists this is considered to be a distinct species, by others as only a variety of *T. caput-serpentis*. It has been several times well figured.	North-East Coast of America; off Halifax, Massachusetts Bay, Coast of Maine; East Port at low water, off Isle of Shoals; Grand Manan; off Cape of Good Hope; West of Kerguelen Island.
82	**Terebratulina* (undetermined species), Dav., Proc. R. Soc., vol. xxvii., 1878.	Off Philippines (Challenger Expedition).
58 to 55	*Terebratulina japonica*, Sow., Thes. Conch., p. 344, pl. lxvi. figs. 7, 8, 1847.—(?) = *Ter. abyssicola*, Reeve, Voy. Samarang, p. 72, pl. xxi. fig. 5, 1850, (?) = *T. angulata*, Reeve, id., pl. xxi. fig. 2, 1850. Seems to be very variable in its shapes.	Japan; Gulf of Korea; China Seas.
26 to 63	(?)*Terebratulina cumingi*, Dav., Proc. Zool. Soc., p. 79, pl. xiv. figs. 17–19, 1852. Still an uncertain species, perhaps distinct, but thought by Mr Dall to be a variety or young *T. japonica* (?).	China Seas.
500	(?)*Terebratulina trigona*, Jeffreys, Proc. Zool. Soc., p. 402, pl. xxii. fig. 3, 1878. Requires more study, perhaps a young shell of some other species (?).	Coast of Portugal, dredged by Mr Kent in Dr Marshall Hall's yacht "Norma," in 1870.
340 to 430	(?)*Terebratulina tuberata*, Jeffreys, Proc. Zool. Soc., p. 401, pl. xxii. fig. 2, 1878.	Josephine Bank ("Josephine" Expedition and "Porcupine" Expedition, 1870).
5 to 50	**Terebratulina* (?) *patagonica*, Gould, Proc. Boston Soc. Nat. Hist., 1850. The genus to which this species should be referred is still uncertain. I have never seen a specimen of it, it is stated to be striated, and looks as if it belonged to the sub-genus *Terebratulina*.	Orange Harbour, Patagonia.
70 to 471	*Terebratulina cailleti*, Crosse, Journ. Conchyl., p.	Florida; Tortugas, West In-

	27, pl. i. figs. 1–3, 1865. It is a smallish species which both Dr Gwyn Jeffreys and Mr Dall consider to be distinct from either *T. caput-serpentis* or its var. *T. septentrionalis*.	dies; off Chorrea, Cuba; near Cojima; off Double-headed Shot Key, near Tennessee Reef; off Rio de Janeiro.
Low water to 100 fathoms most common at about 50 to 60.	(?)*Terebratulina unguiculata*, Carpenter, Proc. Zool. Soc., p. 201, 1865. Attains the dimensions of the largest *Ter. septentrionalis*, and is considered by Dall distinct.	North-West Coast of America, from the Aleutian Islands to San Diego, Cal. Monterey, Vancouver.
600	* (?)*Terebratulina murrayi*, Dav., Proc. Royal Soc., vol. xxvii. p. 437, 1848. The loop is that of *Terebratula* or *Terebratulina*, but the labial appendages differ considerably in their shape from those peculiar to these genera. It is, therefore, only provisionally placed in *Terebratulina*.	Near Kerguelen Island; South of Fiji Islands.

Genus or Sub-genus *Gwynia*, King.

Genus and species uncertain, no loop or septa have been observed.

8 to 25	(?)*Gwynia* (*Terebratula*) *capsula*, Jeff., Annals and Mag. Nat. Hist., ser. 3, vol. iii. pl. ii., 1859. Jeffreys placed this shell into *Terebratula*, then into *Argiope*, but now admits the sub-genus *Gwynia*, into which he places his species (Proc. Zool. Soc., p. 410, 1878). Dall considers it the fry of *Wald. cranium*, but from this view Herman Friele dissents.	Belfast Bay; East and South Coast of Ireland (Hyndman); Plymouth; Weymouth; Guernsey; Etretat; Sluys-kill, Zealand (Jeffreys); near Belgian Frontier (Colbeau). *Fossil:* Norway.

Genus *Waldheimia*, King.

Loop elongated, reflected, simply attached; a longitudinal septum in dorsal valve.

Shore to 10 fathoms.	* *Waldheimia flavescens*, Val. apud Lamarck., Anim. sans Vert., vol. vi. p. 246, 1819, = *Ter. australis* and *Ter. recurva*, Quoy and Gaimard, 1834, = *Ter. dentata*, Val., 1819. A very variable species.	Port Jackson, Sydney, South Australia.
5 to 50	*Waldheimia venosa*, Solander. *Anomia venosa*, Sol., Dixon's Voyage, p. 355, pl. xi. 1788, = *Ter. globosa*, Lam. = *T. gaudichaudi*, Blainv. = *T. fontaineana*, D'Orb. = *T. kochei*, Küster, = *T. physema*, Val. = *T. exemia*, Phil. = (?) *T. dilatata*, Lam. This is the largest species of recent Brachiopod at present known. A specimen, dredged by Admiral Sullivan, measured, length, 82; breadth, 67; depth, 47 millimetres.	Orange Harbour, Terra del Fuego, 5 to 50 fathoms, with *T. pulvinata* and *Magasella lævis* and *M. patagonica* (Dall); Outer harbour of Port William, Falkland Island, in 6 to 7 fathoms (Rear-Admiral B. J. Sullivan, 1843).
5 to 690	*Waldheimia cranium*, Müller. *Anomia cranium* Müller, Prod. Zool. Dan., p. 209, 1870, = *T. sub-vitrea*,	Scandinavian and North British Seas to Vigo Bay,

	Leach, = *T. glabra*, Leach, = *T. plicata*, Philippi, 1788.	Greenland and Norway; off Shetland and Faroe; South-West Coast of France; Cape Breton, opposite southern extremity of the Department des Landes (Fischer); outside Vigo Bay (M'Andrew); St Margaret's Bay, Nova Scotia (Willis) (?); Northern Asia and Japan (A. Adams) (?). *Fossil:* Upper Tertiaries, South Italy, and Scandinavia.
1450	*Waldheimia tenera*, Jeffreys, Proc. Zool. Soc., 1878, and Annals and Mag. Nat. Hist., Sept. 1876. A very delicate thin shell, much smaller than *W. cranium*.	North Atlantic, lat. 56° 11′ N. long. 37° 41′ W.
2160	*(?) *Waldheimia wyvillii*, Dav., Proc. Royal Soc., vol. xxvii. p. 438, 1878. One specimen only dredged by Challenger Expedition.	Off Valparaiso.
100 to 150	* *Waldheimia kerguelenensis*, Dav., Proc. Royal Soc., vol. xxvii. p. 437, 1878. Abundant.	Off Marion Island; West of Kerguelen Island; South of Kerguelen Island.
110 to 200	*Waldheimia floridana*, Pourtales, Bull. Mus. Comp. Zool., vol. i. p. 127, 1868. This is a good species. I cannot agree with Dr Gwyn Jeffreys, who places it as a synonym of *Wald. septigera* (his *W. septata*).	Florida Reefs.
15	*Waldheimia lenticularis*, Deshayes, Mag. Zool., pl. xii. 1841. A large, beautiful, abundant, and well-characterised species.	Straits of Fouveaux, New Zealand. *Fossil:* Upper Tertiaries, New Zealand.
75 to 725	*Waldheimia septigera*, Lovén, Index Moll. Scand., p. 29, 1846. (*Ter. septata*, Philippi, Fauna Moll. Siciliæ, vol. ii. p. 67, 1844, according to Dr Gwyn Jeffreys, not so according to Sequenza, Dall, Friele, and others.) An excellent species, abundant and well-characterised. I prefer to retain Lovén's name, as I feel uncertain whether it is really Philippi's species.	Finmark, Scandinavian, and North British Seas; Shetland, between Shetland and Faroe Islands. *Fossil:* Upper Tertiaries, South of Italy (Jeffreys) (?).
(?)	(?) *Waldheimia raphælis*, Dall., Am. Journ. Conch., vi. pls. iii. vii., figs. *a–d*, 1870. Dr Jeffreys states, Proc. Zool. Soc., p. 407, 1878: "*Wald. raphælis* of Dall, also from the North Pacific, looks like a gigantic variety of *T. septata*. My largest specimen of *T. septata* (*septigera*) measures an inch and three-tenths in length." *W. raphælis* is known only by a single specimen said to come from Japan, it may be a variety only of *W. septigera*.	Japan (?).
7 to 50	*Waldheimia grayi*, Dav., Proc. Zool. Soc., p. 76, pl.	Japan, 7 fathoms (A. Adams);

	xiv. figs. 1–3, 1850. A good, abundant, and well-characterised species.	off Korea, 50 fathoms (Capt. St John). Sir E. Belcher and Mr A. Adams dredged it also off Korea.

Genus *Terebratella*, D'Orbigny.

Loop long, twice attached to hinge-plate and to a slightly raised mesial septum.

25 to 90	**Terebratella dorsata*, Gmel. Syst. Nat. 1778. = *Anomia striata-magellanica*, Chemn. = *T. chiliensis*, Brod. = *T. bilobata*, Blainv. = *T. pectinata*, and = *T. Sowerbyi*, King. This species varies considerably in shape, some examples are almost smooth, while others are more or less strongly ribbed.	Coast of Chili to Magellan Strait; Port Famine; Valparaiso; Coquimbo; off Royal Sound.
From low water to 45 fms., abundant at 10 fms.	*Terebratella frontalis*, Middendorf, Malac. Ross, vol. iii. p. c. Sibir. Reise Bd. 2, p. 241, pl. xviii. figs. 19–21. Seems to be a good and well-characterised species.	Western Aleutians from Atka Island westward; the Okhotsk and Japan Seas; Atka; Amchitka; Attu (Dall); Okhotsk Sea (Middendorf); Japan Seas (Capt. St John).
21 to 55	*Terebratella mariæ*, A. Adams, Ann. and Mag. Nat. Hist., p. 413, 1860. It is a *Terebratella*, and not a *Waldheimia*, and is not, therefore, a variety of *Wald. septigera* as supposed by Dr Jeffreys.	Japan.
7 to 50	*Terebratella coreanica*, A. Adams and L. Reeve, Voy. Samarang, p. 71, pl. xxi. fig. 3, 1850, = *T. miniata*, Gould, Proc. Boston Soc. Nat. Hist., p. 323, 1861. This is a very fine, large and abundant shell in the area where it occurs.	Japan, 7 to 48 fathoms; Korea Sea, 50 fathoms; Kokadadi Bay, W.S.
(?)	(?)*Terebratella bouchardi*, Dav., Proc. Zool. Soc., p 77, pl. xiv. figs. 4–6, 1852. Probably a synonym of another species; type-specimen in British Museum.	Habitat unknown.
15	*Terebratella cruenta*, Dillwyn, Syst., p. 295, 1817, = *T. sanguinea*, Leach, Zool. Misc., p. 76, = *T. zealandica*, Desh., Mag. Zool., 1841. I believe that the *Ter.* or *Magasella evansi*, Dav., Proc. Zool. Soc., 1852, is the young stage of this species, and, according to Dall, *Ter. rhombea* of Philippi would be the same. *T. cruenta* is a fine, abundant, and well-characterised species.	Fouveaux and Cook's Straits, New Zealand.
Near low water to 50 fms.	*Terebratella occidentalis*, Dall, Cal. Acad. Proc., iv. p. 181, 1871. I have never seen a specimen of this or of the following species.	San Francisco to Monterey, California; Pigeon Cove, Canfield.
5 to 50	(?)*Terebratella pulvinata*, Gould, Boston Nat. Hist. Soc., 1850. Requires further study.	Orange Harbour, Terra del Fuego (Dall), not Puget Sound, Oregon, as given by mistake by Gould.

82 to 1340	*(?)*Terebratella frielii*, Dav., Proc. Roy. Soc., vol. xxvii. p. 438, 1878. More material needed.	Near Halifax, 1340 fathoms; Philippine Islands, 82 to 102 fathoms.
15	*Terebratella rubicunda*, Solander, MS. Donovan, Nat. Rep., p. 56, figs. 2–4 = *Waltonia valenciennesi*, Dav. (young). *Terebratula inconspicua*, W. Dall, is, I believe, the young of *Magasella rubicunda*. This is a good and abundant species.	Dusky Bay, Cook's Straits, Sindare Head, New Zealand.
20 to 600	*Terebratella spitzbergenensis*, Dav., Proc. Zool. Soc., p. 78, 1852. An abundant and well-characterised species.	Huntoopus Strait, Spitzbergen; Iceland; Wellington Channel, Davis Strait (Jeffreys); Gulf of St Lawrence; North Japan (A. Adams); Shetland (Jeffreys). *Fossil:* Upper Tertiaries, Scandinavia (Lyell), Canada.
(?)	*Terebratella rubiginosa*, Dall, Am. Journ. Conch., vol. vi. p. 122, pl. vi. fig. 4, 1870.	Cape of Good Hope.
Low water to about 20 fathoms.	*Terebratella transversa*, Sow., Thes. Conch., vol. i. p. 261, pl. lxxii. figs. 114, 115, 1846 = *Ter. caurina*, Gould. A very variable species; in some examples the ribs are evanescent, the shell being almost smooth, in other examples the ribs are strongly marked.	Shumargin Islands to Oregon, Coal Harbour, Shumargins; Sconidi Islands; Kadiak; Port Etches; Sitka Harbour (Dall); Victoria (J. Richardson Hepburn); Neeah Bay, Swan; Puget Sound, Kennery, Oregon (United States Expedition).
(?)	(?)*Terebratella* (?) *labradorensis*, Sow., Thes. Conch., p. 362, pl. lxxi. figs. 89, 90, 1846. Type in British Museum; species requiring more investigation.	Labrador (?).
(?)	(?)*Terebratella algoensis*, Sow., Thes. Conch., p. 362, pl. lxxi. figs. 91–192, 1846. Genus undetermined, species uncertain, known from only one valve in British Museum.	Algoa Bay.
(?)	(?)*Terebratella lamanoni*, Schrenk, Poulette de la Côte de Tartarie; Lamanon, Voyage de la Perousie, 1797; and Schrenk, Reisen und Forschungen in Amur-Land in den Jahren, 1851–56, p. 468. The type cannot be found at the Jardin des Plantes, so that the species is known but from the figures and description of Lamanon. It has been suggested that it might be the same as *Ter. miniata*, Gould (?).	Sea of Tartary.

Sub-genus (?) *Magasella*, Dall.

Loop doubly attached to hinge-plate, and to the sides of a very elevated mesial septum (reflected portions of the apophysis united forming a loop), Dall.

It is still to be determined by further study whether this is a good sub-genus, or a mere modification of the loop of *Terebratella*. Several of the so-termed species placed in this sub-genus (?) have all the appearance of being young shells of *Terebratella*. The species also are nearly all of small dimensions.

5 to 15	**Magasella flexuosa*, King, Zool. Jour., vol. v. p. 337, 1835. Seems to be a good species.	Orange River, Patagonia; Port Famine, Straits of Magellan; near Falkland Islands.
60	(?)*Magasella gouldi*, Dall, Proc. Zool. Soc., p. 307, pl. xxxi. fig. 11, *a*, *b*, *c*, 1871.	Japan.
26	(?)*Magasella adamsi*, Dav., Proc. Zool. Soc., p. 307, pl. xxx. figs. 23, 24, 1871. These last two species require more study. Material insufficient.	Japan.
Low water to 10 fms.	(?)*Magasella aleutica*, Dall, Proc. Cal. Acad. Sci., 1872. The types of all the new species of recent Brachiopoda dredged by Mr W. H. Dall, as well as by Gould, are preserved in the National Museum, Washington.	Aleutian Islands to Port Etches; Kyska Island; Adakh Island; Unalashka (Dall).
(?)	(?)*Magasella crenulata*, Sow., Thes. Conch., vol. i. p. 358, pl. xvii. figs. 96, 98, 1846. Requires further study and more material.	Santa Cruz; Canaries.
5 to 50	(?)*Magasella lævis*, Dall, Am. Jour. Conch., vol. vi. p. 136, pl. vi. figs. 9, 10, 13, 1870. I have never seen this shell.	Orange Harbour.
Lowest spring tides.	(?)*Magasella radiata*, Dall., Rep. on the Brach. of Alaska and the Adjacent Shores of North America, p. 49, 1877. Not figured. I am not acquainted with this species.	Popoff Strait; Shumargin Island.
(?)	(?)*Magasella suffusa*, Reeve, Conch. Icon., pl. v. fig. 18. Type in Mr Davidson's collection. This is, I fear, not a good species.	Habitat unknown.
2 to 10	*Magasella* (?) *cumingi*, Dav., Proc. Zool. Soc., p. 78, pl. xiv. figs. 10–16, 1852. This is a very good species, but I am not quite certain that it is properly classed with *Magasella*. Its shape and beak are very peculiar.	Port Jackson Heads and Chatham Islands, South Australia. Port Jackson (Challenger Expedition, 2 to 10 fms.).
(?)	(?)*Magasella* (?) *fibula*, Reeve, sp. *Bouchardia* (?) *fibula*, Reeve, Conch. Icon., pl. vii. fig. 30, *a*, *b*, 1861. One specimen only known, British Museum. It is probably only a very large example of *Magasella cumingi*, and not a *Bouchardia*. I have not seen its interior.	Bass' Strait (Calvert).
(?)	*Magasella* (?) (*Terebratula*) *lupinus*, Phil. Wieg. Archiv., p. 58, 1845. Described, but not figured. Mr Dall, who saw the type at Berlin, tells me that it is a small, smooth *Magasella*, a little like his *M. lævis*.	Chonos Island.
15	(?)*Magasella* (?) (*Terebratula*) *inconspicua*, Sow., Thes. Conch., p. 359. pl. lxxi. figs. 102–104, 1846. See *Terebratella rubicunda*.	New Zealand.

15	(?)*Magasella evansi*, Dall., *Terebratella evansi*, Dav., Proc. Zool. Soc., pl. xiv. fig. 7, 1852. See *Terebratella cruenta*.	New Zealand.
(?)	(?)*Magasella* (*Terebratula*) *rhombea*, Phil. Wieg. Archiv., 1845. Described, but not figured. Mr Dall tells me that he has seen the type at Berlin, and that it is identical with *Magasella evansi* (?).	Port Famine.

Genus *Laqueus*, Dall.

Loop long, three times attached to hinge-plate; again, by means of two horizontal processes, which branch off from the middle of principal stems to the mesial septum, and by slender processes from the reflected portion of loop to principal stems of loop.

15 to 120	*Laqueus californica*, Koch., nov. ed. Martini, vol. viii. p. 26, figs. 21–23.	Coasts of Sta Barbara, California; Port Etches, Prince William Sound to Catalina Island, Victoria.
40 to 85	*Laqueus picta*, Chemn., sp., Chemnitz, Conch. Tab., vol. xi. figs. 2011, 2012, 1785. Long considered a *Waldheimia*, but I am able to affirm that it belongs to the genus *Laqueus*.	Straits of Korea, 40 fathoms (Capt. St John); Japan, 50 to 85 fathoms.
35	*Laqueus rubella*, Sow., Thes. Conch., vol. i. p. 350, pl. lix. figs. 40–42, 1846 = *L. suffusa*, Dall, Am. Journ. Conch., vol. vi. p. 125, pl. vii. fig. 9, *h*, 1870. These are three good species.	Japan.

Genus *Megerlia*, King.

SECTION A.—*Megerlia* proper; loop three times attached, lateral loops closed, shell transverse, sculptured (Dall).

10 to 292	**Megerlia truncata*, Lin., sp., *Syst. Nat.*, 1152, 1767 = *Anomia scobinata*, Gmelin = *T. decussata* and *T. irregularis*, De Blainville = *T. disculus*, Pallas = *Megerlia oblita*, Michelotti = *Morrisia gigantea*, Deshayes.	Mediterranean, Atlantic Shore; off Department of Finisterre (Collard des Chevres); off Groix, Morbihan; off Noir Mortiers, Vendée; and Cape Breton, France; off Guetaria, Spain (Hidalgo); Teneriffe 70 fathoms; off Island of Bourbon (?); Australia (?). *Fossil:* Upper Tertiaries; Italy; Nice; South of France; Austria.
20 to 292	*Megerlia truncata*, var. *monstruosa*, Scacchi, Osser. Zool., vol. ii. p. 1. This is considered by some malacologists to be a malformation of *M. truncata*.	Mediterranean.
1850	(?)**Megerlia incerta*, Dav., Proc. Roy. Soc., vol. xxvii. p. 438, 1878. A rare deep-sea species; genus uncertain.	Between Sierra Leone and Fernando de Noronha.

SECTION B.—*Ismenia*, King.

Lateral loops open, shell more or less swollen, ovate, smooth (Dall).

10 to 63	**Megerlia sanguinea*, Chemn., Conch. Tab., vol. viii. p. 96, pl. lxxviii. fig. 706 = *A. sanguinolenta*, Gml. = *Anomia cruenta*, Sol. MS. = *T. erythroleuca*, Quoy and Gaimard = *T. pulchella*, Sow. (?), *T. sanguinea*, var. *reevii*, Adams. A fine well-characterised species.	Reefs, Zamboanga; Japan, Indo-Pacific; off Island of Zebu; Korea; off Tahiti; Honolulu, Sandwich Islands; Pharo, New Caledonia; Bird's Island, North Australia.
150	**Megerlia willemöesi*, Dav., Proc. Roy. Soc., vol. xxvii. p. 438, 1878. Three or four specimens alone hitherto obtained.	Twofold Bay, South Australia.
300 to 400	(?)*Megerlia jeffreysi*, Dall. Two distinct species have been mixed up by Mr Dall under the name of *jeffreysi*, as he himself now admits to be the case. *Frenula* and *Ismenia* (? *jeffreysi*), Dall, as described in the American Naturalist, vol. v. p. 55, 1871, and in the Am. Journ. of Conch., vol. vii. part ii. p. 62, pl. ii. figs. 7–10, are, according to Dr Gwyn Jeffreys and Mr Dall, immature young specimens of *Waldheimia cranium*. Subsequently, Mr Dall gave the name *jeffreysi* to another shell (see Jeffreys, Proc. Zool. Soc., 1878, p. 406, pl. xxiii. fig. 3), belonging to Section B. of *Megerlia*, and quite distinct from the shells to which he had originally applied the name. If, therefore, the name *jeffreysi* is to be retained, it will have to be so for the last-named species.	North Atlantic Ocean.

Genus *Kraussina*, Dav.

No loop. Interior of dorsal valve furnished with a forked process, rising nearly centrically from the bottom.

(?)	*Kraussina rubra*, Pallas, sp., Misc. Zool., pl. xv. figs. 2–11, 1866 = *Anomia striata*, Chemn. = *Anomia rotundata*, Blainv.	Port Elizabeth, Natal, South Africa, Cape of Good Hope.
150	**Kraussina pisum*, Lam., Anim. sans Vert., vol. vi. p. 245, 1819 = *T. natalensis*, Krauss.	Near Cape of Good Hope; Natal; Agulhas Bank, South Africa.
(?)	(?)*Kraussina cognata*, Chemn., sp., Conch. Cab., vol. vii. p. 78, pl. lxv. Probably a malformation of a large specimen of *K. pisum*. It can be seen in the British Museum.	South Africa.
Shore to 10 fathoms.	**Kraussina lamarckiana*, Dav., Proc. Zool. Soc., p. 80, pl. xiv. figs. 22, 23, 1852.	Port Jackson, near Sydney, South Australia. Found abundantly under stones (T. Woods).

Shore, tide mark.	*Kraussina davidsoni*, Vélain, Archiv. de Zool. experimentale, 1878. (The so-termed *K. picta*, alluded to by Mr Dall in his Catalogue of Recent Brachiopoda from the Island of St Paul, does not exist. The name is due to an erroneous reference in the Zool. Record.) *K. davidsoni* is so nearly related to *K. lamarckiana*, that it may, perhaps, be only a variety of that species.	Island of St Paul, Indian Ocean.
(?)	*Kraussina capensis*, Adams and Reeve, Voy. Samarang, Zool., p. 71, fig. 4.	Cape of Good Hope.
(?)	*Kraussina atkinsoni*, T. Wood's Census of Marine Shells of Tasmania, 1877. It is a small, smooth species.	Long Bay, Tasmania.
	Genus *Bouchardia*, Dav.	
	Apophysis, anchor-shaped; the septum being furnished with two short lamellæ.	
10 to 15	*Bouchardia rosea*, Mawe, sp., Introduction to Conchology, pl. xiv. fig. 4, 1823 = *T. tulipa*, Blainv. = *T. unguis*, Kuster.	Near Rio de Janeiro and Bahia.
	Genus *Platydia*, Costa = *Morrisia*, Dav.	
	Loop small, not reflected; attached to a small forked process in the centre of the valve.	
40 to 600	**Platydia anomioides*, Scacchi, Moll. Sicil., vol. ii. p. 69, pl. xviii. fig. 9, 1844 = *Ter. appressa*, Forbes, 1844 = *semilunum*, Phil., according to Sequenza.	Mediterranean, 40 to 120 fms.; off Setubal, coast of Portugal, 600 fms. (Kent); off French Coast; Florida Reefs; off Marion and Prince Edward's Islands. *Fossil:* Upper Tertiaries; Sicily and South of Italy; Austria.
90 to 100	(?) *Platydia* (?) *davidsoni*, E. Desl., Ann. and Mag. of Nat. Hist., 2d ser., vol. x. fig. 20, 1855; and P. Fischer, Journ. de Conch., 3d ser., vol. xii. p. 160, 1872. Dr Gwyn Jeffreys considers *P. davidsoni* to be the same as *Megerlia monstruosa* (?), but this opinion will require confirmation, as both Mr E. Deslongchamps and P. Fischer are of a contrary opinion.	Mediterranean, off Corsica; Coral Fisheries, near Tunis; off Cape Breton, France (Fischer). *Fossil:* Upper Tertiaries, Sicily.
59 to 95	(?) *Platydia* (?) *lunifera*, Phil., Moll. Sicil., vol. i. p. 97, pl. vi. fig. 16, 1836. This species and the genus to which it belongs are still uncertain.	Mediterranean.
	Genus *Argiope*, E. Deslongchamps.	
	Loop four-lobed, adhering to three or five sub-marginal septa.	
18 to 364	*Argiope decollata*, Chemnitz, Conch. Cab., vol. viii. p. 96, pl. lxviii., fig. 705 = *A. detruncata*, Gmel. = *T. ungula*, Retz = *T. aperta*, Blainv. = *T. pectiniformis*, Costa =	Two miles east of Guernsey; Atlantic Coast of France; off Cape Breton; Mediter-

	T. dimidiata, Scacchi = *T. candida* and *T. urna antiqua*, Risso.	ranean; Straits of Samos, &c., Ægean Sea; off Gomera, Teneriffe; off Guetaria, Atlantic Coast of Spain; off Madeira; Canary Islands; Adventure Bank. *Fossil:* Upper Tertiaries, Nice; South of France; Italy; Rhodes; Malta; Austria; &c.
	Sub-genus *Cistella*, Gray. Loop two-lobed, a single median sub-marginal septum.	
20 to 45	*Cistella cistellula*, S. Wood, Ann. and Mag. Nat. Hist., vol. vi. p. 5, 1840. (Mr Dall considers *T. lunifera*, Philippi to be a synonym?.) This is a minute but well-characterised species.	Norway; Shetland; North-West shore of Europe; Zetland; near Weymouth, S. coast of England; off Port en Bessin, Normandy (E. Desl.); Guernsey; Cape Breton, France; Mediterranean. *Fossil:* Upper Tertiaries, Coralline Crag, England; Sicily; Austria; Rhodes.
30 to 130	*Cistella neapolitana*, Scacchi, Osser. Zool., vol. ii. p. 18, 1833 = *Argiope forbesi*, Dav. A good and abundant species.	Mediterranean; Adriatic; Canary Islands. *Fossil:* Upper Tertiaries, South of Italy; Rhodes; Austria.
150	(?) *Cistella neapolitana*, var. *biplicata*, Sequenza, Reale Acad. delle Scienze Fisiche e Matematica, 1876. This shell, of which I have seen the type and only specimen, seems to me to be very closely related to *C. neapolitana*. Dr Gwyn Jeffreys, Proc. Zool. Soc., 1878, refers it to *A. cuneata*, Risso.	Straits of Messina, Mediterranean.
70 to 250	*Cistella barrettiana*, Dav., Proc. Zool. Soc., p. 103, pl. xii. fig. 3, *a*, *b*, (?) = *Argiope antillarum*, Crosse and Fischer, Journ. de Conch., p. 270, pl. xiii. fig. 7, 1866. Mr Crosse, in a letter to me (24th March 1870), writes that my *Arg. barrettiana* and his *Arg. antillarum* may eventually turn out to be one species.	North-East coast of Jamaica (Barrett); Guadaloupe; off Rio de Janeiro, 70 fms. (Rathborn).
(?)	*Cistella barrettiana*, var. *lutea*, Dall, Bull. Mus. Comp. Zool., 1871.	Tortugas.
60 to	(?) *Cistella woodwardiana*, Dav., Proc. Zool. Soc., p. 103, pl. xii. fig. 4, *a–c*, 1866.	Jamaica (Barrett).
28 to 200	*Cistella cuneata*, Risso, Faun. Europ. Merid., p. 388, fig. clxxix., 1826 = *T. soldaniana*, Risso = *T. pera*, Kuster. A good species.	Mediterranean; Adriatic; Canary Islands. *Fossil:* Upper Tertiaries, South of Italy; Austria; Rhodes.
200 to 250	(?) *Cistella schrammi*, Crosse and Fischer, Journ. de Conch., vol. xiv. p. 269, pl. viii. fig. 6, 1866. This species requires more study.	Guadaloupe, West Indies.

30 to 43	(?) *Cistella schrammi*, var. (?) *rubrotincta*, Dall, Bull. Mus. Comp. Zool., vol. i. c. p. 19, pl. i. fig. 6, *a*, 1871.	Tortugas.
	Genus *Thecidium*, Defrance.	
30 to 300	*Thecidium mediterraneum*, Risso, Fauna Europ. Merid., p. 394, fig. 183, 1826 = *T. spondylea*, Scacchi. This is a very common shell.	African Coast of Mediterranean; off Province of Oreq, near Calle and Constantine, chiefly attached to corals at depths from 60 to 120 fathoms. North coast of Jamaica, 150 fms. (Barrett); Mauritius (?). *Fossil:* Upper Tertiaries, North and South of Italy; Sicily.
60	*Thecidium barretti*, Woodward, Geol. Mag., vol. i. pl. ii. figs. 1–3, 1864. This is rare, and very remarkable—two examples only are known. The types are in the Cambridge Museum, and in my own collection.	North-East coast of Jamaica (coral reefs) (Barrett). *Fossil:* Upper Tertiaries, Jamaica.
	Genus *Atretia*, Jeffreys.	
	Two short curved processes; an elevated mesial septum in dorsal valve.	
650 to 1750	*Atretia gnomon*, Jeffreys, Annals and Mag. of Nat. Hist., 1876, and Proc. Zool. Soc., 1878, p. 412, pl. xxiii. fig. 4. An uncommon and brittle minute shell, but seemingly well characterised.	North Atlantic; Davis Strait; off Coast of Finmark, about 30 miles west of Tromsö; Coast of Ireland (Jeffreys and Friele).
	Genus *Rhynchonella*, Fischer.	
	Two short curved processes; rudimentary septum in dorsal valve.	
10 to 690	*Rhynchonella psittacea*, Gmelin, Syst. Nat., 3348 = *Rhynchonella woodwardi* (A. Adams), Annals and Mag. of Nat. Hist., 3d ser., vol. xi. p. 100, 1863 (Japan).	Circumpolar, inhabits Franklin-Pierse Bay, lat 79° 25′ N., in 15 fms.; Cape Napoleon, 25 fms. (Fielden Arctic Exp. 1875); Norway; Shetland; Grand Greve, Gaspay Bay, Canada East; Unalashka to Shumargins in the Aleutian Chain; Banks of St Margaret Bay; Drontheim to Cape; Russian Lapland to Sitka; from Behring Strait to Japan in North Pacific. *Fossil:* Upper Tertiaries, Great Britain; Ireland; Scandinavia; Canada; Sicily; South of Spain.

690	*Rhynchonella sicula*, Sequenza. See Jeffreys, Proc. Zool., 1878, p. 413, pl. xxiii. figs. 5, 6. It seems to be a good and well characterised species, more specimens required.	Chops of English Channel, "Porcupine" Expedition (Jeffreys). *Fossil*: South of Italy; Sicily.
15 to 150	*Rhynchonella nigricans*, Sow., Thes. Conch. vol. i. p. 342, pl. lxxi. fig. 81 82, 1846. A very good and remarkable species.	Fouveaux Strait, New Zealand; Chatham Islands.
150	**Rhynchonella nigricans*, var. *pixydata*, R. B. Watson, MS., Dav., Proc. Roy. Soc., vol. xxvii. p 431, 1878.	South of Kerguelen Islands. *Fossil* (?) : Tasmania.
(?)	*Rhynchonella grayi*, Woodward, Ann. and Mag. of Nat. Hist., p. 444, pl. x. fig. 16, 1855. Only one example known. British Museum. More specimens required.	Off Fiji Islands.
48 to 100	*Rhynchonella lucida*, Gould, Proc. Boston Soc. Nat. Hist., p. 323, 1860. Seems to be a very good and well-characterised species.	Japan.

Tretenterata.

Genus *Crania*, Retzius.

3 to 808	*Crania anomala*, Müller, Zool. Dan., p. 237, 1776 = *Patella distorta*, Montagu. *Patella kermes*, Humphreys = *Anomia turbinata*, Dillwyn = *Criopus orcadensis*, Leich = *Orbicula norvegica*, Lam. *D. ostreoides*, Turton = *C. personata*, Def. = *C. rostrata*, Thorpe. *C. fimbriata*, Poli = *C. craniolaris* (pars), Gmel. = *C. ringens*, Hœninghaus.	North European Seas; Loch Fyne; North of Scotland; Tunisian Coast, Mediterranean, from 14 to 120 fathoms; off Province of Asturias, Spain; Vigo (M'Andrew); off Biarritz (Fischer). *Fossil*: Sicily (?).
(?)	*Crania anomala*, var. *alba*, Jeffreys, Brit. Conch., vol. v. p. 165, 1869. I am not acquainted with this or the following variety.	Off Shetland Islands; Hebrides.
(?)	*Crania anomala*, var. *pourtalesi*, Dall, Bull. Mus. Comp. Zool., vol. i. p. 35, pl. i. fig. 7, 1871.	Florida Keys.
71	*Crania japonica*, A. Adams, Ann. and Mag. Nat. Hist., 3d ser., vol. xi. p. 100, 1863.	Japan.
Low water.	*Crania suessi*, Reeve, Conch. con. Mon. Crania, pl. i. fig. 2, 1862. Both these last seem to be good species.	Sydney, Australia.

Genus *Discina*, Lamarck.

Mr Dall proposes to divide the genus *Discina* as follows:—

A. *Discina*, Lamarck, with anteriorly directed tubular foramen, under the central septum or prominence (Dall).

6 to (?)	*Discina striata* (*Crania*), Schumacher, Essai, p. 102, pl. xx. fig. 1, *a–f*, 1817 (not of Defrance) = *C. radiosa*, Gould = *D. evansi*, Dav., *Orbicula norvegica*, Sow. *O. ostroides*, Rang. *Patella anomala*, Sow. (not Müller).	North-West coast of Africa.

	B. Sub-genus *Discinisca*, Dall. Impressed space behind the septum, and posterior foramen under hinder edge of this excavation (Dall).	
5 to 9	*Discinisca lamellosa*, Brod., Proc. Zool. Soc., p. 124, 1833.	Panama to Peru.
6 to (?)	*Discinisca lævis*, Sow., Trans. Linn. Soc., vol. xiii. p. 468, pl. xxvi. fig. 1, 1822.	Great Ocean, from Cobisa (Bolivia) and Callao, Peru, to Island of San Lorenzo.
6 to (?)	*Discinisca cumingi*, Brod., Proc. Zool. Soc., p. 124, 1833 = *O. strigata*, Brod.	Cape St Lucas to Panama; Playta, Peru; and St Elena (D'Orbigny); Ile St Joseph, Cayenne (Deplanche).
(?)	(?)*Discinisca antillarum*, D'Orb., Moll. Cuba, p. 368, pl. xxviii. fig. 34–36, 1853.	Cuba; Martinique; Porto Rico.
17 to 49	**Discinisca stella*, Gould, Proc. Bost. Soc. Nat. Hist., vol. vii. p. 323.	Singapore; Philippines; Japan; near Bermuda; China Seas.
690 to 2425	**Discinisca atlantica*, King, Proc. Nat. Hist. Soc., Dublin, vol. v. pp. 170–173, 1868. A very good and widely-spread deep-sea species.	Lat. 56° 11′ N., long. 37° 4′ W., North Atlantic Soundings; lat. 56° 1′ N., long. 34° 42′ W., Baffin's Bay; lat. 1° 47′ N., long. 24° 26′ W; lat. 4° 33′ S., long. 129° 58′ E.; lat. 34° 37′ W., long. 140° 32′ E.; lat. 36° 10′ N., long. 178° 0′ E.; lat. 0° 33′ S., long. 151° 34′ W.; lat. 33° 31′ S., long. 74° 43′ W.; these six last Challenger Expedition. *Fossil:* Crag, England (?)
(?)	(?)*Discinisca tenuis*, Sow., Thes. Conch., vol. i. p. 366, pl. lxxiii. figs. 4, 5, 1847.	
	Genus *Lingula*, Bruguière.	
Shore, low water.	**Lingula anatina*, Lam., Anim. sans Vert., vol. vi. p. 258, 1819 = *Ling. chemnitzi*, Küst. = *Mytilus lingua*, Dillwyn.	Philippines and Moluccas.
Shore to 7	*Lingula exusta*, Reeve, Conch. Icon., p. 11, fig. 9, 1861.	Moreton Bay, Australia.
(?)	*Lingula hians*, Swainson, Phil. Mag. and Jour., vol. lxii. p. 403, 1823 = *L. antoni*, Küst.	China Sea; Amboyna.
(?)	*Lingula hirundo*, Reeve, Conch. Icon., pl. xi. fig. 7, 1861.	Port Curtis, North-East Australia.
7 to (?)	(?)*Lingula jaspidea*, A. Adams, Ann. and Mag. of Nat. Hist., 3d ser., vol. xi. p. 101, 1863.	Japan.
10 to (?)	(?)*Lingula lepidula*, A. Adams, Ann. and Mag. of Nat. Hist., vol. xi. p. 101, 1863.	Inland Sea, Japan.

(?)	*Lingula reevii*, Dav. = *L. ovalis*, Reeve, Proc. Zool. Soc., p. 100, 1841. (The name *ovalis* had been previously given by Sowerby to a fossil species from the Kimmeridge clay.)	Sandwich Islands.
10 to (?)	(?)*Lingula smaragdina*, Adams, Ann. and Mag. Nat. Hist., 3d ser., vol. xi. p. 101, 1863.	China Sea; Japan.
7 to (?)	(?)*Lingula adamsi*, Dall, Proc. Phil. Acad. Nat. Sciences, p. 202, 1873.	Korean Archipelago.
Shore to 7	*Lingula tumidula*, Reeve, Proc. Zool. Soc., p. 100, 1841 = *L. compressa*, Reeve.	Moreton Bay, Australia.
7 to (?)	(?)*Lingula murphiana*, King, Reeve, Conch. Icon., pl. i. fig. 3, 1861.	Moreton Bay, Australia.
(?)	(?)*Lingula affinis*, Hancock, Trans. Roy. Soc., p. 851, pl. lxvi. figs. 1, 2. The animal but not the shell of this species (?) was described by Mr Hancock. Having obtained the loan of the type, I may mention that in external shape, size, and colour it so closely resembles *Lingula anatina*, that I almost fear it in reality belongs to that species, and that the other species of which Mr Hancock described the animal, may have been the *Lingula murphiana* of King. Mr Hancock's specimen of *L. affinis* measures 50 mm. in length by 23 mm. in breadth, and of a light greenish olive colour, with two or three concentric bands of a vivid green colour.	Habitat unknown, but probably off the Philippine Islands.
	Some reduction in the number of species of *Lingula* may be hereafter needed.	
	Sub-genus *Glottidia*, Dall.	
Shore.	(?)*Glottidia antillarum*, Reeve, Conch. Icon., p. 11, fig. 8, 1861.	Martinique, West Indies.
(?)	(?)*Glottidia audebardi*, Brod., Proc. Zool. Soc., p. 125, 1833.	Bay of Guayaquil; Island of Puna.
17	(?)*Glottidia semen*, Brod., Proc. Zool. Soc., p. 125, 1833. (?)*L. parva*, Sow. These three species appear to be rare, and consequently not sufficiently studied, very few specimens having been collected.	Island of La Platta, West Columbia; Island of Puna.
Tidal, mud at lowest.	*Glottidia palmieri*, Dall, Am. Jour. Conch., vol. vii. p. 77, 1871.	Head of the Gulf of California.
7–60	*Glottidia albida*, Hinds, Voy. Sulphur., p. 77, pl. xix. fig. 4, 1844.	Bay of Madalena (7 fathoms); Monterey to San Diego; California; Catalina Island; Sta Barbara.
Low flats at lowest water.	*Glottidia pyramidata*, Stimpson, Am. Jour. Sciences and Arts, vol. xxxix. p. 444, 1860.	North and South Carolina to West Coast of Florida, at Sarrasota Bay.

Description of the Species dredged by the Challenger Expedition.

Terebratula, Llhwyd.

Terebratula wyvillii, Dav. (Pl. II. figs. 7–9).

Shell somewhat subpentagonal, variable in shape, about as broad as long, sometimes almost square, with a depression in the dorsal valve and fold in the ventral one. Shell very thin, almost transparent, smooth, glassy, yellowish-white; length and breadth 17 or 18 mm., depth 9 mm. Valves in the young shell slightly and evenly convex; dorsal valve moderately convex, with a wide or narrow concave depression of greater or lesser depth, commencing close to the umbo, and gradually widening and deepening as it nears the front; front line wide, straight, or presenting an inward curve; ventral valve deeper and more convex than the opposite one, with a wide median longitudinal convex fold commencing near the beak and extending to the front. Beak very small, slightly incurved, truncated by a small, generally incomplete, circular foramen, laterally margined by deltidial plates. Surface of valves marked at intervals by concentric lines of growth; shell structure with minute widely-separated perforations or canals. In the interior of the dorsal valve the loop is short and simple. The adductor and other muscular impressions very small and delicate, the labial appendages extend to two-thirds of the length of the shell. In the interior of the ventral valve the muscular impressions are small, and occupy a limited area close to the beak.

Habitat.—This very interesting species appears to abound over a wide geographical range, and at depths varying from 1035 to 2900 fathoms.

Station 160 (Pl. II. fig. 7, *a*, *b*, *c*), March 13, 1874, lat. 42° 42′ S., long. 134° 10′ E. Depth, 2600 fathoms. Bottom temperature, 0°·2 C. South Australia. One example was attached to a manganese nodule. Sea bottom, red clay.

Station 184, August 29, 1874, lat. 12° 8′ S., long 145° 10′ E. Depth, 1400 fathoms. Bottom temperature, 1°·8 C. Sea bottom, grey ooze.

Station 299 (Pl. II. fig. 8), December 14, 1875, lat. 33° 31′ S., long. 74° 43′ W. Depth, 2160 fathoms. Bottom temperature, 1°·1 C. Sea bottom, grey mud. Off coast of Chili or Valparaiso; along with it was dredged *Waldheimia wyvillii* and *Discina atlantica*.

Station 302 (Pl. II. fig. 9), December 28, 1875, lat. 42° 43′ S., long 82° 11′ W. Depth, 1450 fathoms. Bottom temperature, 1°·5 C. Sea bottom, globigerina ooze. Off coast of Patagonia.

Station 317. One small example from the net weights, not far from Falkland Islands. February 8, 1876. Depth, 1035 fathoms.

Station 244, June 28, 1875, lat. 35° 22′ N., long. 169° 53′ E. Depth, 2900 fathoms. The greatest depth at which any Brachiopod was obtained by Challenger Expedition. Bottom temperature, 1°·2 C. Sea bottom, red clay.

Observations.—This is one of the most interesting species of deep-sea Brachiopoda dredged during the Challenger Expedition. The shell is of such extreme thinness that it is almost transparent; indeed, the valves when separated are really so, and the muscular impressions may be seen through its transparency. It is also exceedingly brittle. I separated the valves of a specimen in order to be able to study its animal and loop, the latter, which I was very much surprised to find short, is in every respect similar to that of *Terebratula* proper, to which genus the species must be referred, notwithstanding its outward *Waldheimia*-like appearance. It bears much resemblance to several species of the last-named genus occurring in the Jurassic and Cretaceous formations and especially so to *Terebratula boneti*, Zeuschner, from the Kimmeridge of Switzerland, and from which some of the Challenger specimens are scarcely distinguishable, either by size or shape.

Prior to making a complete examination of its interior characters I had provisionally referred it to *Waldheimia*. We find but few recent species with such a thin shell, but among these last may be named the far-spread *Discina atlantica*, King, *Atretia gnomon*, Jeffreys, *Waldheimia tenera*, Jeffreys, *Rhynchonella lucida*, Gould, and one or two others. When quite young and up to 4 or 5 mm. in length, the shell shows no mesial depression, this begins at a more advanced age. I have much pleasure in naming this species after Sir Wyville Thomson, F.R.S., the distinguished director of the civilian staff on board the Challenger.

Terebratula cubensis, Pourtales (Pl. II. figs. 10, 11).

Terebratula cubensis, Pourtales, Bull. Mus. Comp. Zool., vol. i., No. 7, p. 109, 1867.
Terebratula cubensis, Dall, Report on the Brachiopoda obtained by the United States Coast Survey Expedition, Bull. Mus. Comp. Zool., vol. iii., pl. i. fig. 2, 1871.

Shell globose, somewhat trigonal or obscurely pentagonal, longer than wide, smooth, marked at intervals by concentric lines of growth, nearly white; broadest anteriorly, tapering posteriorly. Dorsal valve convex, without fold or sinus, front-line nearly straight or slightly curved; margin of valves laterally flexuous; ventral valve somewhat deeper than the opposite one, longitudinally and broadly flattened, the sides of the flattened portion sloping away rapidly and rather abruptly on either side, giving the valve a somewhat subquadrangular aspect. Beak moderately incurved and truncated by a circular foramen separated from the hinge-line by a narrow deltidium. Loops, short simple. Length 28, width 22, depth 18 mm.

Habitat.—Two examples were dredged off Ascension Island on April 3, 1876, at Station 334. Depth, 420 fathoms. Hard ground.

Observations.—The two living specimens dredged by the Challenger Expedition agreed in every respect with those obtained by M. de Pourtales, in from 100 to 300 fathoms off the Florida Reefs, or off Havana in 270 fathoms. The shell was briefly described in 1867 by M. de Pourtales, and subsequently in 1871 with minute details by Mr W. H. Dall. The loop is described by both those malacologists as differing from that of *Terebratula vitrea.* Mr Dall observes that "The crura are short and blunt, that the interior part of the loop is characteristic and peculiar (Pl. II. fig. 10, *d*). It is strongly squarely convex in the middle, a deep narrow gutter extends on each side of this convexity, and is produced at each side into a point; between these points and the median convexity, on each side, is a deep slit or fissure; the anterior end of the convexity is much produced at each side into a point." The animal has also been minutely described by Mr Dall, and after an examination of one of the Challenger specimens, I am able to completely confirm his statement. The mantle in the dorsal valve of one of the specimens, showed in a very distinct and beautiful manner the four principal pallial sinuses (Pl. II. fig. 10, *a*), which again bifurcate as they approach the front or margin of the shell, the bifurcated extremities bifurcating before reaching the margin. Mr Dall is, I think, right in maintaining by a comparison of both the external and internal characters that *Terebratula vitrea* and *Terebratula cubensis* are distinct species. One of the specimens obtained by the Challenger was quite adult, and attached to a coral.

Terebratula vitrea, var. *minor*, Philippi (Pl. II. figs. 5, 6).

Terebratula vitrea, var. *minor*, Phil., Moll. Siciliæ, vol. i. p. 99, pl. vi. fig. 8, 1836.
Terebratula affinis, Calcara, 1845.
Terebratula minor, E. Suess, Über die Wohnsitze der Brachiopoden, 1859.

Shell elongated, oval or ovate, slightly subpentagonal, moderately globose, thin, semi-transparent, glassy, white, smooth. Dorsal valve moderately and uniformly convex, somewhat flattened along the middle. Front-line very slightly convex; ventral valve convex and a little deeper than the dorsal one, slightly flattened from about the middle of the shell to the front. Beak moderately incurved and truncated by a small circular foramen separated from the hinge-line by a narrow deltidium. Loop simple, short, and small. Shell structure perforated by minute canals. Length 15, width 13, depth 8 mm.

Habitat.—Two specimens without the animal, were dredged by the Challenger Expedition off the Cape of Good Hope, at Station 142, December 18, 1873, lat. 35° 4′ S., long. 18° 37′ E., at a depth of 150 fathoms. Bottom temperature, 8°·3 C. Sea bottom, sand. Many examples of *Terebratulina caput-serpentis*, var. *septentrionalis*, and large and fine specimens of *Kraussina pisum* were obtained at the same time. Another dead shell of *Terebratula minor* was trawled on March 25, 1873, off Culebra Island, West Indies, at Station 24, in a depth of 390 fathoms, sea bottom, mud, and not far from the spot where *Terebratulina wyvillii* occurred. Several fragments of the var. *minor*, and one nearly perfect small dead shell was dredged on June 30, 1873, at Station 73, lat. 38° 30′ N., long. 31° 14′ W., close to the Azores, at a depth of 1000 fathoms. Bottom temperature, 3°·7 C. Sea bottom, globigerina ooze. These last, however, were in a very fragmentary condition, and the loop was not preserved. My identification is, therefore, given with reserve. The Mediterranean is the chief habitat of the var. *minor*. It occurs at Vigo Bay. Mr Friele was so fortunate as to dredge one specimen of this species off Jan Mayen Island during the Norwegian Arctic Dredging Expedition of 1877, in a depth of 263 fathoms. This identification was confirmed by Dr Gwyn Jeffreys, for whose inspection and my own Mr Friele kindly sent the specimen under the name of *Ter. arctica*. *Ter. minor* occurs fossil in the Pliocene formation of Sicily.

Observations.—I was rather surprised to find this small variety of *Terebratula vitrea* so far from the Mediterranean. I showed the Challenger specimens to Dr Gwyn Jeffreys, who placed them among a number obtained by himself from the Bay of Naples. Had we not previously marked the larger Cape specimens, we could not have distinguished them. This fact is, I think, sufficient proof of their identity. The question may, indeed, be further mooted, whether Philippi was not correct in considering *Ter. minor* or *affinis* as merely a small variety of *Ter. vitrea*. Professor Suess, however, believes the former shell to be specifically distinct from *Ter. vitrea*. Dr Gwyn Jeffreys and myself were also at one time disposed to consider the *Ter. davidsoni*, A. Adams (Annals and Mag. Nat. Hist., 3d ser., vol. v. p. 12, 1860, dredged at Satanomoski, Japan), as identical with *Ter. vitrea* or *affinis*. This view is not, however, shared by our distinguished contemporary, Mr Dall.

Terebratula moseleyi, Dav., n. sp. (Pl. II. figs. 12–14).

Shell broadly ovate, semiglobose, rather longer than wide, broadest anteriorly, slightly tapering posteriorly, marginally and laterally convex, nearly straight in front, margin sometimes thickened, surface smooth, white. Dorsal valve uniformly convex without fold or sinus, ventral valve slightly deeper than the opposite one, uniformly convex. Beak moderately produced, slightly incurved, and truncated by a circular foramen separated from the hinge-line by a very narrow and small deltidium; beak ridges not defined. In the dorsal valve the loop is short and simple, the labial appendages occupying about two-thirds of the length of the valve, united to each other by a membrane, the central coil making about three turns. Shell structure perforated by numerous small canals. Length 23, breadth 21, depth 14 mm.

Habitat.—Dredged west of Kerguelen Island on January 3, 1874, at Station 148, lat. 46° 47′ S., long. 51° 37′ E. Depth, 210 fathoms. Sea bottom, rock.

Observations.—Five specimens of this shell were obtained, all of about the same size. It seems to be a smaller species than *Ter. vitrea* and *Ter. cubensis* its nearest allies. It is less elongated, not quite as convex as in the last two species, and does not present the flatness and angularity observable in the mesial and labial portions of the ventral valve of *Ter. cubensis*. I made an examination of the animal of one of the specimens which did not differ materially from *Ter. vitrea*. The mantle is thin and not furnished with setæ at its edge. On the dorsal lobe I observed the ramified bifurcated fine thread-like pallial nerves as well as the pallial sinuses. (Pl. II. fig. 14, enlarged dorsal valve; 14, *a*, ventral valve; *A*, adductor muscular impressions; *B*, ventral adjustors; *C*, divaricators; *M*, mantle; *M'*, edge of mantle; *N*, dorsal pallial nerve; *D*, dorsal pallial arteries.) The brachial or labial appendages, which are unsupported throughout their entire length by a calcified lamina as in *Waldheimia*, occupy a much smaller space in the interior of the shell, and while the lateral branches are visibly shorter, the cirri are of considerable length (fig. 14).

I have named this species after H. N. Moseley, Esq., naturalist of the Challenger Expedition.

Terebratula uva, Broderip (Pl. II. figs. 3, 4).

Terebratula uva, Brod., Trans. Zool. Soc. Lond., vol. i. p. 142, pl. xxii., 1833.

Terebratula uva, Sow., Thes. Conch., vol. i. p. 353, pl. lxx. figs. 53–55.

Terebratula uva, Dall, Cat. of the Recent Species of the Class Brachiopoda, Proc. Phil. Acad. Nat. Sciences, July 1873.

Terebratula uva, Reeve, Monograph of the Genus *Terebratula*, Conch. Icon., pl. iii. fig. ii.

Shell ovate, longer than wide, white, or of a very light salmon colour. Dorsal valve uniformly convex, rather less deep than the opposite one, rounded in front. Ventral valve convex. Beak moderately produced and truncated by a circular foramen, separated from the hinge-line by a deltidium. Surface smooth, marked by a few concentric lines of growth. Loop short, simple. Shell finely punctuated. Length 25, width 17, depth 15 mm.

Habitat.—One dead shell (Pl. II. fig. 3, *a*, *b*) was obtained by the Challenger Expedition at Station 163, April 4, 1874, lat. 36° 56′ S., long. 150° 30′ E., trawled in 120 fathoms off Twofold Bay. A second example (Pl. II. fig. 4) was obtained off Buenos Ayres, at Station 320, February 14, 1876, lat. 37° 17′ S., long. 53° 52′ W. Depth, 600 fathoms. Bottom temperature, 2°·7 C. Sea bottom, hard ground.

A third specimen, or rather two fragments of a dead shell, were dredged off Heard Island, at Station 150, February 2, 1874, lat. 52° 4′ S., long. 71° 22′ E. Depth, 150 fathoms. Bottom temperature, 1°·8 C. Rock.

Broderip states that his specimen of *Terebratula uva* was obtained by Captain Dare, while dredging for *Meleagrina margaritifera*, attached to a dead sea-worn bivalve, at a depth of from 10 to 12 fathoms, off Tehuantepec, Guatemala, Central America; bottom, sand and mud. In the British Museum there are likewise some white specimens stated to have been dredged near the Falkland Islands.

Observations.—*Terebratula uva* varies much in shape, it is usually longer than wide, and oval, but in some examples the length and depth did not differ materially.

In addition to the species of *Terebratula* already named, the Challenger Expedition obtained one incomplete specimen of a *Terebratula* not sufficiently complete for identification, at Station 195, October 13, 1874, lat. 0° 48′ S., long. 126° 58′ E. Depth, 825 fathoms. Two fragments also of a *Terebratula* at Station 13, March 4, 1873, lat. 21° 38′ N., long. 44° 39′ W. Depth, 1900 fathoms. Bottom temperature, 1°·9 C. Globigerina ooze.

Terebratulina, D'Orbigny.

Terebratulina wyvillii, Dav. (Pl. I. figs. 1, 2).

Shell large, trigonal, longer than wide, broadest anteriorly, tapering posteriorly, light yellowish. Dorsal valve triangular, anterior angles rounded. Hinge-line obtusely angular, moderately convex, somewhat flattened along the middle, and abruptly bent inwards close to the margin; lateral sides of umbo auricular. Ventral valve convex, deeper than the opposite one, flattened anteriorly, abruptly bent inwards close to the margin. Beak incurved, truncated by a large oval-shaped foramen, separated from the hinge-line by a triangular concave depression sharply marked laterally. Surface of shell nearly smooth to the naked eye, but marked by very fine radiating raised lines. Shell perforations rather large. In the interior of the dorsal valve the loop is short and simple, rendered annular by the union of the oral processes. Length 63, width 50, depth 35 mm.

Habitat.—A unique specimen of this fine species was dredged on 25th March 1873, by the Challenger Expedition, off Culebra Island, to the north-west of St Thomas, in the West Indies, at Station 24. Depth, 390 fathoms. Sea bottom, mud. Mr Dall informs me that he saw another specimen without name or derivation in the Museum at Amsterdam.

Observations.—*Terebratulina wyvillii* greatly exceeds in dimensions the largest known species of the sub-genus both recent and fossil.[1] The animal was not preserved when sent to me for description, indications of the mantle alone existing; but Willemöes-Suhm, states in his MS. notes that it was "exceedingly small." From the character of the loop the auricular expansions and striation the shell is naturally placed in the sub-genus *Terebratulina*. The margins of both valves are abruptly bent inwards, as is so often the case in adult specimens of several species of *Terebratula*. I have much pleasure in naming this remarkable new species after Sir Wyville Thomson, F.R.S., the distinguished director of the scientific staff of the Challenger Expedition, one of the most successful undertaken by any Government, and reflecting so much credit on all concerned. The scientific treasures assembled during its course of 68,890 miles, comprise an incalculable number of scientific results of the most interesting and valuable character.

[1] *Waldheimia venosa*, Solander, 1789 = *Ter. globosa*, Lam. = *Ter. fontaineana*, D'Orb., is the largest recent Brachiopod with which we are at present acquainted. It measures when full grown, length 80, width 64, depth 45 mm. The next largest recent Brachiopod is the *Terebratulina wyvillii*. The *Terebratula grandis* from the Upper Tertiaries (crag) exceeded these proportions, some adult individuals having attained length 108, width 78, depth 55 mm. No recent species of *Terebratula* with which we are at present acquainted have exceeded length 43, width 30 mm. (*Ter. vitrea*).

Terebratulina caput-serpentis, Lin., var. *septentrionalis*, Couthouy (Pl. I. figs. 3–9).

Terebratulina septentrionalis, Couthouy, Bost. Jour. Nat. Hist., vol. ii. p. 65, pl. iii. fig. 18, 1838 or 1839.

Terebratulina septentrionalis, Sow., Thes. Conch., p. 344, pl. xviii. figs. 5, 6, 1846.

Terebratulina septentrionalis, Stimpson, Test. Moll. New England, p. 75, 1851.

Terebratulina caput-serpentis, Reeve, Mon. of Terebratula. Conch. Icon., 1861.

Terebratulina septentrionalis, Morse, On the Early Stages of *Terebratulina septentrionalis*, Mem. Bost. Soc. Nat. Hist., vol. ii. 1869.

Terebratulina septentrionalis, Gould's Invert. Mass., p. 208, 1867, and Binny's 2d edit., p. 208, fig. 500, 1870.

Terebratulina septentrionalis, Dall, Cat. of Recent Species of Brachiopod, Proc. Phil. Acad. Nat. Sciences, p. 180, July 1873.

Shell rather thin longitudinally, broadly obovate, pear-shaped or somewhat pentagonal, narrow and tapering posteriorly, abruptly widening below the beak, broadest anteriorly; front-line either nearly straight, slightly indented, or rounded. Colour yellowish-white, nearly diaphanous. Dorsal valve gently convex, most so about the middle, slightly depressed towards the front, eared at the umbo. Ventral valve feebly convex or slightly deeper than the dorsal one, somewhat depressed towards the front. Beak short, attenuated, slightly incurved and truncated by a moderately large and incomplete semi-elliptical foramen completed below by the umbo of ventral valve and laterally margined by small deltidial plates. Surface of both valves covered with a variable number of fine rounded radiating striæ (240 in some specimens when counted at the margin). These increase in number by numerous intercalations of shorter ribs at variable distances from the beaks. Ribs few, simple and stronger in the young shell. Valves crossed or decussated by fine concentric lines of growth. Shell structure perforated by numerous small canals. In the interior of dorsal valve the loop is short and simple, rendered annular by the union of the oral processes. Brachial appendages united to each other by a membrane, cirrated and developed from each side of the mouth, divided into three lobes, the two lateral ones extending to a little more than two-thirds of the length of the valve, the central one not exceeding half the length of the valve, spiral at its extremities (fig. 5). Proportions variable. Length 27, breadth 21, depth 12 mm.

Habitat.—The geographical range of the variety *septentrionalis* seems to be very great. The Challenger Expedition dredged it abundantly off the New York coast on May 3, 1873, at Station 48, lat. 43° 2′ N., long. 64° 2′ W., at a depth of 51 fathoms. Sea bottom, rock (Pl. I. figs. 4, 5). Also on May 20, 1873, at Station 49, lat. 43° 3′ N., long. 63° 39′ W., at a depth of 83 fathoms off Halifax. Bottom temperature, 1°·8 C. Sea bottom, gravel and stone (Pl. I. fig. 5). Again, on December 18, 1873, abundantly at Station 142, lat. 35° 4′ S., long. 18° 37′ E. off the Cape of Good Hope, associated with *Terebratula vitrea*, var. *minor* and *Kraussina pisum* in 150 fathoms. Bottom temperature, 8°·3 C. Sea bottom, sand (Pl. II. figs. 6–9). Also along with *Platydia anomioides* and *Waldheimia kerguelenensis*, December 27, 1873, lat. 46° 40′ S., long. 37° 50′ E. Depth, 150 fathoms. It may seem strange to find the same species so far south as the Cape, but neither Dr Gwyn Jeffreys nor myself, after a lengthened comparison could discover any character, however small, to distinguish the Cape shell from that found near the northern coast of the United States. P. Couthouy in his description of *Ter. septentrionalis*, states that it has been found at Lubec Bay by Dr C. T. Jackson, during his geological survey of the State of Maine, and that it is probably an inhabitant of deep water on the whole New England coast. Dr Gould mentions having found it in considerable numbers in the stomachs of fishes, and occasionally on the sea-beach, and that its usual residence is in the laminarian or deep-sea coral zones of northern seas. Eastport at low water; common off Isle of Shoals, 20 fathoms; Cape Cod; Grand Manan, common (Packard, Stimpson); Halifax Harbour, common (Willis).

Observations.—The animal of *Ter. caput-serpentis* and its variety *septentrionalis* has been so minutely and admirably anatomically studied and described by Albany Hancock in his memoir on the Organisation of the Brachiopoda,[1] by M. E. Deslongchamps,[2] by E. Morse in his two remarkable memoirs on the Early Stages of *Terebratulina septentrionalis*, by Kowalevsky, on the Embryology of *Terebratula*,[3] 1875, and others that it will not be necessary to repeat in this report the details so elaborately given in the works alluded to, to which the reader is referred. I may add, however, that I have had several opportunities of examining in detail the animal of both *Ter. caput-serpentis* and of the variety *septentrionalis*, and can confirm the accuracy of the details given by those distinguished zoologists.

The animal of *Ter. caput-serpentis* had attracted the attention of early naturalists, for we find the brachial appendages roughly described and illustrated by Pennant[4] in 1773, and in 1774 Gründler gave a good description and enlarged illustrations of the same appendages.

Some difference of opinion has prevailed with respect to the variety *septentrionalis.* Certain malacologists consider it a distinct species, others a simple variety of *Ter. caput-serpentis.* Gould in 1838 states it to be distinct, and in his report on the Invertebrata of Massachusetts (2d edition by W. H. Binney, 1870), we find stated at p. 208, "An examination of the descriptions of *Ter. caput-serpentis* given by Linnæus, Müller, and Chemnitz, and a comparison of them with our shell had well satisfied me of their correspondence. The downy epidermis is a character too rare and singular to be overlooked. This, however, is rubbed off very easily. The shell is much thinner, in general more

[1] Philosophical Transactions of the Royal Society, 1858.
[2] Recherches sur l'Organisation du Manteau chez les Brachiopodes articulés, Caen, 1864.
[3] Memoirs of the Boston Society of Natural History, vol. ii., 1869.
[4] Nova acta Regii Societatis Upsaliensis, vol. i. p. 39.

elongated, and the striæ nearly twice as numerous, being about thirty to forty in the European, and fifty to sixty in the American specimens. No account of the internal bony process is given in any description except that by Mr Couthouy. These would afford the best possible specific character were it not that they are usually more or less broken. But I have been relieved from all further speculation by the receipt of specimens from Dr Lovén which settle the identity of our species with the European *caput-serpentis*." Mr W. H. Binney seems to be of a different opinion, for he adds, after Gould's observations above recorded: "I have retained the above remarks from the former edition, because our shell is so generally still regarded as identical with the European species, but further examination of numerous specimens has led me to coincide with Dr Stimpson, who has dredged extensively both in British and American seas, and in his opinion, the species differs from European *Ter. caput-serpentis* sufficiently both in shell and animal."

G. B. Sowerby in p. 344 (1846) of his Thesaurus Conchyliorum observes that *Ter. septentrionalis* is distinguished from *Ter. caput-serpentis* by its much finer radiating striæ, its larger and less oblique foramen, and by its rather more extended and somewhat differently formed internal appendages. Mr Lovell Reeve in his Monograph of *Terebratula*, Conch. Icon., 1861, places *Ter. septentrionalis* as a synonym of *Ter. caput-serpentis*, stating that, "*Ter. caput-serpentis* ranges throughout the European seas from the Arctic to the Mediterranean, mostly at considerable depths, and it appears abundantly in a more finely-striated state in the northern seas of the United States. The North American form is given as a distinct species in the Museum Catalogue with Couthouy's name *Ter. septentrionalis*, but is untenable, as Dr Gould himself admits in his Report on the Invertebrata of Massachusetts. Dr Gwyn Jeffreys, in his valuable British Conchology, considers *Ter. septentrionalis* as a local variety of *Ter. caput-serpentis*, and adds that it has a thinner shell, finer ribs, and a white colour, and that he has compared more than a hundred specimens of both forms. Mr Dall in his Revision of Recent Species of Brachiopoda, in the Proc. Phil. Acad. Nat. Sciences for July 1873, considers *Ter. caput-serpentis* and *Ter. septentrionalis* as distinct species, but in a letter to me, dated November 1877, he adds: "I consider *Ter. septentrionalis* as merely a geographical race of *Ter. caput-serpentis*, but I think *Ter. unguiculus* is distinct. The difference between the last and the Atlantic form is chiefly in the loop which remains in *Ter. unguiculus* long open, and is much larger and broader proportionately to the shell than in *Ter. caput-serpentis*." I have likewise, thanks to the Challenger Expedition dredgings and to Professor Verril, been enabled to compare a very large number of specimens at all ages of the species and its variety, and quite concur with the prevailing opinion that there exists very little difference between the two, but still I think sufficient to warrant us in retaining the varietal designation of *septentrionalis*. In addition to the generally finer striation, the shell is more regularly oval and rounded in front than in the *Ter. caput-serpentis*, although exceptional specimens may be found in which the straight and indented front-line is present, but is more often seen in the North Atlantic type. The young shells of both seem undistinguishable. I have examined specimens from 1 mm. in length up to 27 mm. Up to about 5 mm. and even more, the ribs are very few in number, prominent, and radiate from the extremity of the beak to the margin, and are crossed by strongly indented concentric lines which give the striæ the so-termed tuberculated appearance described by conchologists as well as by palæontologists, for the same character seems to be prevalent not only in the recent species of the genus, but also in those that occur fossil both in the Cretaceous and Tertiary formations. As the shell grows the ribs become more delicate and more numerous from repeated interpolations of shorter ribs, and the concentric lines become very much finer. The loop varies also considerably at different stages of the shell's growth. When quite young it forms a simple semicircular curve after having become attached to the hinge-plate, but as the shell grows the anterior portion of the lamella is slightly bent upwards and the crural processes much so as in the form of a ring.

There seems to me to exist more varietal difference between the form of *Terebratulina caput-serpentis* that occurs in the Mediterranean, and especially the North African coast of that sea, than between *Terebratulina caput-serpentis* of the North Atlantic and the North American variety *septentrionalis.* Dr Gwyn Jeffreys has proposed to me to apply to the Mediterranean form the varietal designation of *mediterranea.* It is much more depressed than the typical *Terebratulina caput-serpentis,* and often a strong longitudinal depression or sinus is seen in both valves, and the front is usually deeply indented. In the North Atlantic, *Terebratulina caput-serpentis* and American var. *septentrionalis,* the dorsal valve is generally uniformly convex, and when a depression exists it is much less defined than in the Mediterranean variety.

Terebratulina caput-serpentis and its var. *mediterranea* are found fossil in the upper tertiary deposits of many countries.

Terebratulina, sp. (?) (Pl. II. fig. 10).

A single specimen of a *Terebratulina,* apparently closely allied to *Ter. caput-serpentis,* was also dredged by the Challenger Expedition on October 26, 1774, in lat. 7° 3′ N., long. 121° 48′ E. of Mindanao, one of the Philippine group of islands, in 82 fathoms. The ribs are a little coarser, and the interspaces between them a little wider than in the larger number of specimens of the variety *septentrionalis,* but from the inspection of a single half-grown specimen it would not be safe to consider these details of sufficient importance to warrant referring it to a separate species. I submitted the specimen to the inspection of Mr Dall, who believes it to be specifically distinct from *Ter. caput-serpentis* and its variety *septentrionalis.*

Terebratulina cailleti, Crosse (Pl. II. fig. 2, *a*).

Terebratulina cailleti, Crosse, Journ. de Conch., 3me ser., vol. v. p. 27, pl. i. figs. 1–5, 1865.
Terebratulina cailleti, Pourtales, Bull. Mus. Comp. Zool., Camb., Mass., vol. i., No. 6, p. 109, 1867.
Terebratulina cailleti, Dall., Bull. Mus. Comp. Zool., Camb., Mass., vol. iii., No. 1, 1871.

Of this species only one minute example was dredged by the Challenger Expedition; it measures 2 mm. in length and breadth, and, consequently, is a very young immature specimen. It seems to agree well with similar individuals of the species sent to me by Professor Agassiz, which he had obtained near Barbados; likewise with others dredged by Barrett off Jamaica, as well as with some young shells of the same species which had been obtained in 70 fathoms of water, in lat. 21° 48′ S., and long. 40° 3′ W. of Greenwich, by the captain of the English Atlantic steamer "Norseman," and sent to me in 1877 by Mr R. Rathbun.

Of course, so young a shell does not exhibit the character of the adult condition; it is slightly ovate, with some nine simple rounded ribs and well-defined interspaces; the ribs being likewise intersected by a few equidistant concentric lines of growth. When the shell is adult the ribs are comparatively finer, and more numerous, with shorter ones interpolated between the longer ones. Dr Gwyn Jeffreys considers *Ter. cailleti* to be quite distinct from *Ter. caput-serpentis.*

The single specimen from the Challenger Expedition was obtained at Station 122. September 10, 1873, lat. 9° 5′ S., long. 34° 49′ W. to 53′ W., off Pernambuco, Africa, in 350 fathoms.

Terebratulina cancellata, Koch (Pl. I. figs. 11–16).

Terebratulina cancellata, Koch, Conch. Cab., vol. vii., pl. ii. figs. 11–13.
Terebratulina cancellata, Sow., Thes. Conch., vol. i. p. 358, pl. lxxi. figs. 93–95.
Terebratulina cancellata, Reeve, Mon. of Terebratula, Conch. Icon., pl. iv. fig. 13.
Terebratulina cancellata, Dall, Cat. of the Recent Species of the Class Brachiopoda, Proc. Phil. Acad. Nat. Sciences, p. 179, 1873.

Shell rather large, elongated oval or ovate, livid brown or yellowish, with darker concentric bands, widest about the middle, nearly straight in front. Dorsal valve very convex, flattened longitudinally along the middle, from which the lateral portions slope away at a rapid angle. Ventral valve convex rather less deep than the opposite one, and sometimes flattened towards the front. Beak incurved tapering, moderately produced and truncated by a rather large foramen which is very slightly separated from the hinge-line by a very narrow deltidium, the beak often slightly overlying the umbo of the dorsal valve. Surface of both valves ornamented with a very great number of delicate raised striæ or ribs, augmented in number at various distances from the beaks by the intercalation of shorter ribs. The surface is also crossed at intervals by fine concentric lines of growth. In the interior of dorsal valve the loop is simple and short, and rendered annular by the union of oral processes. Shell structure perforated by canals. Brachial appendages united by a membrane and divided into three lobes, the shorter central one is spirally coiled. Length 38, width 25, depth 22 mm.

Habitat.—*Ter. cancellata* was dredged abundantly by the Challenger Expedition on April 2, 1874. Station 162, off East Moncœur Island, Bass' Strait, in a depth of 38 to 40 fathoms; sea bottom, sand. Mr Dall states that it occurs off West Australia. This *Terebratulina* attaches its peduncle chiefly to different species of mollusca, such as *Pecten*, *Cardium*, *Arca*, &c.; to several species of univalves, spines of *Cidaris*, stones, &c.

Observations.—This fine species strikingly recalls some specimens of the Cretaceous *Terebratulina defrancii*, as some Mediterranean examples of the recent *Terebratulina caput-serpentis*, the Cretaceous *Ter. striata*. When young, *Ter. cancellata* is longitudinally spindle-shaped and oval, but aged examples show more of a straight front. Some of the specimens dredged by the Challenger Expedition have much exceeded in size, those figured by Koch, in Küster, by G. B. Sowerby, and L. Reeve. Its colour is also peculiar, being darker than the other species of recent *Terebratulina*, and more especially so in some specimens than in others. There exists likewise in some exceptional specimens a median depression in the anterior portion of the smaller valve, commencing at about the middle of the valve and extending to the front.

Terebratula or *Terebratulina* (?) *dalli*, n. sp. (Pl. II. fig. 15, *a*).

Shell small, thin, longitudinally oval, globose, glassy, and semitransparent, slightly depressed anteriorly. Ventral valve uniformly convex, a little deeper than the dorsal one. Beak small, slightly incurved, and truncated by an incomplete foramen, laterally margined by a small deltidial plate. Surface covered with fine radiating raised striæ, with shorter ones interpolated between some of the larger ones at various distances from the beak. Loop short and simple. Length 8, width 5½, depth 4 mm.

Habitat.—One example only of this species, without the animal, was dredged by the Challenger Expedition near Yeddo, off Japan, at Station 237. June 17, 1875. Lat. 34° 37′ W., long. 140° 32′ E. Depth, 1875 fathoms. Bottom temperature, 1°·7 C. Mud. Associated with *Discina atlantica*.

Observations.—I regret that but one dead specimen of this very pretty little species should have been obtained, the loop was imperfect, but it seems to have been short as in *Terebratula* or *Terebratulina*. The striæ which cover the shell surface are distinctly observable, both valves are, likewise, very convex. I am not acquainted with any recent form with which it can be assimilated. I have much pleasure in naming this small and interesting species after Mr W. H. Dall of the United Coast Survey, whose ably conducted dredging expeditions have thrown so much light on the molluscous fauna of the Unalashka region of North America.

Terebratulina (?) *murrayi*, n. sp. (Pl. II. fig. 1, *a*, *b*, *c*).

Shell small, obscurely trigonal, about as broad as long, broadest anteriorly, tapering posteriorly, white, surface marked by a small number of strong radiating ribs. Dorsal valve moderately convex, laterally auriculated close to the umbonal hinge-line. Hinge-line widely obtuse. Ventral valve convex, deeper than the opposite one. Beak very slightly incurved, and truncated by a largish incomplete foramen, margined laterally by small deltidial plates. In the interior of dorsal valve the hinge-plate is concave and wide, loop simple, short. Brachial appendages forming two branches, which curve inwards towards the centre of the shell, with spiral terminations. Cirri long. Length 4, width $3\frac{1}{4}$, depth 2 mm.

Habitat.—Dredged by the Challenger Expedition on the July 15, 1874, at Station 171, lat. 38° 33′ S., long. 177° 50′ W., near Kermadec Island, south of Fiji Islands, in a depth of 600 fathoms. Bottom temperature, 4°·0 C. Rock.

Observations.—Some eleven or twelve examples were dredged alive by the Challenger Expedition, and none exceeded the dimensions above given. It is a remarkable and puzzling species, for its shell and loop partake of the character of *Terebratulina*, while its brachial appendages seem to differ very materially from those of the sub-genus to which it is provisionally referred. I sent a specimen to Mr Dall for examination, as I desired to have his valued opinion on the shell. He states—"By devoting about half-an-hour to this little shell, I have cleared away all the animal matter (in the mode I wrote to you [1]), leaving the loop perfect. You will see at once that it is a young *Terebratulina*. I suspected this before I could see the loop, from the character of the punctuation which you will recollect is peculiar to the group." I had myself previously ascertained that the loop was short and simple, and that the mantle rises from the bottom of the shell near the loop, and adheres to its sides, as seen in fig. 1, *c*. It is singular, however, that, if a young shell, no example out of the eleven or twelve dredged by the Challenger Expedition attained larger proportions. It varies a good deal in shape and in the number of its ribs; some examples are also wider than long. I have named this species after John Murray, Esq., the able and obliging naturalist of the Challenger Expedition.

[1] To get at the delicate loop of any small Brachiopod without injuring it or the shell, first moisten in pure glycerine and allow the shell to lie twenty-four hours after it. Next immerse in a rather weak solution of caustic potash for two or three days. This will soften all the ligaments, so that they will admit of opening the shell to its normal extent. Then a small syringe will enable one to throw into the shell a steady stream of pure water, which will wash away nearly all the dried animal matter. After this is done, if some of the animal matter still remains, give the shell twenty-four hours more of potash solution, and repeat the syringing; while for an obstinate ligament, the tip of a fine stiff bristle, say from an ordinary old coat-brush, when the bristle is somewhat feathered, will often stroke it away.

Waldheimia, King.

Waldheimia kerguelenensis, n. sp. (Pl. III. figs. 1–9).

Terebratula globosa, Sow. (not of Lamarck), Thesaurus Conchyliorum, Pl. lxxi. figs. 99–101, 1846.

Shell ovate, ventricose, longer than wide, yellowish-white, smooth. Dorsal valve most convex near the umbo; a broad slight mesial depression or sinus commencing about the middle of the valve, extends to the front, more or less distinctly margined on either side by a faint raised line or ridge; front line slightly depressed and nearly straight. Ventral valve rather more convex than the opposite one, and more or less distinctly or prominently keeled by the presence of a wide convex but slightly raised fold which corresponds with the depression in the dorsal valve. Beak moderately produced and incurved, truncated by a small circular foramen margined laterally by two small disunited deltidial plates. The cardinal process is prominent, and formed of three distinct parts. In the interior of the dorsal valve, and under the incurved extremity of the umbone, hinge-plates wide, septum very short and massive, triangular, wide posteriorly, tapering to a point anteriorly. A pair of muscular impressions, left by the adductor muscles, are present on either side of the septum, at the bottom of the valve. Loop delicate, elongated and reflected. Shell perforated by numerous minute canals. Length 44, width 34, depth 29 mm.

Habitat.—*Waldheimia kerguelenensis* was dredged alive by the Challenger Expedition at the following localities:—

Off Marion Island, west of Kerguelen Island (Pl. III. figs. 3–9).

On the 26th December 1873, at a depth of 100 fathoms, two specimens of *Platydia anomioides* were attached to examples of the species under description.

At Station 149, Balfour Bay, near Kerguelen Islands, lat. 49° 16′ S., long. 70° 12′ E., on 19th January 1874, in 20 to 60 fathoms. Also at Station 150, south of Kerguelen Island (Pl. III. figs. 1, 2), February 2, 1874, lat. 50° 4′ S., long. 71° 22′ E., at a depth of 150 fathoms. Bottom temperature, 1°·8 C. Rock. Three examples of *Rhynchonella nigricans*, var. *pixydata*, were obtained with it. *Waldheimia kerguelenensis* was abundant at both localities, but the largest examples were dredged at Station 150.

Observations.—I have examined several specimens of this species, dredged alive by the Challenger Expedition. It varies in dimensions from 2 to 44 mm. Some examples were nearly circular, and as broad as long, but the majority were of an elongated oval shape, becoming ventricose with age. When the peduncle by which the shell adhered to foreign bodies was sufficiently long, and did not interfere with its limited movements, the beak was much incurved, and the foramen small (Pl. III. fig. 1); but as in most cases the peduncle was exceedingly short, and came into contact with the hard bodies to which the shell was moored, causing the beak at that part to be worn away, and consequently the enlargement of the foraminal aperture. The animal closely resembles in general character that of *Waldheimia flavescens*, so admirably described by Albany Hancock.

I have felt somewhat undecided with regard to the identification of this species. Some specimens bear a certain resemblance to *Waldheimia lenticularis*, but *Waldheimia kerguelenensis* is a smaller shell, more ovate or regularly oval, and especially so in the young and intermediate ages. I forwarded two examples for Dall's examination, and he informs me, "I have carefully compared it with D'Orbigny's *Waldheimia fontaineiana*, and feel more sure than ever of the correctness of my reference of his species to *Waldheimia venosa*. It is certainly not this fine species (*Waldheimia kerguelenensis*)." I consider myself justified, therefore, in regarding *Waldheimia kerguelenensis* as a new and undescribed form. I believe it, however, to be identical with that erroneously described and figured by G. Sowerby at p. 359 (Pl. XXI. figs. 99–101) of his Thesaurus Conchyliorum, 1846, as the *Terebratula globosa* of Lamarck. The specimen he figured under that name, said to have been taken from Lamarck's collection, was, I am assured, obtained in Paris by Mr Cuming, and it is now in the British Museum. Sowerby seems, however, to have gone rather far when he adds, "It agrees perfectly with the representation in the Encyclopédie Méthodique (tab. 339, fig. 2)." Still the foramen is not quite complete, although Lamarck gives "foramine integro" as one of its characters. If we refer to Lamarck's description of *Terebratula globosa*, and look at the figure in the Encyclopédie to which he refers, we are at a loss to see the perfect agreement alluded to by Mr Sowerby. The figure, which is not a very good one, represents a shell 68 mm. in length by 54 mm. in breadth, and most approaches in size the *Waldheimia venosa* of Solander, to which Lamarck's species has been more than once referred. As some uncertainty must, therefore, prevail with reference to the species named *Terebratula globosa* by Lamarck, I would propose to call the shell under description and the one figured by Sowerby in the Thesaurus Conchyliorum, *Waldheimia kerguelenensis*, admitting at the same time *Waldheimia lenticularis* as its nearest ally.

Waldheimia flavescens, Val. *apud* Lam. (Pl. III. figs. 10–12).

Terebratula flavescens, Val. apud Lamarck, Anim. sans Vert., vol. vi. p. 246, 1819.
Terebratula dentata, *ibid.*
Terebratula australis, Quoy and Gaimard, Voyage de l'Astrolabe, Zool., p. 551, pl. lxxxv. figs. 1–5, 1834.
Terebratula recurva, *ibid.*, p. 554, pl. lxxxv. figs. 11, 12, 1834.
Terebratula australis, G. B. Sowerby, Thes. Conch., parts 4 and 7, p. 349, pl. lxix. figs. 25–33, 1846.
Waldheimia australis, King, Mon. of Permian Fossils, Pal. Soc., p. 145, pl. xx. figs. 11, 12, 1849.
Waldheimia flavescens, Dav., Brit. Foss. Brach., Introduction Pal. Soc., vol. i. p. 64, figs. 6, 7, 1853.
Waldheimia australis, Woodward, A Manual of the Mollusca, p. 216, figs. 113, 114, 1854.
Terebratula australis, Gratiolet, Études anatomiques sur la Terebratule australe, Journ. de Conch., October 1857.
Waldheimia australis, Hancock, Phil. Trans. Royal Soc., vol. cxlviii., 1858.
Waldheimia flavescens, L. Reeve, Mon. of Terebratula, pls. i. and ii., 1861.
Waldheimia flavescens, Dall, Amer. Journ. of Conch., vol. vi. part 2, p. 180, 1870; and Proc. Phil. Acad. Nat. Sciences, p. 181, 1873.

Shell longer than wide, ovate or subpentagonal, broadest about the middle, straight in front, yellowish or light brown. Dorsal valve convex, sometimes flattened from about the middle of the valve to the front. Ventral valve rather deeper, or more convex than the opposite one, with a slightly raised longitudinal flattened elevation or fold along the middle. Beak moderately incurved, truncated by a circular foramen, somewhat separated from the hinge-line by a deltidium; beak-ridges sharply defined. Surface of both valves from the beaks smooth up to a certain age, then radiating and irregularly plaited, some ribs being shorter than others, the central ones straight, those on the lateral portions of the valves somewhat curved. Shell structure perforated by canals. In the interior of the dorsal valve the loop long and simple, after being attached to the hinge-plate and having given off its crural processes, the principal branches are outwardly curved,

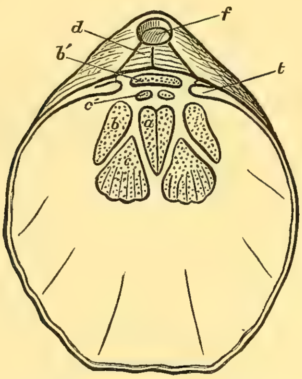


Fig. 1. *Waldheimia flavescens* (enlarged).

Interior of ventral valve. *f* foramen, *d* deltidium, *t* teeth, *a, a* adductor impressions, *c* divaricator, *c′* accessory divaricators, *b* ventral adjustor, *b′* peduncular muscle.

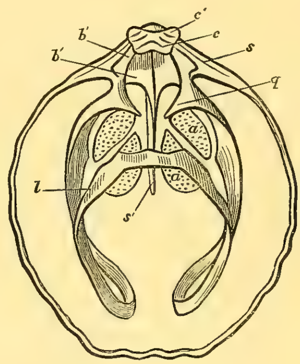


Fig. 2. *Waldheimia flavescens.*

Interior of dorsal valve. *c, c′* cardinal process, *b, b′* hinge-plate, *s* dental sockets, *l* loop, *q* crura, *a, a* adductor impressions, *s, s* septum.

and on reaching to about three-fourths of the length of the valve become reflected. The median septum extends along the bottom of the shell from under the hinge-plate, to a little beyond one-third of the length of the valve. Brachial or labial appendages largely developed, and united to each other by a membrane. The principal lateral branches commence on either side of the mouth, and by an outward curve and facing the bottom of the smaller valve extend to within a short distance of the frontal margin, then becoming suddenly bent back upon themselves to within a short distance of the mouth, are by an elegant semicircular curve directed towards the centre of the larger valve, and form the commencement of the shorter spiral central lobe (Pl. III. figs. 11, 12). Proportions variable, length 36, width 30, depth 20 mm.

Habitat.—*Waldheimia flavescens* was picked up in great numbers by the Challenger

Expedition on June 3, 1874, on the shore, and at from 2 to 10 fathoms at Port Jackson, South Australia. Lamarck, who first described the species, does not refer to any figure, and seems to have been ignorant as to its real habitat, for he states, "Habite les mer des Indes à Java." Quoy and Gaimard found it in 1834 in immense numbers at Port Western, Bass Strait. They observe that hundreds were brought up at each haul of the dredge, either grouped among themselves or attached to other shells. At Port Jackson they were obtained in great numbers in four feet depth of water. Professor J. Beete Jukes collected any number while boating in South Australia among the reefs near Port Jackson. They were merely washed up by the tide, and he gathered them with his hand like limpets on the shore. The Rev. J. E. Tenison Woods observes, in his Census of Marine Shells of Tasmania, that *Wald. flavescens* is found in all Southern Australia, but only on the north coast of Tasmania.

Observations.—The animal of this species, selected by Professor W. King as the type of his excellent genus *Waldheimia*, has been admirably described by several eminent anatomists. First by Professor R. Owen in 1853, in the first chapter of the introduction to my work on British Fossil Brachiopoda; subsequently in 1857 by Pièrre Gratiolet, in his memoir, Études Anatomiques sur la Terebratule Australe, Journal de Conchyliologie; and in the following year by Albany Hancock, in his classical memoir on the Organisation of the Brachiopoda, Phil. Trans. of Roy. Soc., vol. cxlviii., part 2, 1858, to which works the reader is referred for all anatomical details. We may, however, here reproduce an admirable diagram by Albany Hancock showing the arrangement of the muscular system. Its intimate shell structure has likewise been investigated by Professor Carpenter in chapter ii. of my general introduction already referred to.

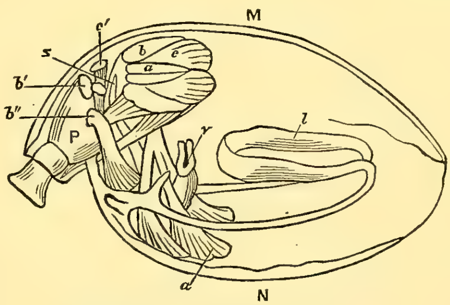


Fig. 3. *Waldheimia flavescens* (after Hancock).

Diagram showing the muscular system. *M* ventral, *N* dorsal valve, *l* loop, *v* mouth, *z* extremity of intestine, *a*, *a* adductor, *c* divaricators, *c′* accessory divaricators, *b* ventral adjustors, *b′* peduncular muscle, *b″* dorsal adjustors, *P* peduncle.

Quoy and Gaimard had also given some brief anatomical details in the description of their *Terebratula australis* (3d vol. of the Voyage de l'Astrolabe), "Ces mollusques," they add, "doivent vivre longtemps hors de la mer, par la faculté qu'ils ont de conserver de l'eau dans leurs valves hermetiquement fermées. La quantité relatif en est considerable car l'animal ne parait occuper qu'une petite place dans la cavité qui semble à demi vide, nous n'avons aperçu d'autres mouvements que celui des lamelles cilices encore est il assez obscurs."

Waldheimia flavescens has received four or five different names, but that of *flavescens* is the oldest, and the one it is desirable should be retained for the species. It is very variable in shape. The shell in some specimens, up to nearly half the size of the largest, is almost entirely smooth, while other examples are ribbed almost up to the beak and umbo. Some are stinted in growth, and with their beak more than usually incurved (*Terebratula dentata* and *Terebratula recurva*). The ribs vary likewise to a considerable extent in number, size, shape, and direction.

Waldheimia wyvillii, n. sp. (Pl. III. fig. 13, *a*, *b*).

Shell ovate or longitudinally oval, very thin, semitransparent, light brownish-yellow, smooth, marked at intervals by concentric lines of growth. Dorsal valve moderately convex longitudinally, slightly flattened along the middle. Ventral valve deeper or more convex than the dorsal one, without sinus. Beak incurved, truncated by an incomplete foramen margined laterally by small deltidial plates. In the interior of the dorsal valve the loop is long and simple, the lateral branches extending to a little beyond two-thirds of its length before becoming reflected. Length 19, width 14, depth 10 lines.

Habitat.—Only one incomplete example of this species was dredged by the Challenger Expedition, off Valparaiso, at Station 299, on December 14, 1875, in lat. 33° 31′ S., long. 74° 43′ W., at a depth of 2160 fathoms. Bottom temperature, 1°·1 C. Sea bottom, grey ooze. *Terebratula wyvillii* and *Discina atlantica* were obtained at the same time.

Observations.—In external shape this species approaches *Waldheimia cranium*, which is, however, a thicker and more convex shell. The extremely delicate shell of *Waldheimia wyvillii* is very remarkable, and reminds us of *Waldheimia tenera*, Jeffreys, but from which it seems to differ in size and some other particulars. The fact that several of the species obtained at such great depths, such as *Terebratula wyvillii* and *Discina atlantica*, possess such exceedingly thin and delicate glass-like shells is certainly worthy of notice.

Terebratella, D'Orbigny.

Terebratella dorsata, Gmel., sp. (Pl. IV. fig. 4).

Anomia striata magellanica, Chem., Conch. Cab., vol. viii. p. 101, pl. lxxvii. figs. 710, 711.
Anomia dorsata, Gmel., s. n., 3348, 1788.
Terebratula dorsata, Lam., Anim. sans Vert., vol. vi. p. 246, 1819.
Terebratula sowerbyi, P. P. King, Zool. Journ., vol. v. p. 339, 1835.
Delthyris dorsata, Menke, Syst. Syn. Mollusc. Gen., 2d edit., p. 96, 1830.
Terebratula bilobata et *pectinata*, Blainville, Teste Rev. Journ. de Conch., p. 127, 1861.
Terebratula magellanica, L. Reeve, Conch. Icon., pl. v. fig. 21.
Terebratella dorsata, Davidson, Dall, and of several malacologists.

Shell somewhat transversely oval, wider than long; valves moderately convex, light yellow, sometimes slightly yellowish-red, smooth or ribbed. Dorsal valve, with a mesial depression or sinus commencing generally at about half the length of the valve, and extending to the front. Ventral valve rather deeper than the dorsal one, with a mesial fold corresponding to the sinus in the opposite valve. Beak produced, slightly incurved and truncated by a rather large circular foramen, more or less separated from the hinge-line by a deltidium in two pieces; beak-ridges sharply defined, leaving a flattened space between them and the hinge-line. In the interior of the dorsal valve the loop is long and doubly attached, first to the hinge-plate, again by horizontal laminæ, given off by the principal branches of the loop, to a slightly elevated mesial septum. Length 25, width 26, depth 11 mm.

Habitat.—Three examples were dredged by the Challenger, off Royal Sound, Kerguelen, on the 17th January 1874, lat. 49° 40′ S., long. 70° 20′ E. Depth, from 20 to 30 fathoms. It is a very common species near the coast of Chili and southward to the Straits of Magellan, in depths of from 25 to 90 fathoms. Mr Cuming got it near Valparaiso. A. D'Orbigny states, in his Voyage dans l'Amerique Meridionale, that he obtained it also at Coquimbo at rather great depths. Some specimens have attained to double the size of the Challenger specimens above recorded.

Observations.—This species varies considerably from the presence or absence of radiating ribs, and this peculiarity is common to many recent and fossil species of Brachiopoda. In 1867 Commodore Acton dredged a very great number of specimens in the Straits of Magellan, which he kindly presented to me. These show every modification in shape, from the smooth shell to those more or less distinctly ribbed. Mr Broderip observes that the radiating striæ almost disappear in the older individuals. When quite young the dorsal valve possesses a high *Magasella*-shaped septum and loop. The shell has received several names, and some difference in opinion has arisen as to the one that should be retained. Mr L. Reeve observes that, "three years before Gmelin gave the name of *Anomia dorsata* to this species, it was fully described and figured by Chemnitz with the name of *magellanica*, which had already been given to it in French by Davila, Favart, and D'Herbigny." Mr Dall is, however, of opinion that, "as Chemnitz was not a binominal writer, his name cannot be retained." The anatomy of this species has been well described by Professor Owen in vol. i. of the Transactions of the Zoological Society. The three dead and separated valves brought back by the Challenger Expedition were nearly smooth, or with the radiating ribs but very faintly indicated, and seem to partake more of the aspect of the variety *sowerbyi* of King, than of the generality of specimens of *Terebratula dorsata.*

Terebratella frielii, n. sp. (Pl. III. figs. 19, 20).

Shell small, ovate, slightly longer than wide, smooth, white. Dorsal valve moderately convex, slightly flattened or depressed anteriorly. Ventral valve deeper than the dorsal one. Beak short, truncated by an incomplete foramen, laterally margined by two very short and small deltidial plates. In the interior of the dorsal valve, the loop, which extends to about two-thirds of the length of the valve, is doubly attached, first to the hinge-plate, and again to a mesial septum. Length 10, width 9, depth 5 mm.

Habitat.—Two small specimens (Pl. III. fig. 19) were dredged off Halifax by the Challenger Expedition, at Station 47, lat. 41° 15′ N., long. 65° 45′ W., on May 7, 1873. Depth, 1340 fathoms. Sea bottom, mud. Two other examples (Pl. III. fig. 20), which seem to belong to the same species and of the same proportions, were likewise dredged by the same Expedition, at Station 201, on October 26, 1874, close to the Philippine Islands, in 82 to 102 fathoms. Sea bottom, gravel and stones.

Observations.—I have felt much uncertainty with respect to the identification of the two small immature shells from off Halifax above described, the only ones brought back by the Challenger Expedition. I forwarded one of them to Mr Dall for examination, and he wrote back that he could not positively identify it with any of the described species. Mr Jeffreys expressed a similar opinion, adding that the septum and cœcal tubercules are very peculiar and remarkable, and that he felt certain that it is an undescribed species of *Terebratella.* Two other similarly shaped and sized shells were likewise dredged by the same Expedition (fig. 20) off the Philippine Islands, and which I could not distinguish from those obtained off Halifax.

I have, therefore, much pleasure in naming this species after Herr Herman Friele, of Bergen, Norway, whose series of elaborate observations, with respect to the modifications assumed by the loop in *Waldheimia cranium* and *Waldheimia septigera*, as seen in the fry and up to the full-grown condition, are worthy of much commendation.

Magasella, Dall.

Magasella flexuosa, King, sp. (Pl. IV. fig. 5, *a*, *b*, *c*).

Terebratula flexuosa, P. P. King, Zool. Jour., vol. v. p. 337, 1835; Sow., Thesaurus Conch., parts 6 and 7, p. 347, pl. lxix. figs. 23, 24, 1846.

Terebratella flexuosa, Dav., Classification of the Recent Brachiopoda, Ann. and Mag. of Nat. Hist., vol. ix. p. 367, 1852; and Gray, Brit. Mus. Cat., p. 87, 1853.

Terebratula magellanica, L. Reeve, Conch. Icon., Mon. of Terebratula. (Not of Chemnitz.)

Magasella flexuosa, Dall, Am. Jour. of Conch., part 2, p. 135, 1870, and Cat. of Recent Brach., Proc. Phil. Acad. Nat. Sciences, p. 189, 1873.

Shell somewhat subtetragonal, about as wide as long, yellowish or light reddish-brown. Dorsal valve moderately convex, mesially longitudinally depressed from about half the length of the valve to the front. Ventral valve deeper than the dorsal one, longitudinally keeled. Beak short; foramen rather large, completed by a narrow deltidium; beak-ridges well defined, leaving a flattened space or false area between them and the long obtuse angular hinge-line. Margin of valves strongly flexuous. Surface of both valves ornamented with numerous radiating diverging ribs curving to the lateral margin, straight along the middle, with shorter ribs interpolated between where the space widens to receive them. In the dorsal valve the loop is doubly attached. Mesial septum large, and abruptly elevated at its anterior extremity, extending from under the hinge-plate to about two-thirds of the length of the valve. The principal branches of the loop are first attached to the base of the hinge-plate; again, at about two-thirds of their length, become very much widened in the shape of horizontal expansions, which become fixed to the middle of the top of the septum, the principal branches then continue to extend for a short distance before becoming reflected and form the loop. Length 22, width 21, depth 5 mm.

When quite young, and up to about 8 mm. in length, the shell is quite smooth, the ribs afterwards commence to appear as the shell acquires age and size.

Habitat.—About twelve or thirteen specimens of this species were dredged by the Challenger Expedition in the Gulf of Patagonia, on December 28, 1875, at Station 312, in lat. 42° 43′ S., long. 82° 11′ W., or near Cape Horn, and not far from Falkland Islands, in 1450 fathoms. Bottom temperature, 1°·5 C. Sea bottom, globigerina ooze. Six specimens were also dredged by the Challenger Expedition at Station 315, January 26, 27, 28, 1876, in lat. 51° 40′ S., long. 57° 50′ W., Port Stanley, at a depth of 5 to 12 fathoms. Sea bottom, sand and gravel. Specimens in the Smithsonian Cabinet are labelled, "Orange Harbour, Patagonia." Captain P. P. King, R.N., the first discoverer of the species, states—"This shell was dredged in the Bay of Port Famine, attached to stones: it is a common shell in the Straits."

Magasella incerta, Dav. (Pl. IV. fig. 6, *a*, *b*).

Shell elongated, pear-shaped, broadest anteriorly, tapering posteriorly, very slightly and evenly convex, somewhat flattened, without fold or sinus, smooth, nearly white. Beak in ventral valve pointed, nearly straight, with a large incomplete foramen extending from under the extremity of the beak to the hinge-line, and margined partly by the umbo of the dorsal valve, and by small lateral plates. In the interior of the dorsal valve a short elevated vertical mesial septum almost reaches to the bottom and middle of the opposite valve; it extends along the middle portion of the bottom of the dorsal valve to about half the length of the shell; to its sides and to the base of the hinge-plate are attached the principal stems of the loop, the reflected portion being small. Length 5, breadth 4, depth 1½ mm.

Habitat.—Some twelve examples of this small shell were dredged by the Challenger

Expedition on March 25, 1878, west of St Thomas, Danish West Indies, at a depth of 390 fathoms.

Observations.—None of the examples exceeded the proportions above given, and they look as if they were young and immature specimens of some species at present unknown. I have in my collection a number of young specimens of a *Magasella*, agreeing in size and shape with the one under description, which were dredged by Commodore Acton in the Straits of Magellan. I felt inclined to consider these last as the young age of *Terebratella dorsata*, which occurs in vast abundance in the same Straits. It will hereafter have to be ascertained whether *Magasella* is really a good sub-genus, or if only a modification of *Terebratella* due to age. *Terebratella* may have undergone modifications in the development of its loop, as is now well known to have been the case with *Waldheimia*.

Magasella cumingi, Dav., sp.

Terebratella cumingi, Dav., Proc. Zool. Soc., p. 78, pl. xiv. figs. 10–16, May 1852.
Magasella cumingi, Gray, Catalogue of the Brachiopoda of the British Museum, p. 99, 1853.
Terebratula cumingi, L. Reeve, Conch. Icon., *Terebratula*, pl. viii. fig. 29.
Magasella cumingi, Dall, Proc. Phil. Acad. Nat. Sciences, p. 188, July 1873.

Shell ovate, longitudinally oval, very thick, flexuous at the margin. Larger or ventral valve most convex, slightly keeled. Beak large, acuminately produced, very slightly incurved and truncated by a small oval-shaped foramen. Area triangular, concave, laterally sharply defined. Dorsal valve slightly and uniformly convex. Surface of valves smooth, whitish, or feebly tinted with red. In the interior of the dorsal valve the cardinal process is large and massive, a mesial elevated triangular septum arises from under the cardinal process, and by a gentle curve reaches and touches the bottom of the larger valve near to its anterior portion, and from which it descends by an almost perpendicular line to the bottom of the valve. The calcareous riband-shaped lamellæ forming the loop proceed from the base of the inner socket walls, directing themselves by a gentle curve to the anterior portion of the septum, to which they adhere prior to being reflected so as to form a loop. The brachial or labial processes are of a brilliant red colour. Length 11, width 8 mm.

Observations.—In 1852, two examples of this small and interesting species, so remarkable on account of the great thickness of its valves, large projecting beak, and interior peculiarities, were sent to Mr Cuming as having been dredged off New Zealand, and were put into my hands by him for description and illustration. I placed it into the genus *Terebratella*, on account of the shape of its loop, which is doubly attached; subsequently Mr Dall located it into his genus or sub-genus *Magasella*, on account of the shape of its large triangular septum.

Habitat.—The exact habitat of the species was not then positively known; and I have no certainty that it was ever dredged off New Zealand. In 1877 I ascertained that the shell occurred off Port Jackson Heads, South Australia, and the Challenger Expedition dredged four separate valves on April 17, 1874, off Port Jackson, in 2 to 10 fathoms.

I regret that as my plates were finished prior to the discovery of this species among the Challenger shells, that it could not be figured, but good illustrations of it have already been given by both myself and Mr Lovell Reeve.

It is possible that the so-termed *Bouchardia* (?) *fibula* of Reeve may be only a large example of *M. cumingi*, and belong to the same sub-genus. It is likewise said to have been dredged alive somewhere off South Australia, and not very far from where *M. cumingi* is known to occur.

Megerlia, King.

Megerlia (?) *incerta*, n. sp. (Pl. XI. figs. 17, 18).

Shell semicircular, small, somewhat broader than long. Hinge-line long and straight, rather exceeding two-thirds of the breadth of the shell, with obtuse cardinal angles, semi-transparent, whitish. Dorsal valve very slightly convex, most so at the umbo; ventral valve a little deeper and more convex than the opposite one, slightly longitudinally depressed along the middle. Beak small and truncated by an incomplete circular foramen, laterally margined by small deltidial plates; beak-margin very sharply defined, leaving between them and the hinge-line a sharply-defined narrow area. Surface of both valves marked by numerous rounded radiating ribs with concave interspaces, some bifurcating near the front, or increasing in number by the interpolation of shorter ribs between the longer ones. Surface of valves crossed at irregular intervals with concentric lines of growth. Shell perforated by minute canals. Length 8, breadth 9, depth 4 mm.

Habitat.—One young specimen attached to *Limopsis aurita* (?), Brocchi, and two or three more aged examples were dredged by the Challenger Expedition, August 25, 1873, in lat. 1° 47′ N. long 24° 26′ W., between Sierra Leone (Africa) and Fernando de Noronha (South America) south of Cape Verde Islands, in 1850 fathoms, associated with *Discina atlantica.*

Observations.—I am uncertain with respect to the genus to which this small Brachiopod should be referred, as I am unacquainted with the shape and character of its loop. I did not like to run the risk of opening the shell or separating its valves, but the strong general resemblance it bears to *Megerlia truncata* induces me to provisionally leave it in that section of the Terebratulidæ. The long straight hinge-line and sharply-defined area are well exposed in three of the specimens. When young the ribs were few in number, and the interspaces between them wide, the ribs becoming more numerous and close as the shell acquires age and growth.

Megerlia truncata, Linné (Pl. III. figs. 15–18).

Anomia truncata, Lin., Syst. Nat., 1152. Born, Chemnitz, Gmelin, Dillwyn, Poli, &c.
Terebratula truncata, Retz, n. gen., p. 14. Lamarck, Sowerby, Blainville, Costa, and others.
Terebratella truncata, D'Orb., Ann. Sci. Nat., 1848, vol. viii., pl. vii. figs. 11, 12, 16, 37.
Terebratula monstruosa, Scacchi, Osser. Zool., vol. ii. p. 1.
Anomia disculus, Pallas, Misc. Zool., p. 184, pl. xi. fig. 1.
Terebratula disculus, Blainville, Dic. Sci. Nat., vol. liii. p. 138.
Orthis truncata, Philippi, Moll. Sicil., vol. ii. p. 69.
Terebratula oblita, Mick. Brach. Fauna Misc., pl. ii. fig. 21.
Meganthyris oblita, D'Orb, Prodrome, vol. iii. p. 134.
Terebratula scobinata, Gmelin; *Terebratula decussata*, Blainv.; *Terebratula irregularis*, Blainv.; *vide* Reeve.
Megerlia truncata, King, *Perm. Foss.*, p. 145. Davidson, Gray, Reeve, Woodward, Chemnitz, Suess, Dall, H. & A. Adams, Jeffreys, Monterosato, and the generality of modern authors.
Morrisia gigantea, Deshayes, Cat. des Moll. de l'Ile de la Reunion (Bourbon) annexe E., p. 37, pl. xxxii. figs. 9–11.

Shell transversely oval or semicircular, somewhat depressed, fulvous white. Hinge-line nearly straight. Dorsal valve gently convex, mesially longitudinally depressed from close to the umbo to the front. Ventral valve deeper than the dorsal one, and longitudinally keeled. Beak very slightly incurved, and truncated by a large circular incomplete foramen, with two small deltidial plates, area flat, sharply defined. Surface of valves marked with numerous fine pustulate radiating riblets, increased in number at variable distances from the beaks by the intercalation of shorter ribs. Surface crossed by concentric lines of growth. Shell structure perforated by minute canals. Loop trebly attached, first to the base of hinge-plate, to the median short septum, and again by lateral branches departing from the reflected upper part of the loop to the upper anterior extremity of the septum. Brachial or labial appendages forming two ear-shaped processes, connected by a membrane forming two large lateral lobes and a short median spiral one. Dimensions, length 13, width 14, depth 6 mm. (Some Mediterranean examples have exceeded these proportions by a third.)

Habitat.—This species was dredged in great profusion by the Challenger Expedition off Gomera, Teneriffe, on February 10, 1873, in 70 or 75 fathoms, with *Argiope decollata* adhering to it. It seems to enjoy a very extended geographical range. It occurs in the Mediterranean, and abounds on the adjacent Atlantic shores. Signor Costa obtained it from near the Island of Capri, Ischia, Palmieri, and the Gulf of Taranto. E. Forbes in his report on the Mollusca of the Ægean Sea, 1844, found it living at from 60 to 105 fathoms. It was also dredged off the coast of France, Morbihan, Ile de Noirmoutier in Vendée, Guetaria, North Spain. Mr Dall mentions, that a specimen under the name of *Megerlia truncata* was sent to the Smithsonian Cabinet with the habitat of New South Wales, but this locality requires further confirmation, especially as Mr Dall observes that "the spiral lobe of the branchia, prominent in the European species, seemed to be nearly wanting in the Australian shell, the fringes in the former being twice as long, and the individual filaments much more slender and five or six times as numerous as the latter. According to Messrs Adams and Dall, *Megerlia truncata* occurs in the Japanese seas, but I have not seen any specimens. The habitat of the Philippine Islands given by Woodward also requires corroboration. The specimen figured by Deshayes as having been dredged off the Island of Bourbon (?) certainly belongs to the species under description, but is erroneously named *Morrisia gigantea.*

It is a common fossil in the upper tertiary formations of Sicily, Italy, Nice, and elsewhere.

Observations.—This is a well-known species, and has been often described, and, as may be seen from the synonyms, often very much misunderstood. Externally it certainly bears a somewhat obscure resemblance to some forms of *Orthis*, but has none of its real characters. The strangest mistake, however, was that of Deshayes who described and figured a specimen said to be from off the Island of Bourbon, under the designation of *Morrisia gigantea.* In his admirable memoir Recherches sur l'Organisation du Manteau chez les Brachiopodes articulés, 1864, Mr E. Deslongchamps treats in minute detail of the mantle in this important genus and especially of that of *Megerlia truncata.* He states that the microscopic flattened spiculæ of the mantle are still more abundant than in *Terebratulina* and have a very peculiar shape, and that the calcified portions are well defined in shape in both valves. The flattened spiculæ are wide and nearly quadrilateral with rounded extremities, the edges festooned; they form denticulated calcareous plates, and vary sufficiently in arrangement in different genera of Brachiopoda as to serve as distinguishing characteristics.

Megerlia willemöesi, n. sp. (Pl. IV. figs. 1–3).

Shell ovate, or longitudinally oval, broadest anteriorly, tapering posteriorly. Valves moderately convex, surface smooth, white. Dorsal valve moderately convex, dorsal valve not quite as deep as the ventral one, and somewhat flattened anteriorly so that the front line is slightly depressed. Ventral valve very convex, slightly flattened along the middle and especially so anteriorly. Beak produced, comparatively large and truncated by a circular foramen, separated from the hinge-line by a rather wide and high deltidium. In the interior of the dorsal valve the loop is three times attached, first to the hinge-plate, again to a median septum, and thirdly by perpendicular lamellæ which connect the lateral reflected extremities of the loop with the median septum. Length 10, width 9, depth 5 mm.

Habitat.—Fine examples of this interesting species attached to branched Polyzoa were dredged in company with *Terebratula uva* by the Challenger Expedition on April 4, 1874, at Station 163, in lat. 36° 56′ S., long. 150° 30′ E., off Twofold Bay, South Australia, or between Sydney and Melbourne, in 120 fathoms. Bottom temperature, 0°·7 C. Sea bottom, red clay.

Observation.—The more elongated shape of this species distinguishes it from *Megerlia jeffreysi.* The shell was submitted to Mr Dall, who states that the loop resembles that of a *Megerlia,* like *jeffreysi.* I have named it after the late able and much regretted naturalist of the Challenger Expedition, Dr Rudolf von Willemöes-Suhm, to whom science is indebted for many valuable contributions.

Megerlia sanguinea, Chemn., sp. (Pl. III. fig. 14, *a*).

Anomia sanguinea, Chem., Conch. Cab., vol. viii. p. 96, pl. lxxviii. fig. 706, 1785. Dillwyn, Cat. Rec. Shells, p. 293, 1817. (Not of Solander.)
Anomia sanguinolenta, Gmel., n. sp., p. 3347.
Anomia cruenta, Soc. MS. (Not of Dillwyn.)
Terebratula cruenta, Donovan, Nat. Rep., pl. lvi. fig. 1.
Terebratula erythroleuca, Quoy and Gaimard, Voyage de l'Astrolabe, vol. iii. p. 557, pl. lxxxv. figs. 9, 10.
Terebratula sanguinea, Sow., Thes. Conch., vol. i. p. 357, pl. lxxi. figs. 71–73. (Not. of Lam., Leach, or Donovan.)
Terebratula pulchella, Sow., Thes. Conch., vol. i. p. 360, pl. lxxi. figs. 105–107. Dav., Ann. and Mag. Nat. Hist., p. 368, 1852. Gray, Brit. Mus. Cat., p. 90. Reeve, Conch. Icon., pl. vii. fig. 25.
Megerlia pulchella, Dav., Ann. and Mag. Nat. Hist., p. 369, 1852.
Megerlia (*Vonenia*) *pulchella,* Gray, Brit. Mus. Cat., p. 104. A. Adams, Ann. and Mag. of Nat. Hist., vol. ii. p. 99, 1863.
Megerlia sanguinea, Dav., Proc. Zool. Soc., p. 308, pl. xxxi. figs. 1, 2, 1871. Dall, Proc. Phil. Acad. Nat. Sciences, p. 187, 1873.

Shell small, ovate or circular, smooth, thin, whitish or yellowish, radiately interruptedly freckled with bright blood colour. Dorsal valve moderately convex, with a more or less defined mesial depression, commencing at about half the length of the valve and extending to the front. Ventral valve rather deeper than the dorsal one, uniformly convex, sometimes either slightly keeled or flattened along the middle. Beak moderately incurved and truncated by a circular foramen, very slightly separated from the hinge-line by a small deltidum; beak-ridges well defined, leaving a flattened space or area between them and the hinge-line. Shell perforated by canals. In the interior of dorsal valve the loop does not extend to much further than to about two-thirds of the length of the valve, and is three times attached; first to the hinge-plate, then before attaining half its length to a longitudinal septum, and a third time by vertical laminæ, which connect the lateral reflected extremities of the loop with the median septum (fig. 14, *a*). Length 11, width 10, depth 9 mm.

Habitat.—Only one specimen was dredged by the Challenger Expedition, between Stations 212 and 213, on February 1, 1875, at the Reefs of Zamboanga, in 10 fathoms depth. One example had likewise been dredged by the "Astrolabe" Expedition at Tongatabu. I have very fine and large specimens from off the Island of Zebu in the Philippines, and Honolulu in the Sandwich Islands, attached to coral and stones. The Rev. J. E.

Woods kindly sent me specimens of the shell, both white and coloured, from near Bird's Island, North Australia. A. Adams obtained it near Japan, and M. Emile Deplanche dredged it in 1859 not far from the coast of Tahiti. It was likewise recently got off Phare, New Caledonia.

Observations.—In 1846 Mr G. Sowerby (Thesaurus Conchyliorum, parts 6 and 7, p. 357) noticed the triply-attached condition of the loop, for he says: "The internal appendages at first form two rays, then a central ring and two lateral loops, and at length a reflected dorsal loop united to a central ring." This description seems, however, somewhat difficult to understand, and he seems not to have observed that two of the three attachments are made to a short longitudinal septum. In 1871 I gave enlarged, and I believe correct, figures of the loop of this species in my paper On Japanese Recent *Brachiopoda* (Proc. Zool. Soc. of London, pl. xxxi. fig. 2, *a*), and did not fail to mention (p. 308) that "Mr Dall is of opinion that there is no difference in the interior of *Megerlia sanguinea* and *Megerlia truncata*, except that the lateral lobes are open instead of closed in *Megerlia truncata*, and that this and the external shape of the shell may perhaps serve as characters for the creation of a sub-section. The same internal arrangements take place in *Megerlia jeffreysi*, *Megerlia reevii*, Adams, and this last is in all probability nothing more than a bleached example or variety of the shell under description."[1] In his monograph Mr Reeves states that Sowerby's *Terebratula pulchella* is merely a variety of the old *Anomia sanguinea* of Chemnitz.

Kraussina, Davidson.

Kraussina lamarckiana, Dav. (Pl. IV. fig. 9).

Kraussina lamarckiana, Dav., Ann. and Mag. of Nat. Hist., vol. ix. p. 370, 1852, and Proc. Zool. Soc., pl. xiv. figs. 22, 23, 1852. Chem., Manuel de Conchyl., vol. ii. p. 206, 1857.

Kraussina lamarckiana, Dav., Ann. and Mag. Nat. Hist., p. 31, 1861.

Kraussina lamarckiana, Dall, Am. Journ. of Conch., vol. vi., part 2, p. 139, 1870, and Proc. Phil. Acad. Nat. Sciences, p. 190, 1873.

Shell small, somewhat tetragonal, about as wide as long, yellow or light brown. Dorsal valve slightly convex, with a rather deep longitudinal mesial depression. Hinge-line nearly straight and rounded at its angles. Ventral valve deeper and more convex than the dorsal one, longitudinally keeled along the middle. Beak slightly incurved and truncated by a large incomplete foramen, laterally margined by two rudimentary deltidial plates; beak-ridges sharply defined, leaving a flat areal space between them and the hinge-line. Surface of both valves ornamented by a number of small radiating costæ,

[1] Herr Friele is mistaken when stating at p. 384 of his excellent paper On the Development of the Skeleton in the Genus *Waldheimia*, that I consider *Megerlia jeffreysi* to be the young of *Megerlia sanguinea*. I have always considered them to be distinct species; but I said both agreed in the character of the loop.

increasing in number by the intercalation of shorter ribs. Apophysary system in dorsal valve consisting of two short, central, diverging branches, forked at their extremities. Interior surface tuberculated, a row of short, erect spine-like asperities rising perpendicularly close to, and all round the inner margin of valves. Its brachial appendages are small, the central spiral lobe especially so. Shell perforated by small canals. Length 7, breadth 7, depth 4 mm.

Habitat.—Five specimens of this small species were brought home by the Challenger Expedition attached to specimens of *Waldheimia flavescens.* They were obtained on June 3, 1874, at Port Jackson, near Sydney, South Australia. The specimens of *Waldheimia* being found close to the shore. The Rev. T. E. Tenison Woods, F.G.S., states in his Census of the Marine Shells of Tasmania and Adjacent Islands (p. 34, 1877), that *Kraussina lamarckiana* occurs in abundance under stones at low water at Tamar Heads, also in South-East Australia and New Zealand, and occasionally at Long Bay.

Observations.—*Kraussina lamarckiana* is distinguishable from *Kraussina pisum*, Lam., by its much smaller dimensions and comparatively stronger ribs. A very closely allied species, or variety of *Kraussina lamarckiana,* to which M. Vélain has given the name of *davidsoni* in his valuable Malacologie de l'Ile de St Paul, occurs in vast abundance on the shore in the interior crater of the Island of St Paul. M. Vélain informs me that after having examined many hundred specimens, and compared them with the Australian *Kraussina lamarckiana,* he had determined to raise the St Paul shell to the rank of a new species. That during the ordinary low tides they are scarcely covered by water, and are alternately covered and left bare at the ebb and flow of the tide. They occur in an area of a few yards' width, and, consequently, at very shallow depth, doubtless because they find there those conditions to which they are accustomed in other localities. M. Vélain informs me that during his lengthened stay at the Island of St Paul, no other species of Brachiopod was dredged, that the shell referred to by Mr Dall as *Kraussina picta,* Val., Verh. Zool. Bot. Ges. Wien., p. 894, 1865, as from the Island of St Paul has been nowhere described, and thus that name must be attributed to an incorrect citation.

Kraussina pisum, Val. *apud* Lam., sp. (Pl. IV. figs. 7, 8).

Terebratula pisum, Val. apud Lam., Anim. sans Vert., vol. vi. p. 330, 1819.
Terebratula natalensis, Kuster, 1843, and Krauss, Die sudafricanschen Mollusken, pl. ii. fig. 11, 1848.
Kraussia pisum, Dav., Ann. and Mag. Nat. Hist., vol. ix. p. 370, 1852, and Reeve, Mon. of *Terebratula,* Conch. Icon., pl. ix. fig. 26.
Kraussina pisum, Dall, Am. Journ. of Conch., vol. vi., part 2, p. 140, 1870.

Shell suborbicular, or oval, often rather wider than long, yellowish-white; dorsal valve very slightly convex with a groove-like central, longitudinal depression extending from the umbo to the front. Hinge-line nearly straight, and rather more than half as long as the breadth of the shell. Ventral valve deeper than the dorsal one, longitudinally keeled. Beak slightly incurved, with a rather large incomplete foramen and two small lateral deltidial plates; beak ridges sharply defined, leaving a flattened area between them and the hinge-line. Surface of valves covered with numerous small radiating ribs, which increase in number at variable distances from the beaks from the bifurcation of many of the ribs and the interpolation of shorter ones. Some of the ribs are likewise shorter than others. The valves are also crossed at variable intervals by fine concentric lines of growth. In the interior of dorsal valve a forked process for the support of the brachial appendages rises nearly centrically from the septum, its upper extremities being branched. The brachial appendages are small and do not occupy a space larger than about half the length of the valve, central spiral lobe very small. Length of a large example 15, width 17, depth 6 mm.

Habitat.—A small number of very fine examples of this species were dredged by the Challenger Expedition, off the Cape of Good Hope, associated with *Terebratula vitrea*, var. *minor*, and *Terebratulina caput-serpentis*, var. *septentrionalis*, at Station 142, lat. 35° 4′ S., long. 18° 37′ E., on December 18, 1873. Depth, 150 fathoms. Bottom temperature, 8°·3 C. Sea bottom, sand. It has also been dredged near Natal.

Observations.—This is a well-known South African species. The so-called *Kraussina cognata* of Chemnitz, will, I believe, very probably turn out to be a large malformed example of the shell under description. My opinion is shared by Mr Dall. *Kraussina deshayesi* is, as was justly remarked both by Reeve and Dall, closely allied to *Kraussina pisum*, but it is a more triangular form, and painted with deep crimson rays. It may, however, be the same as *Kraussina capensis* of Adams and Reeve. I have observed the row of spine-like projections round the inner margin *Kraussina cognata*, a character apparently common to several, if not all, the species of the genus. I have noticed them in *Kraussina rubra* of Pallas, and also in *Kraussina lamarckiana*. *Kraussina lamarckiana* is a much smaller species than *Kraussina pisum*, and its ribs are comparatively coarser. Krauss gave a good description and illustration of the forked process in 1848.

Platydia, Costa.

Platydia anomioides, Scacchi, sp. (Pl. IV. figs. 10, 11).

Terebratula appressa, Forbes, British Association Report, p. 193, 1843. Rep. Moll. Ægean Sea, p. 141, 1844.
Orthis anomioides, Scacchi, Philippi, Fauna Molluscorum Regni Utriusque Siciliæ, tab. xvii., fig. 9, 1844.
Platydia anomioides, Costa, Fauna del regno di Napoli, p. 48, pl. iii. *bis*, fig. 6, 1843.
Morrisia anomioides, Dav., Ann. and Mag. of Nat. Hist., p. 371, 1852, and S. P. Woodward, Manual, p. 218, fig. 119, 1856. Reeve, Mon. of *Terebratula*, Conch. Icon., pl. x. fig. 40, 1861.
Platydia anomioides, Dall., Cat. Recent Brach., Proc. Phil. Acad. Nat. Sciences, p. 192, 1873.

Shell small, transversely oval or nearly circular, semitransparent, yellowish-white, conspicuously perforated by minute canals, foramen large, encroaching equally on both valves. Dorsal valve nearly flat, and mesially depressed; umbo notched by a semicircular foramen. Ventral valve convex, of moderate depth, hinge-line straight, area small. Beak very slightly incurved, foramen situated under its angular extremity, margined by narrow deltidial plates. Surface smooth, marked with concentric lines of growth. In the interior of the dorsal valve the loop is small, and not reflected; but the converging principal branches are first attached to hinge, and again to the upper extremity of a small vertical medium septum. Peduncle very short; animal possessed of sigmoid labial appendages. Length 4, breadth 5, depth 2 mm.

Habitat.—Two examples were dredged by the Challenger Expedition, attached to two examples of *Waldheimia kerguelenensis*, off Marion Island, on December 26, 1873, in 100 fathoms. Five likewise off Prince Edward's Island, close to Marion Island, on December 26, 1873. It was also dredged in the Mediterranean by Professor E. Forbes at a depth of 91 fathoms, and by Mr W. S. Kent off the Portugal coast, near the mouth of the Tagus.

Platydia anomioides occurs fossil in the Pliocene deposits of Sicily.

Observations.—The animal of this interesting and well-marked genus has not yet been sufficiently anatomically studied. The arrangements of the labial appendages are very remarkable. They were briefly described and figured by Signor Costa in 1843, and by myself in 1852, but more particularly in 1864 by Mr E. Deslongchamps, in his valuable memoir, Recherches sur l'Organisation du Manteau chez les Brachiopodes articulés. His observations were, however, like my own, unfortunately founded on dried specimens. He states that the brachial appendages are much more simple than in other genera of the Brachiopoda, and that the two principal branches which lie close to each other at their origin, and towards the centre of the shell, deviate by a curve, and having made almost a complete circle, return close to their origin, without forming a spiral. But his most important observations relate to the mantle which he states to be so thickly coated with spiculæ that it is impossible to separate it from the brachial appendages without injuring them; that they are small, but exceedingly numerous, and get so blended together that it becomes at last very difficult to define their shape; that they appear to be a white spongeous mass formed of an innumerable number of short lamellæ crossing each other in every direction. In his paper Sur les Brachiopodes des Côtes Oceaniques de la France (Journal de Conchyliologie, 3d series, vol. xii. p. 160, pl. vi. figs. 3–9, 1872), Mr P. Fischer describes at great length *Platydia anomioides* and the characters that distinguish it from *Platydia davidsoni.* He gives an enlarged sketch of the brachial appendages which he likewise states to be extremely simple. "De chaque coté de la bouche part une portion horizontale qui se coude ensuite et forme une première anse ou boucle buccale. Elle est continuée de chaque coté par la portion currante dirigée du crochet de la valve vers le bord frontal et en rapport avec la valve inferieure ou dorsale: cette portion currante se soude, décrit un circle complet et revient au-dessus de la portion currente en étant en rapport avec la valve dorsale: elle se termine enfin par une sinuosité dirigée vers la bouche. C'est là le rudiment de la portion spirale, qui est assez developée chez les *Megerlia*, et beaucoup plus chez les Terebratules. L'appareil branchial resemble donc à celui du *Platydia anomioides* mais la bouche boucle est moins large par rapport aux boucles laterales, les cirrhes des bras sont assez longs et disposes par paires ou plutot chaque cirrhe semble se divise, en deux filaments ègaux. Ce caractière a été representé chez la *Platydia anomioides* par M. Davidson."

After a lengthened examination of two specimens of this shell which I found adhering to two examples of *Waldheimia kerguelenensis* dredged off Marion Island, neither Dr Gwyn Jeffreys nor myself were able to detect any characters to distinguish them from the well-known Mediterranean *Platydia anomioides*. Other smaller examples, dredged by the Challenger Expedition off Prince Edward's Island, agreed exactly in shape and size with some specimens dredged by Edward Forbes in the Ægean Sea. I have also a specimen dredged by Mr W. S. Kent off the coast of Portugal near the Tagus, which appears to be identical in shape with the two examples from the Marion Islands.

The true *Terebratella appressa* of Forbes, or *Platydia anomioides* of Scacchi, from the Ægean Sea, is generally more circular or orbicular; but among the specimens dredged by my distinguished friend Edward Forbes, and given to me after his return from the Mediterranean, are two or three examples that are transversely oval, and which closely resemble larger specimens dredged by the Challenger Expedition. Owing to the extreme shortness of the peduncle, the ventral valve is kept so close to the object to which it is attached, that the asperities or irregularities of the rock or shell to which it is attached are often reproduced upon it. This peculiarity is especially observable on the smaller valve of *Platydia davidsoni*.

As the name *anomioides* is now in general use, I do not feel inclined to disturb it, although that of *appressa*, Forbes, seems to hold priority. The two species of *Platydia* at present known are of small dimensions, none exceeding 7 mm. in length by 10 mm. in breadth. The so-termed *Morrisia gigantea*, Deshayes, from off the Island of Bourbon, is an example of *Megerlia truncata*.

Argiope, E. Deslongchamps.

Argiope decollata, Gmel., sp. (Pl. IV. figs. 12, 13).

Anomia decollata, Chemnitz, Conch. Cab., vol. viii. p. 96, pl. lxxviii. fig. 705, and of the generality of modern authors.
Anomia detruncata, Gmelin, Syst. Nat.
Terebratula ungula, Retz., n. gen., Tert.
Terebratula aperta, Blainville, Dic. Sci. Nat.
Terebratula dimidiata, Scacchi = *Terebratula candida*, Risso = *Terebratula urna-antiqua*, Risso.
Megantheris decollata, D'Orb., and of Dall.

Shell small, generally wider than long, semi-oval or obscurely subpentagonal; hinge-line about as long as the greatest breadth of the shell. Dorsal valve semicircular, gently convex, with acute cardinal extremities, and either gently rounded or nearly straight in front. Ventral valve rather deeper than the opposite one. Beak prominent, nearly straight, with a wide triangular area; foramen large, incomplete, margined laterally by narrow deltidial plates. Surface in each valve ornamented with about twelve rounded corresponding ribs, the two central ones generally deviating so as to admit a short, smaller one between them. Three or five sub-marginal septa, the three central ones being, at the same time, the largest and most prominent. The loop is composed of a single ribband-shaped lamella, which is first attached to the hinge-plate, and afterwards forms a semicircular curve, lying close to the bottom of the shell in the spaces intervening between the septa, to which it likewise adheres. Brachial appendages folded into two or four lobes, united by a membrane, forming a brachial disk, fringed with long cirri, mantle extending to the margins of the valves, closely adherent. Shell structure perforated by numerous canals. Length 5, width 0, depth 3 mm.

Habitat.—Argiope decollata was dredged alive in great abundance by the Challenger Expedition, at Gomera, off Teneriffe, adhering to *Megerlia truncata*, on February 10, 1873, in 70 or 75 fathoms.

Mr MacAndrew states that he obtained it off the Island of Madeira in 20 fathoms (Geog. Dist. of Tert. Mollusca, p. 39, 1854). Professor E. Forbes dredged it in 1841 in the Ægean Sea, in a range of from 27 to 110 fathoms (Report on the Mollusca and Radiata of the Ægean Sea, p. 141, 1844). Costa observes that it generally accompanies *Terebratulina caput-serpentis* in the Mediterranean, and occurs plentifully near the Islands of Capri, Ischia, Palmieri, and in the Gulf of Taranto. Jeffreys states that it is found at depths varying from 20 to 60 fathoms. Mr Fischer mentions, in the supplement to his paper on the Brachiopodes des Côtes Oceaniques de la France (Journal de Conchyliologie, 1871), that he dredged it off Cape Breton, in upwards of 45 fathoms. Dr Jeffreys quotes it from two miles east of Guernsey, in 18 fathoms It has also been found in the Atlantic, coast of Spain, in 80 fathoms.

It abounds in the Pliocene deposits of Sicily, at Nice, and elsewhere, also in rocks of the Miocene group.

Observations.—Dr S. P. Woodward and myself were able to give the first description and illustration of the manner in which the loop and brachial appendages are arranged in this important genus and species (Annals and Mag. Nat. Hist., vol. iv., May 1852). Since then, Dr Gray has proposed to separate from the genus *Argiope* all those forms with a single sub-marginal septum, uniting them in the sub-genus *Cistella*. This view has since been adopted by the larger number of malacologists, but by so doing the genus *Argiope* would, up to the present time, be represented by the single species under description. Externally *Cistella barettiana*, Dav. = *Argiope antillarum*, Crosse, so completely resembles *Argiope decollata* that it would hardly be possible to distinguish it. In *Cistella neapolitana*, *Cistella cuneata*, *Cistella woodwardiana*, *Cistella schrammi*, and

Cistella cistellula there is but one septum, while in *Argiope decollata* there are from three to five.

Rhynchonella, Fisher.

Rhynchonella nigricans, var. *pixydata*, R. B. Watson[1] (Pl. IV. fig. 14).

Terebratula nigricans, Sow., Proc. Zool. Soc., p. 91, 1846, and Thesaurus Conchyl., p. 342, pl lxxi. figs. 81, 82.
Rhynchonella nigricans, Dav., Proc. Zool. Soc., pl. xiv. figs. 30, 31, 1852.
Hemithyris nigricans, Dall, Catalogue of the Recent Species of the Class Brachiopoda, Proc. Phil. Acad. Nat. Sciences, p. 196, 1873.

Var. *pixydata*.—Shell transversely oval, widest anteriorly, tapering posteriorly, wider than long. Dorsal valve uniformly convex to about half its length, when a broad mesial fold, scarcely raised above the general convexity of the valve, occupies the anterior middle of the valve. Ventral valve rather less deep and convex than the opposite one, with a broad, well-defined mesial sinus, commencing at a short distance from the extremity of the beak, and extending to the front. Beak rather small, acute, and incurved; foramen incomplete, situated under its pointed extremity, laterally margined by narrow deltidial plates; surface of both valves ornamented by about forty to forty-six small, angular radiating ribs, closely intersected by equidistant squamose concentric ridges of growth, giving an imbricated appearance to the surface. Colour yellowish-white, sometimes brownish at the beaks. Length 18, width 20, depth 30 mm.

Habitat.—Six examples were dredged by the Challenger Expedition, south of Kerguelen Island, on February 2, 1874, associated with numerous specimens of *Waldheimia kerguelensis*, at Station 150, lat. 50° 4′ S., long. 71° 22′ E. Depth, 150 fathoms. Bottom temperature, 1°·8 C. Sea bottom, rock.

The typical form of the species has been often dredged in about 19 fathoms at Foveaux Straits, five miles off Ruapuke Island, New Zealand. Sea bottom, coral and rock.

Observations.—Nearly all the specimens from Foveaux Straits, New Zealand, were of a blue, black, or brownish colour, while the six examples dredged by the Challenger Expedition from near Kerguelen Island, were of a light, yellowish-white colour. One, however, showed at the beaks the brown tint of the New Zealand type. The New Zealand shell is also generally more transverse, and comparatively less convex than is the variety from near Kerguelen. The ribs in the latter are likewise more numerous, and smaller. These differences, no doubt, led the Rev. R. Boog Watson to distinguish it as a distinct species under the MS. name of *pixydata*, from πυξ, as he thought it like a box

[1] By mistake in my Extract of Report on the Brachiopoda dredged by H.M.S. Challenger, read before the Royal Society on May 8, 1878, this variety was referred to Willemöes-Suhm, but Mr Watson subsequently informed me that it was an MS. name of his own.

in form. After careful study and comparison with an extensive series of the New Zealand types, I am led to the conclusion that *Rhynchonella pixydata* is merely a local variety of *Rhynchonella nigricans*, in the same way as *Terebratula septentrionalis* is by the generality of malacologists regarded as a local variety of *Terebratulina caput-serpentis*. *Rhynchonella nigricans* and its variety *pixydata* bear a close resemblance to more than one Jurassic, Cretaceous, and Tertiary species of the genus, and a *Rhynchonella* recently found by the Rev. J. E. Tenison Woods in the Tertiary rocks of Table Cape, Tasmania, seems absolutely undistinguishable. It has received the MS. name *Rhynchonella cœlata* from Professor M'Coy, and described under that name by the Rev. Tenison Woods in his paper On the Tertiary Deposits of Australia, and published in the Proceedings of the Royal Society of New South Wales in 1877.

Lingula, Bruguière.

Lingula anatina, Lamarck (Pl. IV. figs. 15, 16).

Rostrum anatis, Petiver; *Patella unguis*, Linnæus; *Mytilus lingua*, Dillwyn.
Lingula anatina, Cuvier, Memoirs du Museum, vol. i. p. 69, pl. vi., 1802.
Lingula anatina, Val. apud Lamarck, Anim. sans Vert., vol. vi. p. 258, 1819.
Lingula chemnitzi, Kust., vol. vii. pl. i. figs. 7–9, teste Hanley.
Lingula anatina, C. Vogt, Anatomie der *Lingula anatina*, 1845.
Lingula anatina, De Blainville, Manuel, tom. li. fig. 3.
Lingula anatina, Dav., Ann. and Mag. Nat. Hist., vol. ix. p. 377, 1852.
Lingula anatina, G. B. Sowerby, Thes. Conch., vol. i. p. 337, figs. 1, 2, 9, 10, 1846.
Lingula anatina, Reeve, Conch. Icon., pl. ii.
Lingula anatina, Dall, Am. Journ. of Conch., vol. vi. p. 155, 1870, and Proc. Phil. Acad. Nat. Sciences, p. 203, 1873.

Shell oblong, elongated, sides nearly straight and parallel; valves very slightly convex, and nearly straight in front, attenuated at the posterior extremities. Surface smooth, colour bright green. Peduncle longer than the length of the shell, passing out between the valves through a narrow channel in the hinge margin. Valves about equal and moderately convex, slightly gaping at the beaks, most convex along the middle, somewhat flattened laterally. Dorsal valve a little shorter at the beaks than the ventral one; texture horny and calcareous, no calcified support for the labial appendages, the fleshy spiral coils directed upwards. Length, irrespective of the peduncle, 38, width 17, depth 6 mm.

Habitat.—The late Dr Willemöes-Suhm, of the Challenger Expedition, in one of his letters published in Siebold and Kölliker's Zeitschrift, 1876, mentions finding on the beach at Zamboangan, Philippines, a *Lingula* (*L. anatina*) in hundreds, and that he gave a dollar for a hundred. Three large bottles full were forwarded to me for examination, collected by the Challenger Expedition, in sand at low water at the same place, on October 23, 1871, and February 1, 1875. These specimens, from 10 to 40 mm. in length, were of most brilliant emerald green. Mr L. Reeve states in his monograph of *Lingula*—"Mr Cuming happened to be at Manilla in 1836 after an unusually boisterous typhoon, when as many as twenty bushels of this species were collected on the shore of the bay." It occurs, no doubt, in other places. In the British Museum there are specimens from Timor (Stoke's Coll.), and from the Fiji Islands (Hind's Coll.).

Observations.—This is the only species of the genus brought home by the Challenger Expedition. It is also one of the oldest and best known. Cuvier, who was the first (as far as I am aware) who described the animal in 1797 and 1802, observes: "Comme elles n'ont point de dents à leur charnière, on ne pouvait deviner, en les voyant isolées, qu'elles étoient bivalves; et Linnæus qui n'en avoit vu qu'une, l'avoit placée parmi les patelles, sous le nom d'*unguis*, sous lequel elle paroît encore, quoiqu' avec doute, dans l'édition de Gmèlin. Rumphe, et d'après lui Favanne avoient pensé que ce pouvoit être le bouclier testacé de quelque limace. Chemnitz ayant eu occasion d'en voir les deux valves, jugea, je ne sais trop pourquoi, qu'elle devoit passer dans le genre des jambonneaux, et la nomina *Pinna unguis.* Bruguière est le premier auteur systématique qui ait su que ces deux valves sont naturellement attachées à un pédicule membraneux, comme celle des *térébratules* et des *anatifes*, et qui en ait fait en conséquence, dans les planches de l'Encyclopédie, un genre particulier dont il ne donne point de description, parce que son ouvrage et sa mort l'empêchèrent de conduire jusqu'a la son dictionnaire d'Helminthologie. Mais le citoyen Lamarck a adopté et caractérisé ce genre."

The animal of *Lingula anatina* has been anatomically studied with great minuteness by several of our best contemporary zoologists. Professor R. Owen described it in 1833, in the Philosophical Transactions of the Zoological Society; and again in his chapter on the anatomy of *Terebratula*, in the Introduction to my work on British Fossil Brachiopoda. In 1845 the same subject was well treated by Dr C. Vogt, in his memoir, Anatomie der *Lingula anatina.* In 1856 it was studied by Dr S. P. Woodward in his excellent Manual of the Mollusca, in 1858 the anatomy of *Lingula anatina* was admirably treated by Albany Hancock, in his memorable memoir On the Organisation of the Brachiopoda, published in the Philosophical Transactions of the Royal Society. Then followed, in 1860, Dr Gratiolet's remarkable memoir, Études anatomiques sur la *Lingule anatina*, printed in the Journal de Conchyliologie. We have likewise Professor Semper's important observations On the Animal of *Lingula anatina*, in the Zeitschrift für wissenschaftliche Zoologie, vol. ii. p. 100, 1859, and in the *Reisebericht* in the Zeitschrift für wissenschaftliche Zoologie, vol. xiv. p. 424, 1864; and lastly, Professor King's instructive memoir, on some characteristics of *Lingula anatina*, in the 4th ser., vol. xii., 1873, of the Annals and Mag. of Nat. Hist. To all these works the reader is referred.

When young, and up to a certain age, *Lingula anatina* is very oval, and rounded at its anterior margin; the beaks tapering more than in the adult condition. Some specimens also attained somewhat larger proportions that those above recorded, but none of the numerous examples brought back by the Challenger Expedition exceeded the dimensions already given. The manner in which the *Lingulæ* slide their valves upon one another has been admirably described by Professors Semper, E. Morse, and W. King.

Some of the Philippine specimens of *Lingula anatina* approach very nearly in shape, and vivid verdigris-green brilliancy of colour to *Lingula ovalis*, of Reeve, from Honolulu, one of the Sandwich islands. I may, however, mention that the name *ovalis* cannot be made use of for the recent species, as it had been given many years previously to a fossil one. I, therefore, propose to substitute the specific designation of *Lingula reevii* for the recent species.

Discina, Lamarck.

Discina atlantica, King (Pl. IV. figs. 17, 18).

Discina atlantica, King, Proc. Nat. Hist. Soc. of Dublin, vol. v. p. 170–173, 1868; Dav., Brit. Foss. Brach., vol. iv. sup., p. 2, pl. i. fig. 11, 1874.
Discinisca (?) *atlantica*, Dall, Cat. Recent Brach., Proc. Phil. Acad. Nat. Sciences, p. 177, July 1873.
Discina atlantica, J. Gwyn Jeffreys, Annals and Mag. of Nat. Hist., p. 252, 1876, and Proc. Zool. Soc., 1878, "Porcupine" Expedition, 1869. Station 19*a*, 1366 fathoms.

Shell very small, slightly longitudinally oval, broadest anteriorly, sometimes marginally almost circular. Shell very thin, semitransparent, corneous, light yellowish-brown, marked with numerous concentric lines, or ridges of growth. Dorsal or upper valve conical; vertex almost central, or situated at about one-third of the length of the valve from the posterior margin; ventral valve flat, exceedingly thin. Length 3, breadth $2\frac{3}{4}$ mm.

Habitat.—This species was not known previous to 1862. Since then it has been dredged in no less than eight separate and widely-spread localities. It appears to be a very abundant shell, but occurs only at very great depths. It was obtained at seven or eight different localities by the Challenger Expedition :—

Station 106 (Pl. IV., fig. 17, *a,b,c*), August 25, 1873, lat. 1° 47′ N., long. 24° 26′ W. Bottom temperature, 1°·8 C. Sea bottom, globigerina ooze. Three examples attached to *Limopsis aurita*, Brocchi, associated with one example of *Megerlia* (?) *incerta*, Dav. Depth, 1850 fathoms. This station is situated between the Cape Verde Islands or Sierra Leone (Africa), and Fernando de Noronha (South America).

Station 194, September 29, 1874, lat. 4° 33′ S., long. 120° 58′ E. Depth from 200 fathoms to 360 fathoms. Sea bottom, volcanic detritus.

Station 237 (Pl. IV. fig. 18), June 17, 1875, lat. 34° 37′ N., long. 140° 32′ E. Depth, 1875 fathoms. Bottom temperature, 1°·7 C. Sea bottom, mud. Some examples of the upper valve were got in washing the dredge, along with one specimen of *Terebratula dalli*.

Station 246, July 2, 1875, lat. 36° 10′ N., long. 178° 0′ E. Depth, 2050 fathoms.

Bottom temperature, 1°·3 C. Globigerina ooze, and where it is often found attached to rolled fragments of pumice stone.

Station 271, September 6, 1875, lat. 0° 33′ S., long. 151° 34′ W. Depth, 2425 fathoms; attached to a specimen of Arca. Bottom temperature, 1°·0 C. Sea bottom, globigerina ooze.

Station 300, December 17, 1875, lat. 33° 31′ S., long. 74° 43′ W. Depth, 2160 fathoms. Bottom temperature, 1°·5 C. Sea bottom, globigerina ooze, along with *Waldheimia wyvillii.*

Professor King, to whom we are indebted for the first description and illustration of this interesting species, informs us that it was first dredged in 1862 by staff-commander Richard Hoskyn, R.N., then in command of the "Porcupine," for purposes in connection with the then proposed telegraphic connection between Ireland and Newfoundland. The specimen was not quite perfect, and came up in the sounding machine, from a depth of 1240 fathoms, in lat. 52° 8′ W., long. 15° 30′, or nearly due west of Dingwall Bay.

The second specimen was dredged by Dr Gwyn Jeffreys, in nearly the same place, at a depth of 1366 fathoms. "Porcupine" Expedition, 1866. It was also dredged by Sir James Anderson, in the North Atlantic, when fishing up the telegraphic cable in 2400 fathoms depth; and by Dr J. Gwyn Jeffreys during the cruise of the "Valorous" in 1875, in Baffin's Bay, at depths of 1450 and 690 fathoms.

Dr Nicholson observes that abyssal, or deep-sea forms, are usually widely diffused, their range depending chiefly on temperature, and being influenced chiefly by oceanic currents.

Observations.—I have seen all the upper valves of this small species hitherto collected, but only one specimen of the smaller valve. Dr Gwyn Jeffreys, in his paper On North Atlantic Brachiopoda, published in the Annals and Mag. of Nat. Hist. for September 1876, says that the "arms are furnished with long and slender setæ or stiff hair-like cilia, which project beyond the edges of the shell on every side to an extent equalling its diameter." He meant the margin of mantles, not arms. The brachial appendages are, as stated by Dr S. P. Woodward and myself, curved backwards, returning upon themselves, and ending in small spires directed downwards towards the ventral valve. Professor R. Owen, who in 1833 [1] described with much care the anatomy of the genus *Discina*, says—"The labial processes, or brachia, are scarcely more adapted to protrude externally than in *Terebratula chilensis,* the only parts that are free being the short spiral extremities. . . . The brachial filaments, when viewed through the lens, presented an equal cylindrical figure, and an entire surface" (p. 155). He also minutely describes and illustrates the two lobes of the mantle, and states that "the branchial vessels may be seen in rich profusion on their inner surface," and in a highly magnified view of a small portion of the edge of the mantle he shows the "terminal divisions of the branchial vessels, and their

[1] On the Anatomy of the Brachiopoda of Cuvier, and more especially on the Genera *Terebratula* and *Orbicula*, Trans. Zool. Soc., vol. i. p. 145, pl. xxii. figs. 2–13.

setose cilia." At my request, Dr Halifax of Brighton made for me a series of preparations of the mantle of both *Discina lævis* and *Discina atlantica.* These last, from specimens brought home by the Challenger Expedition, showed in the most admirable manner the highly vascular mantle, fringed with long horny setæ entirely agreeing with the description and illustrations of Professor Owen and Dr S. P. Woodward. The cirri are of great length, and barbed throughout, with spine-like asperities, in some cases they bifurcate near their extremities, and lie close together at their origin. In some specimens of *Discina lævis*, great numbers of full-grown *Pedicellinæ*, belonging to the Polyzoa, adhered to the long barbed cirri (Pl. IV., fig. 17, *b*), looking like Lingulæ, with their long pliant peduncles. The smaller valve of *Discina atlantica* was described by Dr Gwyn Jeffreys, from a North Atlantic specimen, obtained during the "Valorous" Expedition—"Flat, thin, having near the middle a comparatively small round disk, within which is an oval slit for the passage of the byssal stalk (peduncle) of attachment. This disk is slightly sunk within a calcareous substance to which it is attached, as if the byssus had the power of excavation; the rest of the lower valve is free and concentrically striated, like the upper valve. Muscular (adductor) scars in the upper valve, club-shaped, rather close together, no scars observable in the lower valve, not the slightest trace of tubular or perforated structure could be detected in either valve, with one of Smith's and Beck's best microscopes, under a lens of one-fifth power." I am not certain that this species has been hitherto positively found in the fossil state, but Dr Gwyn Jeffreys thinks that the *Discina fallax*, S. Wood, from the crag of England, may, perhaps, be referable to the species under description.

Discina stella, Gould (Pl. IV. fig. 19, *a*).

Discina stella, Gould, Mem. Boston Soc. Nat. Hist., vol. vii. p. 323; Otia Conch., p. 120, 1860.
Orbicula stella, Reeve, Conch. Icon., pl. i. fig. 1, 1862.
Discina stella, Dall., Am. Journ. of Conch., vol. vii. part 2, p. 76, 1871.

Shell orbicular, about as broad as long; upper valve conical, and moderately elevated, vertex sub-central, surface marked by numerous radiating striæ, vertex almost smooth, yellow. Attached valve almost flat. Length 6, breadth 6, depth 3 mm.

Habitat.—Five upper valves of this species were dredged by the Challenger Expedition, off Bermuda, at Station 190, lat. 8° 56′ S., long. 136° 5′ N., on September 12, 1874, in 49 fathoms. Bottom temperature, 23·°9 C. Sea bottom, mud. It has also been found by Mr Cuming, near Singapore, and the Philippine Islands. Stimpsom and Wilkes quote it from the China Seas.

Observations.—In his Conch. Icon., Reeve states that "this species has a wide distribution in eastern seas. On comparing authentic specimens received from Dr Gould, of which is given at fig. 1, *b*, collected in the China Sea, by Wilkes' exploring expedition, I find them identical with specimens collected by Mr Cuming, attached to fragments of

Pullastra, Pinna, and *Malleus,* at Singapore, and at the Philippine Islands." Dr Gould states, the "sculpture varies in strength; on young specimens the radiating striæ are scarcely developed, in older specimens, and especially those that have had to contend with irregularities in their place of attachment, the sculpture has a minutely-latticed character, like the grains of a thimble, or thicker, concave or convex, according to circumstances of habitation; and the position of the slit obviously varies with the position of the vertex in the opposite valve. On a flat place of attachment the sub-incumbent slit is nearly central, but when attached to a sloping or declivitous substance the vertex is pressed to one side, and the slit of the under valve follows the same direction."

APPENDIX.

After my Report had been written and handed to Sir Wyville Thomson, the Rev. R. Boog Watson found among the Mollusca placed under his charge a few additional specimens of Brachiopoda.

Discina atlantica, King.

Station 184. August 29, 1874. 145° 10′ E. Off Australia, with *Terebratula wyvillii.* Depth, 1400 fathoms. Bottom temperature, 1·8° C. Sp. gr. 02.

Crania, sp.

Station 33. Off Bermuda. April 4, 1873. Depth, 435 fathoms. Mud.

Among some Mollusca dredged off Bermuda, a dead incomplete valve of a small *Crania* occurs, the only specimen of this genus obtained during the Challenger Expedition. The specimen is too imperfect to warrant a specific identification. It measured 4 mm. in length and breadth.

Terebratulina caput-serpentis, or *cailleti.*

Station 344. April 3, 1876. Off Ascension Island, along with *Terebratula cubensis.* Depth, 420 fathoms. Hard ground.

Waldheimia dilatata, Lam.

In the article Mollusca, in the Report on the Transit of Venus Expedition, in the year 1874–1875, Trans. of the Royal Society of London, vol. cxlviii. (extra volume), p. 192, 1879, Mr Edgar Smith mentions this shell as having been obtained with the aid of a grapple out of a cleft in the rocks at 4 fathoms depth, at Observatory Bay, Kerguelen Island. I have seen the specimen in the British Museum, and it certainly belongs to the species so named by Lamarck, but it remains still to be determined whether it is specifically distinct from *Waldheimia venosa*, Solander. Mr E. Smith says: "Reeve questions the correctness of the habitat attributed to this species by Gray, but considering how many species of animals found at Kerguelen Island are also indigenous to the Patagonian seas, there can be little doubt that Gray was correct in this instance."

Waldheimia septigera, Lovén.

In his work Mollusca Regionis Arcticæ Norvegiæ, 1878, Dr G. O. Sars describes this shell as in all probability a true Arctic species. Professor Herman Friele, however, informs me by letter that he is unable to agree with Sars in regarding it as a true Arctic form, or its asserted occurrence in the cold area. He further states that *Waldheimia septigera* is not found, so far as he is aware, living there; some dead valves only were dredged by Sars outside the steep Banks of Aalesund in 1872. During the Norwegian North Atlantic Expedition, it was not found either in the cold area or north of Finmark; and neither he nor Sars dredged it above lat. 65°. Lovén states that he has found it in Finmark. It has never hitherto been obtained at Spitzbergen. In the Arctic seas it is replaced by *Terebratella spitzbergenensis*, Dav.

Magasella cumingi, Dav.

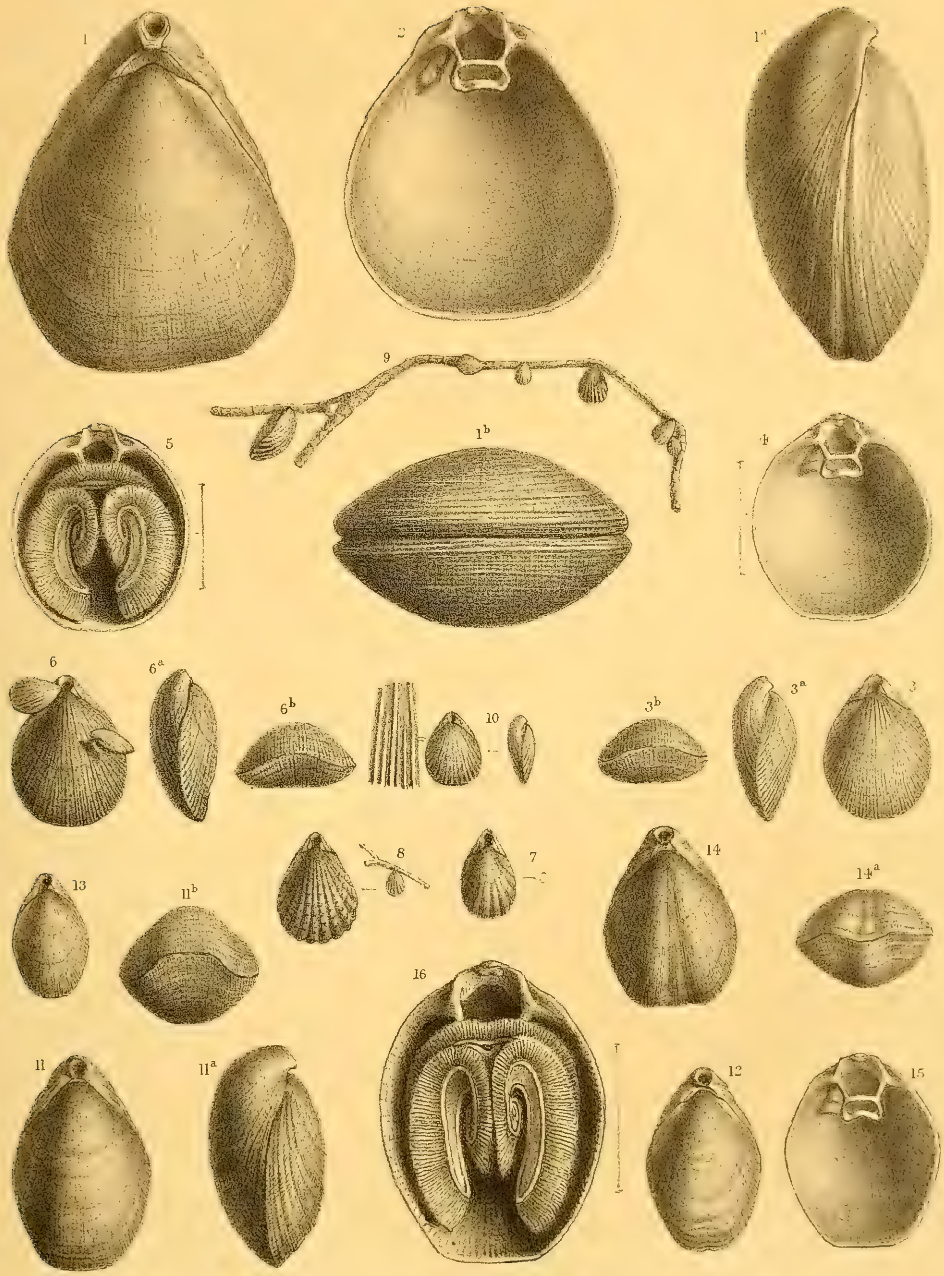
Mr John Brazier, of Sydney, Australia, informs me by letter that this species is so exceedingly abundant at Pigs Rocks, Port Jackson, that in one haul he obtained about one hundred dead specimens at a depth of 3 to 4 fathoms; bottom, sand and mud. At South Reef, Port Jackson Heads, in 10 fathoms, bottom of broken shells, stones, and coarse white sand, he obtained twelve living specimens, of which he sent me examples; they are of a light salmon colour. Although quoted by Cuming from New Zealand, Mr F. W. Hutton of the Otago Museum, Dunedin, assures me he has never seen a New Zealand specimen.

Mr Brazier has also dredged *Megerlia pulchella* off Bottle and Glass Rocks, Port Jackson, rocky bottom, 5 fathoms, attached to a large *Spondylus*. In the year 1868 he obtained a few specimens near the rocks at Camp Cove or Green Point, Port Jackson, in 7 fathoms, bottom of broken shells and sand; and in 1869 he found a specimen which was washed on shore at Cabbage Tree Bay, outside Sydney Heads, and which was well marked with red. Mr Brazier dredged *Megerlia sanguinea* at Sandal Bay on the north-west side of the island of Lifou, Loyalty Islands, in 1873, the beach being strewn with it; he also found a small specimen of this shell attached to *Pecten pallium*, Lam., at Wantoro, near Noumea, New Caledonia; also at Aneiteum, New Hebrides; and at Isle Nou, New Caledonia; and lastly, at the Sandwich Islands, whence it has been often quoted.

Mr Brazier tells me also that he has dredged in Port Jackson for the last twenty-five years, and never found a specimen of *Terebratulina* until quite lately, when he went to what he calls a new field, where one can only go when the wind is either north or north-east, with the sea smooth, so as to get close in to the rocks with a boat. The locality is Inner North Head, off Port Jackson, and the Old Man's Hat Point, 7 to 8 fathoms, rocks, stones, broken shells, and sandy mud. The first day he went, in washing out the dredgings, he obtained a specimen dead, and as black as ink, caused by being in mud. He examined it closely, and seeing that he had never found the like before in Port Jackson, continued dredging all day, and was rewarded with three more specimens in good condition. Mr Brazier believes this shell to be a dwarfed variety of *Terebratulina cancellata*, Koch.

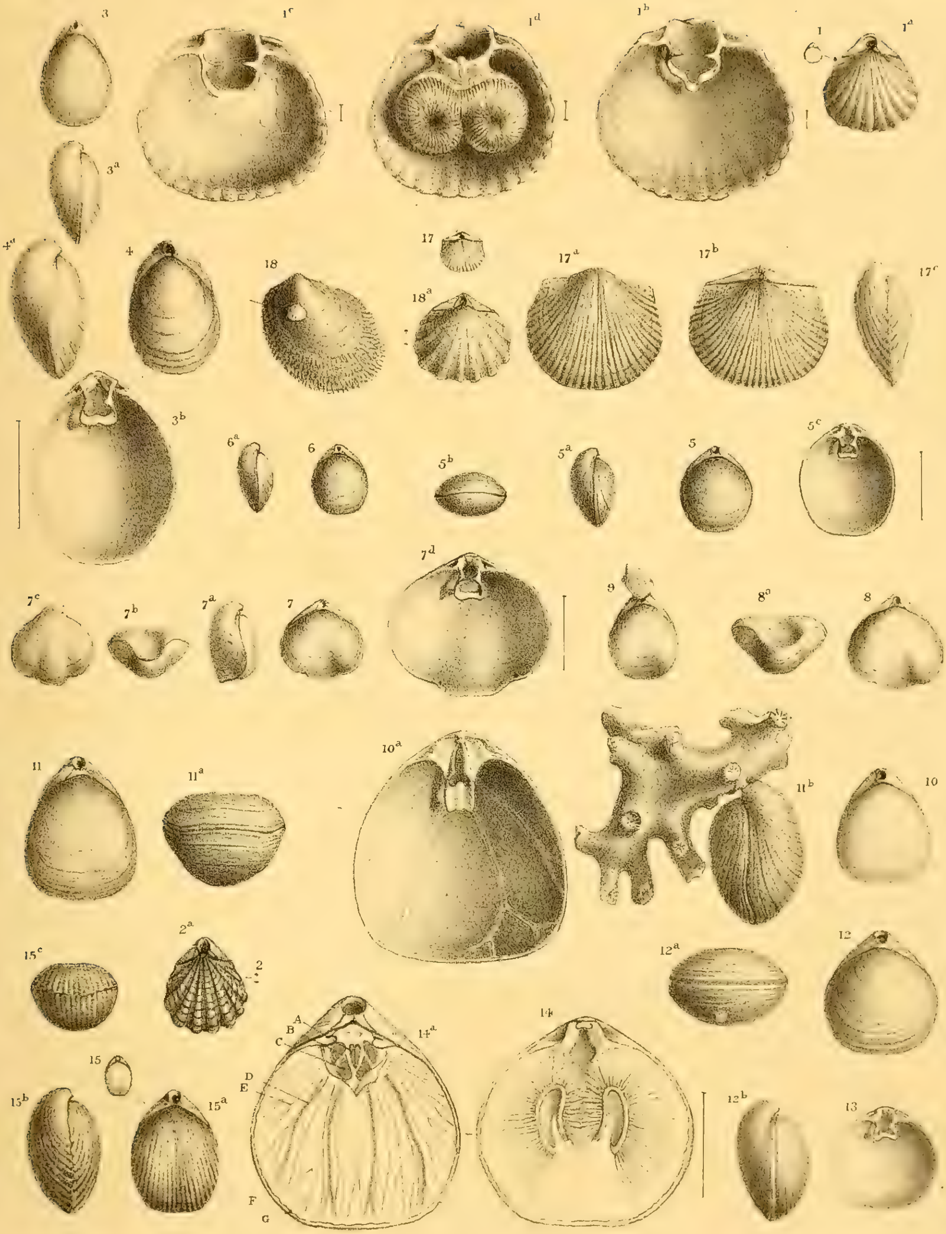
Through the kindness of Mr Dall I have been able to examine the types of Gould's *Terebratella pulvinata* and *Terebratella patagonica* from the State Museum, Washington. I much fear that the first is no more than a young smooth specimen of *Terebratella dorsata*, while the second appears to me to be a young *Magasella* (*Ter.*) *flexuosa*, King. I also arrived at the conclusion, after examination of the type specimens of *Cistella rubrotincta*, Dall, and *Cistella antillarum* and *Cistella schrammi*, Crosse, that all these three are synonyms of my *Cistella barrettiana* of which the type is in the Museum at Cambridge, and I believe that Mr Dall is disposed to take a similar view. *Cistella lutea*, Dall, cannot be well distinguished externally from *Cistella barrettiana*, but its median septum presents certain peculiarities which render it possible that it may be a distinct species.

Discina tenuis and *Discina lævis*, Sow., evidently belong to a single species, and it may also remain a question for further consideration whether the large, square, oblong examples of *Lingula* from Moreton Bay, Australia, to which L. Reeve has given the name *tumidula* (see specimens in British Museum), may not be mere variations in shape of the more elongated *Lingula murphiana* that occurs in the same locality. It appears quite evident that on further study, with the aid of more ample material, the number of so-termed species of *Lingula* and *Glottidia* will have to be reduced. Unfortunately, of several of them, we are acquainted with one or two individuals only, and upon such scanty and insufficient material it is impossible to arrive at satisfactory conclusions. This remark will apply equally well to a certain number of the species belonging to other genera; and there is every hope that these matters will, with time, be set right by the numerous dredging expeditions that are now being carried on by nearly all the maritime nations.



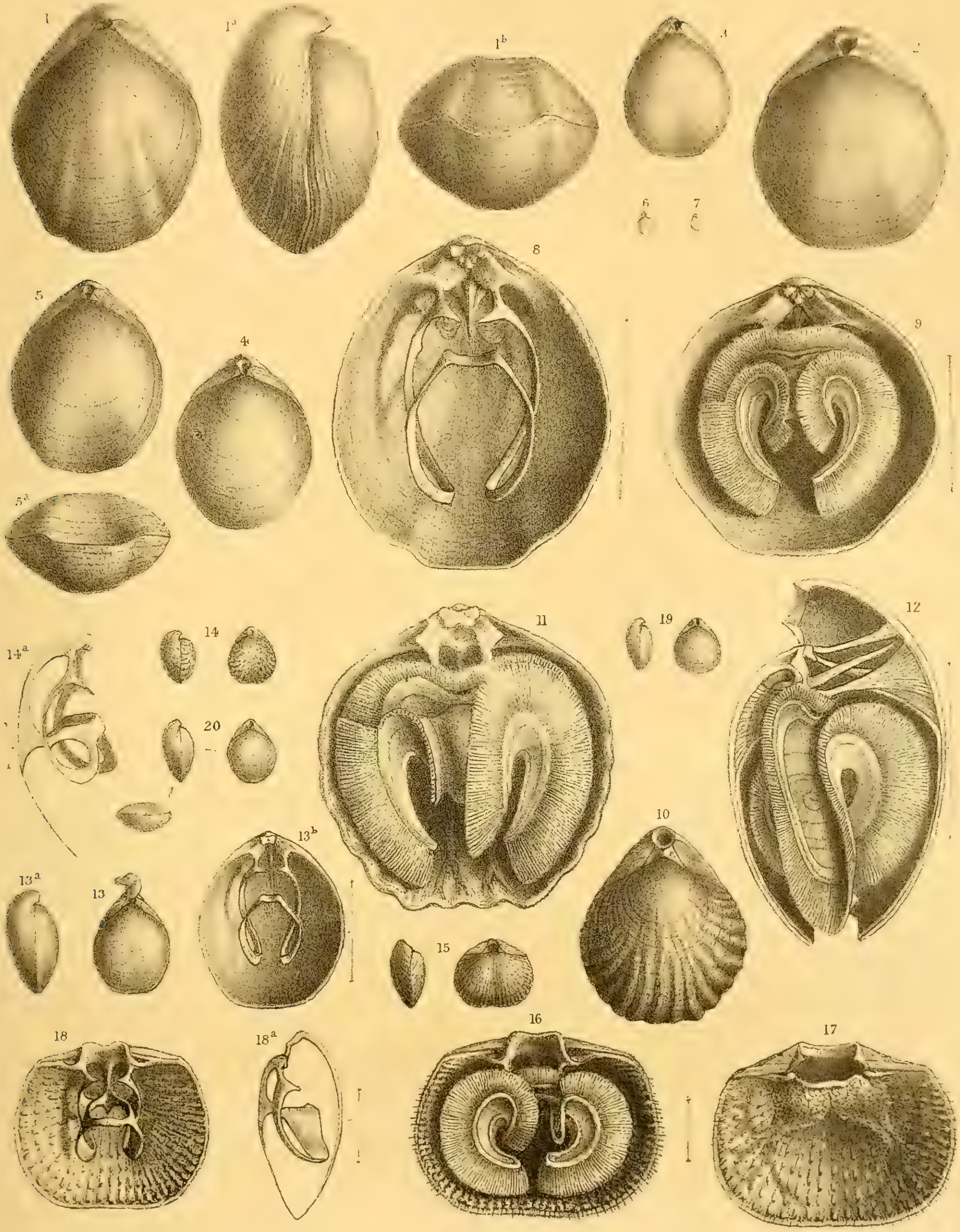
Thos Davidson del et lith.
Hanhart imp.

1, 2 TEREBRATULINA WYVILLEI. 10 TEREBRATULINA Sp.?
3–9 " CAPUT SERPENTIS *var.* SEPTENTRIONALIS. 11–16 " CANCELLATA.



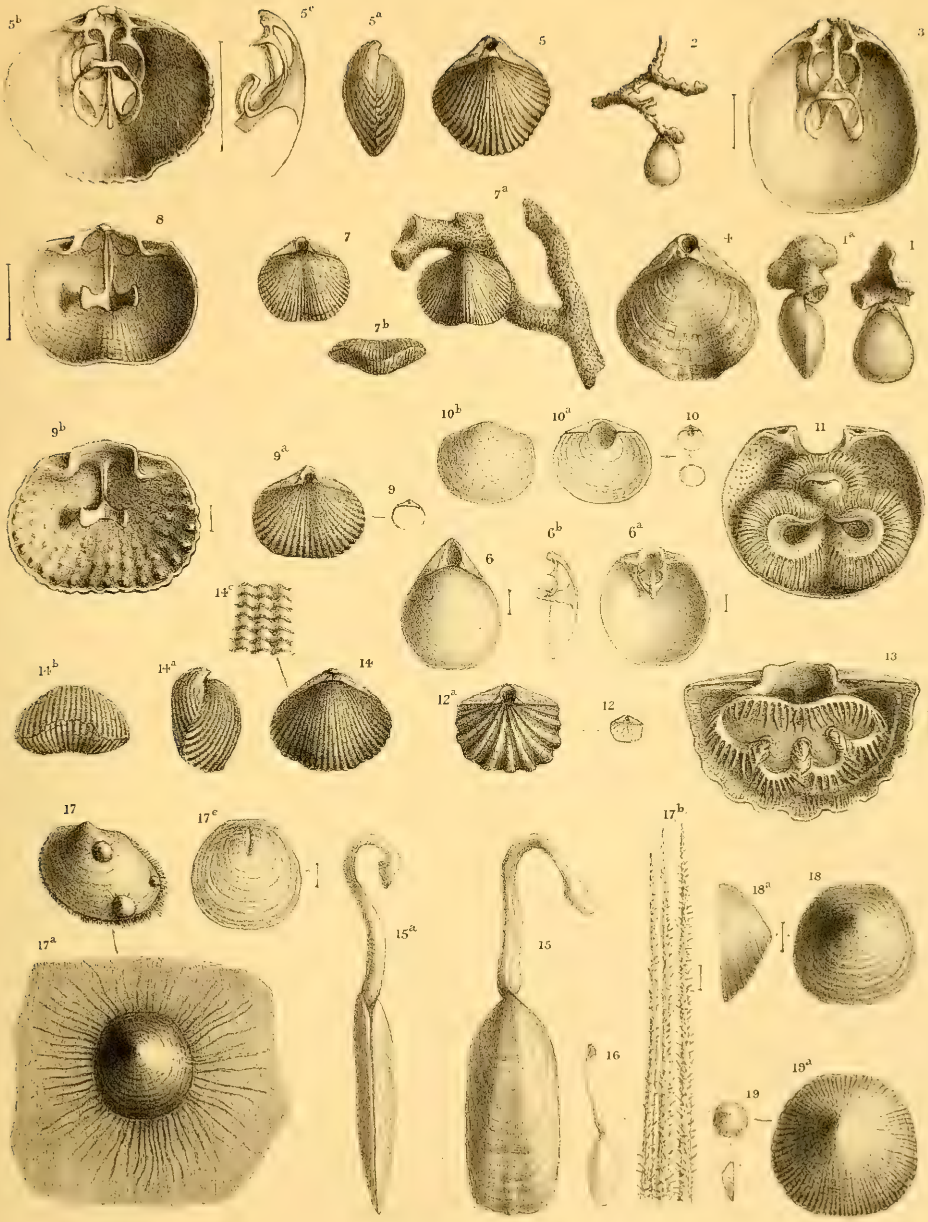
Thos Davidson del et lith. Hanhart imp.

1 TEREBRATULINA MURRAYI.
2 " CAILLETI.
3, 4 TEREBRATULA UVA.
5, 6 " MINOR.
7_9 TEREBRATULA WYVILLEI.
10, 11 " CUBENSIS
12_14 " MOSELEYI.
15 " DALLI.
17, 18 MEGERLIA INCERTA.



Thos. Davidson del et lith

1–9 WALDHEIMIA KERGUELENSIS.
10–12 " FLAVESCENS.
13 " WYVILLEI.
14 MEGERLIA SANGUINEA.
15–18 " TRUNCATA.
19–20 TEREBRATELLA FRIELEI.



Thos Davidson del et lith.

1, 3 MAGASELLA WILLEMOESI.
4 TEREBRATELLA DORSATA.
5 MAGASELLA FLEXUOSA.
6 " INCERTA.
7, 8 KRAUSSINA PISUM.
9 " LAMARCKIANA.
10, 11 PLATYDIA ANOMIOIDES.
12, 13 ARGIOPE DECOLLATA.
14 RHYNCHONELLA NIGRICANS *var* PIXYDATA.
15, 16 LINGULA ANATINA.
17, 18 DISCINA ATLANTICA.
19 " STELLA.

THE

VOYAGE OF H.M.S. CHALLENGER.

ZOOLOGY.

REPORT on the PENNATULIDA dredged by H.M.S. Challenger during the years 1873–1876. By Professor ALBERT v. KÖLLIKER, F.M.R.S., &c., &c.

IN accordance with the request of Sir Wyville Thomson, I undertook the description of the PENNATULIDA collected by the Challenger Expedition. With the exception of *Umbellula thomsoni*, the whole collection came into my hands in April 1879. I devoted the whole of the succeeding summer to the investigation, and sent my MSS., with a number of plates drawn by Mr Rabus of Würzburg, to Sir Wyville Thomson in the beginning of August of the same year.

Want of time, and the nature of the material forwarded to me, prevented me from going deeply into anatomical details, and there was, perhaps, the less reason for my doing so, as my monograph of the Pennatulida (Anatomisch-systematische Beschreibung der Alcyonarien, Frankfurt, 1872) gives to those who have a special interest in this department an opportunity of gaining a clear insight into the structure of the group.

The following is a description of all the Challenger PENNATULIDA according to the classification given at the end of this paper :—

Order PENNATULIDA.

Section I. PENNATULEÆ.

Sub-section I. PENNIFORMES.

Family 1. PTEROEIDIDÆ.

Pteroeides, Herklots.

1. *Pteroeides esperi*, Herkl.

This species is represented by five entire specimens of different ages, and a larger number of fragments. All were collected at Station 212, lat. 6° 55′ N., long. 122° 15′ E., off Mindanao, one of the Philippine Islands, on the 28th January 1875, at depths of 10, 14, and 20 fathoms.

The larger and more fully developed specimens correspond pretty closely with my *Pteroeides esperi*, var. *latifolia*, which was collected by Professor Semper at nearly the same locality (near Bohol); but the Challenger specimens, like those of Professor Semper, vary in the form of the leaves, which are also larger in some specimens and smaller in others, in colouring, and in the number of the leaves and the number of their spines.

The largest perfect specimen measures 132 mm. in length, of which 99 belong to the pinnuliferous part, and 54 mm. in breadth. The broadest imperfect specimen is 80 mm. broad, and the pinnuliferous portion 84 mm. long. The number of leaves in both specimens is twenty-five, and that of their spines eight in the first and ten to twelve in the second.

2. *Pteroides breviradiatum*, Köll.

Two well-preserved specimens, with the label, "6th May 1875, Yokohama, Japan, 5–25 fathoms."

The larger of these specimens measures 180 mm. in length and 100 mm. in breadth, the other is 145 mm. long and 85 mm. broad. They are identical in structure, and agree pretty well with my variety *latifolia*. The whole polypidom is colourless, with the exception of the polypiferous border of the pinnæ, which is pale blue.

Sarcophyllum, Köll.

Sarcophyllum grande, Gray.

Three fragments with the label, "Port Jackson, 6–15 fathoms."

All three are colourless, and rich in small calcareous needles in the polypiferous zone of the pinnules.

Family 2. Pennatulidæ.

Pennatula, L.

1. *Pennatula naresi*, n. sp. (Pl. I. figs. 1, 2).

Polypidom large, red and yellow in colour; pinnules triangular, hard, not transparent; polyp-cells alternating, numerous, with eight long spines; polyps with small calcareous spicules in the tentacles and in the stomach walls; zooids lateral and ventral, the latter in sets beginning at the ventral borders of the pinnules.

Feather more than double the length of the stalk, and more than four times longer than broad.

Pinnules twenty-nine, of which the lowest six or eight are rudimentary; the exact form of these could not be determined, as this portion of the single specimen is defective. The fully-developed pinnules are triangular, with a curved free end. The expanded base is placed very obliquely on the rachis, so that its dorsal portion, which reaches the middle line of the rachis, runs in a longitudinal direction. The ventral margin of the pinnule is concave, thickened, and beset with irregular wart-like protuberances; whilst the dorsal convex border bears the closely set polyp-cells, thirty to thirty-four in number, which alternate in such a manner as to give the appearance of two rows. Besides the more fully-developed cells, each pinnule has at the dorsal end of its polypiferous margin from three to five smaller or rudimentary cells, which are not to be confounded with the zooids. The polyp-cells are in part well separated, and together with the eight strong spines at their opening, 3 to 4 mm. long; in part shorter, more or less confluent; and some are as if imbedded in the pinnules, and only free at their openings.

The rachis is nowhere free on the dorsal side of the feather, but on the ventral aspect its middle line is not covered by the zooids. These are ventral and lateral. The ventral zooids form thick prominent yellow spiny bands, which begin at the ventral margin of the pinnule at a little distance from its attachment, run obliquely upon the sides of the rachis, and end with a longitudinal streak, the point of which reaches the next band of zooids, so that all the ventral zooids together form one continuous line on each side, giving offsets to each leaf. The zooids themselves are crowded on each band, larger and smaller, and largest in the neighbourhood of the pinnule. The lateral zooids fill the intervals between the leaves, are numerous toward the ventral side of the rachis, where they reach the ventral zooids, and run out with a single row at the outside of the dorsal attachment of the pinnule; they are all much smaller than the ventral zooids, but they are also armed with projecting spines.

The stalk is thickened at the upper end, and seems to terminate inferiorly in a rounded point. The colour of the whole polypidom is generally red, and darker on the stalk, with the exception of its lower end which is pale red, becoming colourless towards the tip. The feather is pale red, with the exception of the polyp-cells and ventral zooids, which are yellow. The axes of the polyps and their stomach-walls are also red. All coloured parts owe their colour to calcareous needles of characteristic form. Uncoloured calcareous bodies are found at the lower end of the stalk.

Maximum length of the yellow needles of the polyp cells,	1 mm.
Breadth,	0·058
Maximum length of the red spicules of the pinnules,	0·85 to 0·90
Width,	0·021 „ 0·027
Uncoloured bodies of the end of the stalk, round or elliptical,	0·004 „ 0·015
Length of the whole polypidom,	300
Length of the stalk,	84
Breadth of the feather,	43
Breadth of the stalk,	8
Breadth of the enlargement of the stalk,	10·5
Breadth of the base of the pinnules,	17–19

Habitat.—A single specimen from Station 232, south of Yeddo, Japan, lat. 35° 11′ N., long. 139° 28′ E. Depth, 345 fathoms. Sandy mud. Bottom temperature, 5° C. May 12, 1875.

Pennatula naresi at first sight somewhat resembles *P. grandis*, Ehrenberg (*P. borealis*, Sars, *Ptilella grandis*, Koren and Danielssen), but on closer inspection the differences are numerous and great. Before entering into this subject, I wish to say that I cannot accept the genus *Ptilella* of Gray, which has been defined by him as follows :—" Pinnules membranous, broad, rounded, fringed with three close parallel series of short polyp-cells on the edge. Rachis granular on each side behind without any spines." Koren and Danielssen have accepted the genus *Ptilella*, and define it as follows :—" Very large sea-pens, with large, broad, semilunar fins bearing several rows of polyp-cells. The ventral surface naked. The zooids lateral, extending towards the centre of the dorsal surface. On the ventral margin of the fins strongly developed zooids. The sexual organs in the fins. On the upper part of the stalk a fleshy enlargement. The axis is thick and round, curved downwards in the form of an S, terminating in a hook, while in the upper part it terminates in a volute." With regard to this definition I have to add, (1) that *Pennatula grandis*, Ehrb., has very fully developed ventral zooids, which are tolerably well represented in fig. 2 of Sars; and (2) that this species has also a row of zooids at the dorsal end of the polypiferous margin of the leaves on the ridge, with which each leaf runs out upon the rachis. Now, if we define, as I have done, the Pennatulidæ as sea-pens with well-developed leaves, which bear the zooids principally upon the ventral surface of the rachis; and the genus *Pennatula* as a pennatulid the leaves of which are beset in their totality with calcareous needles, whilst these are found only in the polypiferous zone, in the genera *Ptilosarcus* and *Leioptilum*, and are totally wanting in *Halisceptrum*,—*Pennatula grandis* is a true *Pennatula*. At all events, I would rather unite the genera *Ptilosarcus* and *Leioptilum* with *Pennatula* than subdivide the *Pennatulæ* on ground so slight as the number of rows of polyp-cells, the size of the enlargement of the stalk, the disposition of the zooids in each group, or even the presence or absence of zooids on the ventral and dorsal margins of the leaves.

2. *Pennatula pearceyi*,[1] n. sp. (Pl. II. fig. 5).

Small, of a reddish colour, with four to five polyps on the margin of the small lanceolate pinnules. Zooids ventral and lateral, two to four in each set, small, all of the same size. Feather more than double the length of the stem.

Pinnules thin, transparent, slender, obliquely attached to the rachis, 3 mm. broad at their base. Ventral margin of the pinnule straight, dorsal margin with obliquely disposed polyp-cells, and thus appearing serrated. Free end of the pinnule formed by one polyp-cell.

Polyps four to five on the dorsal margin of the pinnule, and two to three small

[1] Named after Mr Frederick Pearcey, an excellent assistant attached to the Civilian Staff.

zooid-like individuals on that part of the margin which runs out upon the rachis. Polyp-cells of the larger polyps united inferiorly, free at their ends, which are surrounded by short spines.

Ventral zooids, three in number, longitudinally disposed at the base of each pinnule. Lateral zooids, three to four, at the dorsal side of the ventral zooids along the base of the pinnules. All the zooids are small, white, and surrounded by red spicules.

Rachis small, thicker than the stem. Colour of pinnules and rachis pale red, polyps white. Stem white, with a small enlargement at each end. Calcareous needles of the common type; the red needles of the feather measure 0·53 mm. by 0·028 mm. Colourless needles of 0·15 to 0·20 mm. in length, and 0·020 to 0·026 mm. in breadth, are situated in the cutaneous layer of the upper part of the stalk, and the end bulb contains minute oblong and round calcareous corpuscles of 3 to 12 μ. The Challenger collection contains two specimens of this Pennatulid, one pretty well preserved and a second in a fragmentary state.

	A.	B.
Length of the feather, ...	44 mm.	51
Length of the stalk, ...	21	20·5
Length of the pinnules, ...	11	
Breadth, ...	2·5–3·0	
Breadth of the rachis, ...	1·5	

Habitat.—Station 235, south of Japan, lat. 34° 7′ N., long. 138° 0′ E. Depth, 565 fathoms. Bottom temperature, 3°·3 C. June 4, 1875.

3. *Pennatula murrayi*, n. sp. (Pl. II. figs. 6, 7).

Small, yellow and red in colour. Pen twice and a half as long as the stalk. Pinnules lanceolate, triangular, transparent, with nine to ten polyps on their margin; calyces with well developed spines. Zooids ventral and lateral, the ventral of two kinds, two large at the base of each pinnule and many smaller, forming one longitudinal row on each side.

Pinnules lanceolate, thin, transparent, yellow, with a vermilion-coloured ventral border; twenty-one to twenty-two in number, attached nearly parallel to the longitudinal axis of the rachis, but so that the dorsal upper end of their base reaches the dorsal middle line.

Polyps nine to ten on the more developed pinnules, placed in one single row on the dorsal margin; calyces the colour of minium, with eight well-developed spines.

Rachis yellow, with ventral and lateral zooids. The ventral zooids are of two kinds. Larger spiny and reddish zooids, two in number, are situated at the base of each pinnule just opposite the middle part; smaller and whitish rudimentary polyps are disposed in one single row on each side between the larger ones. Zooids of the same kind are also placed laterally between the pinnules in a single or partly double row, so that they are only visible from the ventral side of the feather. The lower part of the rachis of the only specimen of this *Pennatula* was evidently beset with small pinnules, of which remnants were still visible ; the exact number of these could not, however, be determined, therefore the number of twenty-one to twenty-two is only approximate.

The stem has an enlargement at the upper end, the upper part of which is of the same sulphur-colour as the rachis, while the lower portion is colourless like the rest of the stem. This lower part diminishes in size till near the end, where there is a small swelling or bulb covered with minute papillæ only visible under the microscope.

The whole feather, with the exception only of the polyps, is furnished with a large number of yellow and red calcareous needles of the form common in the Pennatulidæ. Yellow needles are also found in the stem where it is coloured yellow. The lower part of the stalk is destitute of calcareous bodies with the exception of the end-bulb, which contains very small round and oblong calcareous corpuscles.

The only polypidom at my disposal was of female sex, and the eggs were situated in the pinnules.

Length of the whole polypidom, ...	140 mm.
Length of the whole stalk, ...	40
Length of the whole feather, ...	100
Length of the longest pinnules, ...	17
Breadth of the pinnules at the base, ...	53
Breadth of the upper enlargement of the stem, ...	3·30
Maximum length of the yellow needles, ...	1·28
Maximum breadth, ...	0·085
Maximum length of the red needles, ...	0·85
Breadth of the red needles, ...	0·041
Calcareous bodies of lower bulb of stalk, ...	0·007–0·011

Habitat.—Station 192, on the south-east of Ceram, west of New Guinea, lat. 5° 42′ S., long. 132° 25′ E. Depth, 129 fathoms. Mud. September 26, 1874.

4. *Pennatula moseleyi*, n. sp. (Pl. II. figs. 8, 9).

The Challenger collection contained only one specimen of this remarkable species, consisting of a fragment of the pen 138 mm. in length ; but this fragment showed characters sufficiently marked to cause it to be recognised as a good species. Polypidom large, intensely red. Pinnules thick, not transparent, crowded, triangular and lanceolate, curved at their free end, and with thirty to thirty-four polyps in two or three rows on their border. Polyp-cells with spines. Zooids of two kinds, the ventral beginning at the border of the leaves, large and spiny, the lateral small.

Pinnules twenty-six in number on each side of the fragment, of which the upper end is wanting. Form of the pinnules nearly triangular or lanceolate. Their broad basis obliquely attached to the rachis, the polypiferous dorsal border convex and much longer than the concave ventral margin, so that the free end of each pinnule is curved like a hook.

Polyps arrayed in two or three rows on the dorsal margin of the pinnules, with well-separated cells or calyces 3 mm. in length, the apertures of which are surrounded by eight strong spines. Total number of polyps on a leaf 30 to 34.

Rachis of a medium thickness, with two kinds of rudimentary polyps or zooids. One set, the ventral zooids, consists of a row of larger spiny zooids, which begins at the ventral margin of the pinnules, at 3 to 4 mm. from their attachment, runs obliquely towards the ventral side of the rachis, and there changes its direction so as to become longitudinal. Each row has the aspect of a curved spiny ridge, and shows the openings of the zooids as whitish points arranged in one single series.

The lateral zooids begin with a large crowded mass at the dorsal side of the ventral zooids, but as soon as they reach the interspace of the pinnules their number greatly diminishes, and they end with a double or single row near the dorsal attachment of the pinnules. These zooids have only small spines or none at all, and look more like small rounded or conical papillæ.

The rachis has between the zooids on its ventral side a free space of 2·5 to 4·0 mm. in breadth, and looks here as if it were beset with little papillæ or wart-like bodies. In one part of the pen some two or three zooids seem to occupy a portion of the groove. The dorsal side of the rachis is destitute of a free middle line, as the leaves somewhat overlap each other.

The colour of the whole fragment, which is deep red, is occasioned by red spicules lying in the integument. The greatest number of these is found in the polyp-cells, and on both margins of the leaves, while the surfaces of the latter are pale red and whitish. A whitish colour is also found on the ventral side of the rachis, but this is only produced by the thick epithelium of this part, which contains many thread-cells, while the subjacent cutis is red. The polyps themselves are not coloured, and the same holds good of the whole interior of the pinnules and the rachis. The spicules are of the typical form of those of the Pennatulidæ, with a maximum length of 1·14 to 1·2 mm., and a maximum breadth of 0·058 mm. The minute and microscopic structure of this *Pennatula* corresponds, as far as I can judge, with that of the *Pennatula rubra* described in my monograph; but I have to remark that in the Challenger example the calcareous axis is wanting, having evidently been torn out of the fragment by accident.

The fragment belongs to a female polypidom, and the eggs are found in the pinnules.

Length of the pinnules measured in the curved state, ...	12–14 mm.
Breadth at base, ...	10–12
Breadth at their free end without the polyp-cells, ...	3–4
Breadth of the rachis, ...	5–6

Habitat.—Station 164, off Sydney, Australia, lat. 34° 8′ S., long. 152° 0′ E. Depth, 950 fathoms. Temperature, 2°·2 C. Grey ooze. 12th June 1874.

5. *Pennatula sulcata*, n. sp. (Pl. II. figs. 3, 4).

General character of *Pennatula rubra* and *Pennatula fimbriata;* colourless, with a deep groove on the dorsal side of the rachis; the leaves are very numerous; ventral and lateral zooids are present, the latter of which are also visible on the dorsal aspect of the rachis. Besides these there is a long row of zooids at the dorsal end of the polypiferous margin of the leaves.

Feather more than twice the length of the stalk.

Pinnules thin, transparent, closely set, twenty-six to twenty-seven in number, lanceolate or triangular. Base of the pinnule attached transversly to the rachis. Ventral and dorsal margin straight, the latter beset with one row of polyp-cells, alternating so as to produce the appearance of two rows, especially near the dorsal end of the border. The polypiferous margin of each pinnule ends in a long narrow ridge, which runs obliquely upon the dorsal side of the rachis, as far as the base of the next pinnule. This ridge is merely a single row of small zooids about twenty-seven in number, and of the size of 0·10 to 0·12 mm., which I call the zooids of the dorsal margin of the pinnules.

Polyp-cells small, crowded, twenty-four to twenty-six on the larger pinnules; and pretty well separated, with eight strong spines.

Rachis with a groove on its dorsal side, which begins shallow between the lowest pinnules, assumes a depth of 3 mm. toward the middle of the feather, and runs out at its upper end. This groove is narrow where it is deepest, and bordered by sharp whitish lips. The calcareous axis lies inside at the bottom of the groove, and shines through the thin integument as a white streak. The ventral side of the rachis is covered on its sides by small zooids, while the middle line is smooth. These ventral zooids are small wartlike or conical bodies, 0·2 mm. in breadth, all of one kind with this exception only, that those near the pinnules have their calcareous needles projecting, and resemble small spines, whilst the others are rather rounded protuberances. These zooids are continuous between the pinnules with very numerous lateral zooids of rounded form, which run up to the dorsal aspect of the rachis, and reach as far as the ridges of the pinnules described above, on the side of which they end with a pointed train. The stalk is short, enlarged in its upper part, and pointed at the end.

With regard to the internal structure I have only to make the following remarks:—The eggs are found in the leaves, and, as it appears, also in the stalk, as in *Pennatula rubra,* if we may judge from the fact that the stalk contains on both sides a crowded mass of eggs along the attachment of the pinnules. Calcareous corpuscles are found in the whole integument. In the polyps short stout needles of 0·11 to 0·20 mm. lie in the stem of the tentacles. The polyp-cells contain needles of 0·86 mm. maximum length, and 0·032 mm. breadth. Those of the lateral and ventral zooids are numerous but smaller, and those of the zooids of the pinnules are smallest, measuring only 0·081 to 0·10 mm. in length. Besides these needles the rachis contains none except at the ventral side, where needles of 0·050 to 0·080 mm. are found in the lips which border the longitudinal groove.

The stalk is very rich in flat elliptical calcareous corpuscles resembling those of *Veretillum*, the maximum size of which is 0·1 mm., while the greater majority are not more than 27 to 54 μ long, and many measure only 5 to 10 μ.

Length of the stalk,	29 mm.
Length of the feather,	58
Length of the longest pinnule,	20
Breadth of the longest pinnule at base,	4·5
Breadth of the longest pinnule at rachis,	10·0
Breadth of the longest pinnule at stalk,	5·0

Habitat.—Station 203, Zebu, Philippines, lat. 11° 7′ N., long. 123° 7′ E. Depth, 10 to 20 fathoms. Mud. October 31, 1874. One single specimen.

Halisceptrum, Herklots.

Halisceptrum gustavianum, Herkl., var. *parvifolia*, mihi.

Of this form the Challenger collection contains four fragments, from Station 212, off Mindanao, one of the Philippines. Lat. 6° 55′ N., long. 122° 15′ E. Depth, 10, 14, and 20 fathoms. Sand. January 30, 1875.

Sub-section II. VIRGULARIEÆ.

Family 1. VIRGULARIDÆ.

Virgularia, Lam.

1. *Virgularia bromleyi*, n. sp. (Pl. III. fig. 10).

Of this species the Challenger got only one small fragment.

Polyps nearly sessile, so that there is only a very faint appearance of pinnules, and they must at all events be called very small. Pinnules nearly opposite, each group about 4 mm. distant from its neighbours. Polyps with their cells 2·5 to 2·8 mm. long, three in each pinnule, with pretty well-marked cells, the margin of which has no spines nor protuberances of any kind.

Rachis small, of 0·37 to 0·42 mm., with lateral zooids disposed at the base of the leaves in one single row of three individuals.

Axis round, 0·38 mm. in breadth, with well-developed radial fibres.

Calcareous corpuscles of the ordinary form of needles, 0·085 mm. maximum length, are scantily found in the stalk, the rachis, and the tentacles of the polyps.

Habitat.—Station 235, South of Japan, lat. 34° 7′ W., long. 138° 0′ E. Depth, 565 fathoms. Bottom temperature, 3°·3 C. Mud. June 4, 1875.

2. *Virgularia gracillima*, n. sp. (Pl. III. fig. 11).

A fragment of a *Virgularia* may be so named provisionally, as it seems to differ from all known species.

Pinnules very small, about 0·85 mm. high, and 1·1 mm. distant from each other.

Polyps four on each pinnule, without well-marked cells.

Rachis small, with a breadth of 0·48 to 0·51 mm. in the middle part, and of 0·62 in the region of the undeveloped pinnules.

Zooids.—(?)

Axis round, yellow, 0·42 mm., large in the lowest part of the rachis, with the typical well-developed radiating fibres. Length of the whole fragment 77·5 mm.

Habitat.—Station 167*a*, Queen Charlotte Sound, near Long Island, New Zealand. Depth, 10 fathoms. Mud. June 27, 1874.

Scytalium, Herkl.

1. *Scytalium sarsi*, Herkl. (Pl. IV. figs. 14, 15).

Of this remarkable species, the habitat of which has been hitherto unknown, the Challenger got five more or less well-preserved specimens; these agree specifically with the only two specimens known, which are preserved in the Leyden Museum. The only remark I have to make is, that the colour of the polypidom, which depends upon calcareous corpuscles of an opaque red colour, varies very much. One specimen had the whole rachis uncoloured, and only the polyp-cells and stalk red. In a second the rachis was uncoloured below; the colour then began at the base of the pinnules on both sides, but more intensely on the ventral side; and on both faces of the rachis, more on the dorsal side; at length the whole rachis became red, with the exception of small patches here and there on the ventral border of the leaves.

The measurements of the three better preserved specimens are—

	A.	B.	C.
Length of the entire polypidom,	343 mm.	400	324
Length of the stalk,	?	52	48
Breadth of the stalk,	3	1·7	3
Breadth of the rachis,	2·7	1·3	1·0
Length of the base of the pinnules,	6–8	4–5	4·2
Length of the ventral margin of the pinnules,	6–8	4–5·5	4·0

Habitat.—Station 212, Philippines, lat. 6° 55′ N., long. 122° 15′ E. Depth, 10, 14, and 20 fathoms. Sand. January 30, 1875.

2. *Scytalium tentaculatum*, n. sp. (Pl. III. fig. 12, Pl. IV. fig. 13).

General appearance of *Scytalium sarsi*, in every part larger, less coloured, with a long simple tentacle at every polyp-cell.

If this form did not present the very remarkable feature of the tentaculated polyp-cells, of which fig. 13 representing a young leaf gives a very good idea, nobody would entertain a doubt of its being only a stout form of the long-known *Scytalium sarsi.* But the tentacles, which are found on every polyp-cell, and, as the younger leaves show, are developed before the polyps, make it necessary to describe it under a new name, so long as no intermediate forms between it and *Scytalium sarsi* are found. Besides this, the size of the most developed polypidom and the colour deserve attention. The largest specimen was only coloured (1) in the region of the polyp-cells, but not everywhere on all leaves, and not on all cells of the coloured leaves, and (2) on the upper part of the stalk. A second specimen was nearly colourless, with the exception of the upper end of the stalk. Two others, on the contrary, were pretty strongly coloured on the stalk, the rachis, and the base of the leaves. As a difference between the two forms I may also mention the form of the lowest undeveloped leaves. In *Scytalium tentaculatum* these form a short series, and the leaves assume very near the end the form given in fig. 13, whilst in *Scytalium sarsi* the row of these pinnules is longer, and many of them are remarkable from the fact that the polyp-cell near to the ventral surface is larger than the rest. The calcareous corpuscles are the same as those in *Scytalium sarsi*, only their maximum length is a little less on the stalk, in *Scytalium tentaculatum* 38 μ, in *Scytalium sarsi* 53 μ.

Four well-preserved specimens were at my disposal, of which I here give the following measurements :—

	A.	B.	C.	D.
Length of the whole polypidom,	620 mm.	340	330	90
Length of the whole stalk,	92	71	77	33
Length of the base of the pinnules,	12–15	6–8	6–8	8–9
Length of dorsal border,	7–9	5	5–6	5
Breadth of the stalk,	7·5	4	4	1·5
Breadth of the rachis,	3·6	2	2	2·0
Number of pinnules,	101	...	...	17

Length of the tentacles at the polyp-cells in adult leaves 0·58 mm.
Length of the tentacles at the polyp-cells in young pinnules 0·80 to 1·0 mm.

Habitat.—Station 203, Philippines, lat. 11° 7′ N., long. 123° 7′ E. Depth, 10 to 12 fathoms. Mud. October 31, 1874.

Section II. SPICATÆ.

Sub-section I. FUNICULINEÆ.

Family 2. STACHYPTILIDÆ.

Stachyptilum, n. gen.

Small pens without leaves, polyps with cells in small rows of four on both sides, and on the dorsal aspect of the rachis. Cells without stronger spines at their openings.

Zooids ventral, lateral, and dorsal on all free surfaces of the rachis; all of one kind. Stalk with a small zone of papillæ at the upper end. Axis pretty strong, round. Calcareous corpuscles of different forms, needles on the cells and zooids, lenticular bodies in the stalk, cylindrical corpuscles with three alternating ridges on each end in the tentacles of the polyps.

1. *Stachyptilum macleari*, n. sp. (Pl. VII. figs. 24–26).

Feather a little longer than the stalk, uncoloured.

Polyp-cells in fourteen rows on each side, situated on the lateral and dorsal surfaces of the rachis, the middle rows longer, with four cells, the inferior and superior shorter, with three and even only two cells. All the rows oblique, and the dorsal cells a little smaller than the ventral. Cells about 2 mm. in length, with strong needles 0·56 mm. long and 0·037 to 0·043 mm. broad in their walls; these needles project more or less at the openings of the cells, and form here and there regular spines, 1, 2, or 3 in number.

Polyps with a strong band of calcareous corpuscles in the stem of each tentacle, which are represented in fig. 26, and measure 0·027 to 0·060 mm. in length, and 0·016 to 0·028 in breadth.

The zooids are small bodies of 0·28 to 0·34 mm. in diameter, each of which is protected at its lower side by a plate of strong needles of the same kind as those of the polyp-cells. Besides these the mouth of each zooid has at its lower side a projecting two-lobed lip, which might also be described as a divided short tentacle. These zooids cover every part of the rachis which is not beset with the polyps, with the exception only of a very small line on its ventral surface. The zooids go even further down than the polyp-cells, form below the last of them about four regular rows on each side, and are also present in this region on the dorsal and ventral surface of the rachis.

The stalk has at its uppermost part a zone of about 2 mm. in length, where it is covered on its dorsal aspect, and on both sides by a crowded mass of small cylindrical papillæ of 0·17 to 0·19 mm. in length. The middle part of the stalk is whitish and the end pointed. The end of the stem contains peculiar flat, oval, or biscuit-shaped calcareous corpuscles of the length of 0·054 to 0·64 mm.

Length of the feather,	42 mm.
Length of the stalk,	32
Breadth of the feather,	8
Breadth of the stalk,	3·5
Breadth of the ventral side of rachis,	3·8

Habitat.—One single specimen from Station 192, south-east of Ceram, on the west of New Guinea, lat. 5° 42′ S., long. 132° 25′ E. Depth, 129 fathoms. Mud. September 26, 1874.

Family 3. Anthoptilidæ.

Anthoptilum, n. gen.

Polypidom without leaves, of the general appearance of *Funiculina*. Polyps in many short rows on the sides of the rachis, large, without cells. At the lower end of the rachis no prolonged streak of undeveloped polyps. Zooids lateral, ventral, and dorsal, all of one kind, small, wart-like. Axis round. No calcareous corpuscles, except at the end of the stalk.

1. *Anthoptilum thomsoni*, n. sp. (Pl. V. figs. 16–18).

A large, magnificent sea-pen, with a short, thick stalk, long feather, and long polyps crowded eight to ten in one row. Polyps often united at their bases. Zooids very numerous. Rachis free only on the ventral side.

Stalk with a thick swelling at the upper part, and a smaller end-bulb, with short pointed free end.

Polyps very long, without cells, and with long tentacles very seldom retracted. These polyps are disposed in many oblique rows on both sides of the rachis, so as to cover more or less completely its dorsal aspect. In the higher parts of the rachis it is quite impossible to find a free surface on this side, whilst the reverse is the case below in the neighbourhood of the stalk. On the other side the ventral surface of the rachis is free in its whole length. With regard to the position of the polyps, I have further to remark that very often the lowest parts of two, three, or more of them are united so as to produce the appearance of very small pinnules, shorter even than those of *Pavonaria finmarchica*, but in no place are all the polyps of one row united in such a manner. The tentacles of the polyps are very long, and provided with long, slender branches (pinnules), which are remarkable from their moniliform appearance (fig. 18), and the great number of small thread-cells situated in their single protuberances.

The zooids of *Anthoptilum thomsoni* are very numerous. The principal are lateral, and lie between the rows of polyps; but these lateral zooids reach everywhere the ventral surface of the rachis, and in many places the single lateral rows coalesce there so as to form genuine ventral zooids. This coalescence, however, never takes place on the greater part of the rachis, and generally coalesced lateral zooids alternate with separated sets. On the dorsal side the zooids avoid the middle line where this line is free of polyps, but where the polyps cover the whole dorsal surface the zooids are also to be found everywhere. A peculiar feature of this sea-pen is that in many places little groups of zooids reach as far as the base of the polyps themselves, and are also found between the individuals of one row. The size of the zooids is from 0·40 to 0·58 mm., and their structure the ordinary one, inasmuch as they possess two well-developed mesenteric filaments. With regard to the colour of *Anthoptilum thomsoni*, some specimens are totally uncoloured; others have all the polyps more or less brown, the stalk and rachis on the contrary colourless.

Calcareous corpuscles are only found very scantily in the muscular layer in the lowest parts of the stalk. They are small oblong bodies of 7 to 22 μ, which are often united four together so as to form small star-like figures.

The axis is round, and of the common lamelliferous and fibrous structure. Its radiating fibres are very numerous, but short.

The measurements of nine well-preserved specimens of *Anthoptilum thomsoni* are as follow :—

	A.	B.	C.	D.	E.	F.	G.	H.	I.
Length of the whole polypidom,	420 mm.	560	530	362	422	410	400	360	440
Length of the stalk, . .	65	87	75	63	67	75	65	61	57
Breadth of its enlargement, .	18	18	16	11	14	14	15	6·5	12
Breadth of the pen, . .	25	...	...	...	...	...	...	...	...
Length of the polyps with the tentacles, . . .	19	17·5	...	20	13	18	17	12	16
Length of their tentacles, .	...	6–8	...	7	9	...	...	...	...
Breadth of the rachis, . .	...	8–9	10	...	...	...	...	...	...

Habitat.—Station 320, Atlantic Ocean, south of Buenos Ayres, lat. 37° 17′ S., long. 53° 12′ W. Depth, 600 fathoms. Bottom temperature, 2°·7 C. Hard ground. February 14, 1876.

2. *Anthoptilum murrayi*, n. sp. (Pl. VI. figs. 19–21).

General appearance of *Anthoptilum thomsoni*, smaller, with smaller and less numerous polyps, two to three in each row. Polyps all sessile, widely separated from each other. Rachis without polyps in the middle line on both sides. Zooids more distant than in the last species.

Stalk long, slender, without distinct enlargement.

Polyps disposed in oblique rows of two to three, seldom four, on both sides of the rachis, which arrangement is not very apparent everywhere, all well separated from their neighbours, and the dorsal smaller than the ventral, with tentacles often far surpassing in length the bodies of the polyps.

The zooids cover the whole rachis between the polyps, and leave only the middle part of its ventral and dorsal aspect free. On the ventral side the zooids are situated on the margin and form not more than one single row, which is even interrupted here and there on the ventral side of the lowest polyps, whilst on the dorsal aspect they go nearer the middle line, and leave only a small part of the rachis free. These zooids, which in no case are situated on the bodies of the polyps as in *A. thomsoni*, measure 0·34 to 0·40 mm. in width, and their distance from one another is equal to, or greater than, their diameter. They have all two mesenteric filaments. The colour of the polypidom is pale red, the polyps brown, while the rachis and stalk are usually colourless, and present only here and there a light brown or pale rosy tint.

The axis is round, and tolerably strong.

Calcareous corpuscles in the end of the stalk oblong, of the same form and size as in *Anthoptilum thomsoni.*

The measurements of the only specimen are—

Length of the whole polypidom,	510 mm.
Length of the whole stalk,	76
Length of the lower polyps,	6–10
Length of the tentacles,	3–4
Breadth of the stalk,	3–4
Breadth of the rachis,	4–5·5

Habitat.—Station 50, North Atlantic, south of Halifax, lat. 48° 8′ N., long. 63° 39′ W. One specimen. Depth, 1250 fathoms. Bottom temperature, 2°·8 C. Grey ooze. May 21, 1873.

3. *Anthoptilum simplex*, n. sp. (Pl. IV. fig. 22).

Polypidom colourless. Polyps sessile, widely separated, very large with a broad base, two in each row. Rachis free on both sides in the middle line. Zooids numerous, more elevated than in the other two species, and somewhat conical.

Stalk with an enlargement in the upper part.

Polyps long and large, resembling in size those of *A. thomsoni*, and measuring without the tentacles 12 to 15 mm. in length. The tentacles, of which there exist only traces on some polyps, seem to have been very long. A remarkable feature is the large area of elliptical form upon which each polyp stands, and which may be regarded as a broad base to the polyp.

The zooids are to be found in the same position as in the other species, and differ only by their greater elevation on the surface of the rachis and their smaller size, as they measure only 0·28 to 0·30 mm. in diameter. The ventral zooids form a single or double series, and the dorsal a double or triple series.

Calcareous corpuscles as in the other species.

Measurement as follows:—

Length of the whole polypidom,	400 mm.
Length of the stalk,	55
Breadth of the stalk,	7
Breadth of the rachis,	4–5

Habitat.—One single specimen in a bad state of preservation, from Station 133, South Atlantic, west of Tristan d'Acunha, lat. 35° 41′ S., long. 20° 55′ W. Depth, 1500 fathoms. Bottom temperature, 1°·3 C. Globigerina ooze. October 11, 1873.

Sub-section II. JUNCIFORMES.

Family 1. Kophobelemnonidæ.

Kophobelemnon, Absjörnsen.

1. *Kophobelemnon ferrugineum*, n. sp. (Pl. XI. fig. 43).

Rachis longer than the stalk, cylindrical and pointed at the upper end, of a clear brown colour. Polyps short with broad base, retractile, at the oral side of the tentacles brown, and dark brown in their inner cavities. Zooids large, numerous, of the form of pointed warts or short spines, all obliquely directed upwards. Stalk with an end-bulb, externally of a pale grey or greenish colour, internally brown. Calcareous bodies in every part of the structure, in the form of shorter or longer slender needles, with warts and tubercles at the ends and also in the middle. Those of the stalk shorter, thicker, and more warty and spiny.

The different species of *Kophobelemnon* are not easily distinguishable so long as their structure is not thoroughly known; nevertheless, I think myself justified in separating this form from those hitherto described. Fig. 43 is sufficient to show the external form and the size of the species, and I have only to add that the longest calcareous needles of the rachis and the polyps measure 0·57 to 0·71 mm. in length and 0·052 in breadth, and the shortest on the stalk 0·09 to 0·10 mm. in length and 0·027 to 0·037 in breadth.

Habitat.—Station 232, south of Yeddo, Japan. One specimen. Lat. 35° 0′ N., long. 139° 28′ E. Depth, 345 fathoms. Bottom temperature, 5° C. Sandy mud. May 12, 1875.

2. *Kophobelemnon*, sp. (Pl. XI. fig. 44).

A young *Kophobelemnon*, with only one polyp, and a pointed end to the rachis. It resembles, by the occurrence of needles 0·54 mm. long and 0·070 mm. broad in the tentacles, my *K. stelliferum*, var. *durum*.

Zooids not numerous, in two rows on the ventral side of the rachis.

Habitat.—Station 169, north-east of New Zealand, lat. 37° 34′ S., long. 179° 22′ E. Depth, 700 fathoms. Bottom temperature, 4°·2 C. Grey ooze.

3. *Kophobelemnon burgeri*, Herkl. (Pl. XI. fig. 45).

The Challenger brought home two specimens of this rare species, which I thought right to represent in fig. 45, as their form is in some respects different from that described and figured by Herklots.

Habitat.—Station 209, Zebu, Philippines, lat. 10° 10′ N., long. 123° 55′ S. Depth, 95 to 100 fathoms. Bottom temperature, 21° F. C. Mud. January 22, 1875.

Family 2. Umbellulidæ.

Umbellula, Cuv.

1. *Umbellula durissima*, n. sp. (Pl. VIII. figs. 32, 33).

Calcareous needles very numerous in every part of the cutis. Principal needles of the polyps and those of the tentacles of enormous length, 2·0 to 2·8 mm. Pinnules of the tentacles brown. Zooids very numerous; the ventral forming a nearly continuous plate. Rachis short, without a longer enlargement below. Stalk here and there very light brown. Axis nearly cylindrical.

Of this very remarkable species I had only one young specimen at my disposal, and it is, therefore, possible that the characters given are not fully sufficient. Nevertheless, they are of such a kind that this form can be easily distinguished from all others at present known.

The stalk has a long enlargement towards the lower end, with here and there a very slight brown tint, the seat of which is in the longitudinal nutrient canals. Its calcareous needles are extremely numerous, those of the upper part are 0·19 to 0·26 mm. long, those of the lower half are shorter and broader, and measure 0·076 to 0·20 mm. in length, and 0·019 to 0·045 mm. in breadth, all of them are warty, and have the typical three edges, but those of the lower part show the first character better, while in the others the edges are more prominent, and the surface less uneven. The breadth of the stalk is 0·58 mm. in the upper part, and 1·0 to 1·4 and 2·0 mm. towards the base.

The rachis has the aspect of a flat rhomboid expansion of the stalk, which contains the end of the axis in the middle, and bears on the dorsal side one large and two undeveloped polyps. The whole ventral surface of the rachis, with the exception only of a narrow middle line, is studded with wart-like zooids 0·28 to 0·42 mm. in size, which are also found on the dorsal side of the rachis, on a small space below and between the polyps. Two or three zooids are also found on the end of the stalk in the neighbourhood of the rachis, the lowest at a distance of 4 mm. from the great mass of zooids. All the zooids are surrounded by calcareous needles, of the same size as the smaller needles in the polyps, about 0·30 to 0·50 mm. in length.

This *Umbellula* is remarkable from the white colour of the body of its developed polyp, and of the aboral aspect of the central stems of its tentacles, while all the pinnules of the tentacles and their oral sides are of a deep brown. The white colour is occasioned by calcareous needles, the largest of which, measuring more than 2·0, even 2·85, mm. in length, and disposed in eight lines on the body of the polyp, are directly continuous with those on the stems of the tentacles. The brown colour, on the contrary, lies in the outer epithelium of the tentacles, and is brighter at the aboral side of the pinnulæ, where the epithelium is also strengthened by needles of about 0·30 to 0·34 mm. in length. The undeveloped polyps are small, pyriform bodies of 2·0 to 2·5 mm. in length without tentacles, but with large sized needles in eight rows.

The axis measures in the stalk 0·28 to 0·45 mm. in diameter. The length of the whole polypidom including the polyp, 160 mm.

Habitat.—Station 234, North Pacific Ocean, south of Yeddo, Japan, lat. 34° 7′ N., long. 138° 0′ E. Depth, 565 fathoms. Bottom temperature, 2°·3 C. Mud. June 4, 1875.

2. *Umbellula güntheri*, n. sp. (Pl. IX. fig. 34).

Exquisitely bilateral. Calcareous needles very numerous in every part of the cutis, none very large. Polyps disposed alternately, of a very light brown colour, very large, with hard thick sarcosoma. Zooids very numerous, situated on the rachis and on the stalk; those of the rachis cover every free part of it, with the exception of both middle lines; and are, therefore, ventral, dorsal, and lateral. Those of the stalk are situated in small numbers on irregular enlargements. Stalk strong, with well developed sarcasoma. Axis quadrangular, with concave surfaces and rounded edges. Of this species also I had only one imperfect specimen, which wanted the lower part of the stalk.

Stalk quadrangular, length 175 mm., broken below, where it measures 1·5 mm. in diameter. It is beset with many irregular but mostly spindle-shaped enlargements, where it attains over 2·0 mm. in width, and shows invariably in these places a certain number of zooids, of the form of those of the rachis but less prominent, all disposed irregularly, singly, in pairs or more, even eight together, and in this case all in one longitudinal line. The stalk, being broken in several places, it was impossible to make out on which side these zooids were placed, only this, that they are situated on opposite aspects, and are probably lateral. The needles of the stalk are of different sizes, longer in the upper, shorter in the lower parts. All possess very distinct edges, and besides this a granular surface. Their length is from 0·11 to 0·20 mm., and their breadth from 0·026 to 0·045 mm.

Rachis without inferior enlargement, and so evidently bilateral that it suggests a young *Kophobelemnon* with only a few polyps. The ventral side shows a direct continuation, a kind of keel, which ends with a bend or curvature where the uppermost polyp is situated. Expansions at the sides of this keel, covered with zooids, are directly continuous with the bases of the polyps, so that no other trace of demarcation exists, except that given by the zooids. On the dorsal side the rachis shows a deep groove between the polyps, which is totally covered with zooids, with the exception of a very small space in the middle line. The polyps are very large, 44 mm. long, with the tentacles extended; five well-developed, and one rudimentary, and are disposed quite regularly on both sides of the rachis in the usual alternating manner, so that the fifth developed polyp has its seat at the dorsal side of the end of the rachis. The cutis of the polyps is studded with needles, which show this peculiarity, that they are all about the same size in the same place. Those of the bodies of the polyps measure 0·27 to 0·72 mm. in length, and 0·041 to 0·045 mm. in breadth, and are in general disposed in a transverse direction. The same holds good of the needles of the principal stem of the tentacles, only these are smaller, 0·38 to 0·62 mm. in length, and 0·022 to 0·041 mm. in breadth. Those of the lateral branches or pinnules are disposed lengthways on their aboral side, and measure 0·19 mm. in length, and 0·011 to 0·020 mm. in breadth. All these needles are three-edged, and slightly granular at the end.

The zooids fill all interspaces between the polyps, and are in general conical bodies of

0·42 to 0·58 mm. in height and breadth at their bases. They are all surrounded with needles, which frequently form a kind of cell ending with several points.

Habitat.—Station 106, Atlantic Ocean, a little north of the Equator, lat. 1° 47′ N., long. 26° 46′ W. Depth, 1850 fathoms. Bottom temperature, 1°·8 C. Globigerina ooze. August 25, 1873.

3. *Umbellula thomsoni*, Köll.

(Von Willemoes-Suhm in Zeitschrift f. wiss. Zool., 1873; Kölliker in Würzburg. Verhandl., Bd. viii., 1874, and in Die Pennatulide *Umbellula* und zwei neue Typen der Alcyonarien, Würzburg, 1874, Festschrift, pp. 1–11, Taf. i. figs. 1–5.)

Indistinctly bilateral, colourless. Calcareous corpuscles in all parts of the sarcosoma. Polyps forming a pendant bunch, with a distinct rachis containing the end of the axis, which goes near the bases of the terminal polypi. Stalk quadrangular, with a well-developed lower, but no upper, enlargement. Zooids on the ventral and dorsal sides of the rachis; none on the stalk. Axis quadrangular, with excavated surfaces and rounded edges.

For further details I refer to the paper above quoted, and only adjoin here the measurements of the two specimens of this *Umbellula*.

	A.	B.
Length of the whole polypidom,	895 mm.	270
Length of the lower enlargement of stalk,	80	...
Length of the polyps,	33–39	17
Length of the bodies of the polyps,	18–20	10
Length of their tentacles,	15–19	7
Breadth of the axis,	2·5	0·7
Number of polyps,	13	5
Number of rudimentary polyps,	...	5
Length of needles of tentacles,	0·24–0·30	
Breadth of needles of tentacles,	0·021–0·032	
Length of needles of stalk at its lower end,	0·15	
Breadth of needles of stalk at its lower end,	0·064	

Habitat.—Station 7, North Atlantic Ocean, between Portugal and Madeira, lat. 35° 20′ N., long. 13° 4′ W. Depth, 2125 fathoms. Bottom temperature, 2°·0 C. Mud. January 31, 1873.

I add here some remarks on the *Umbellulæ* described by Joshua Lindahl (Om. Pennatulid slægtet *Umbellula*, Stockholm, 1874; Kongl. Svenska Vet. Akadem. Handlingar, Bd. xiii., No. 3). These *Umbellulæ*, called by Lindahl *miniacea* and *pallida*, and brought together by me (*loc. cit.*) under the name of *U. lindahli*, come very near my *U. magniflora*, but so long as we are unable to compare the different forms, it will be impossible to decide whether they are identical or not, particularly as the remoteness of the localities in which the *Umbellulæ* of Lindahl (in Baffin's Bay, lat. 70° 43′ N., long. 52° 3′ W., depth 410 fathoms; and off the entrance of

Omenakfiord, North Greenland, lat. 71° 71′ N., long. 23° 58′ W., depth 122 fathoms) and *U. magniflora* have been found militates *a priori* against their identity.

The *Crinillum siedenburgii* of Van der Hoeven is, as I have shown, the basal part of a Pennatulid, and no doubt of an *Umbellula*, as the axis has the same form as that of most *Umbellulæ*.

Habitat.—Banda Sea, lat. 6° 40′ S., long. 126° 47′ E. Depth, 2700 fathoms.

4. *Umbellula leptocaulis*, n. sp. (Pl. IX. fig. 35).

Decidedly bilateral. Calcareous needles pretty numerous in every part of the cutis, none very large. Polyps disposed alternately, of a light brown colour, large, with thin sarcosoma. Zooids scanty, on the rachis only, ventral, lateral, and dorsal. Stalk quadrangular, thin, with thin sarcosoma. Axis quadrangular, with concave surfaces and blunt edges.

Of this species I had at my disposal one smaller, perfect specimen (B), 150 mm. in length, with three polyps; and the upper part of a larger one (A), with five polyps, consisting of four fragments, and altogether 350 mm. in length.

The stalk is remarkable for its thinness. In A it measured 0·85 mm. in diameter below, and 0·34 to 0·37 mm. in its upper part. In B there was an end-bulb of 0·42 mm., and the average breadth of the rest of the stalk was 0·42 to 0·28 mm.

In the polypiferous part the ventral side shows a small, keel-like rachis, which bears the polyps on both sides, so that there is no larger free ventral space as in *Umbellula durissima* and *Umbellula güntheri*. The ventral zooids are, therefore, very few, and form only a small series on both sides of the keel. The lateral zooids are represented by a few individuals only, and the dorsal are also few in number, and disposed on a small dorsal free space between the polyps.

The polyps, 27 to 30 mm. in length in A, are thin in their sarcosoma, and show the same arrangement of the calcareous needles as in *Umbellula güntheri*, with this exception, that the needles of the tentacles are all disposed parallel to the longitudinal axis of the stems of the tentacles. The needles of the polyps in A measure 0·43 to 0·54 mm. in length, and 0·027 mm. in breadth, and those of the tentacles 0·16 to 0·21 mm. Those of the stalk measure in A 0·11 to 0·18 mm. in length, and 0·027 to 0·054 mm. in breadth; in B, 0·064 to 0·10 mm. in length, and 0·027 to 0·064 mm. in breadth. The needles in the lower part of the stem are of the common type, the shorter granulated and warty, and broader the shorter they are.

Habitat.—Station 181, South Pacific Ocean, south-east of New Guinea, lat. 13° 50′ S., long. 151° 49′ E. Depth, 2440 fathoms. Red clay. August 25, 1874.

5. *Umbellula simplex*, n. sp. (Pl. IX. fig. 36).

Decidedly bilateral. Calcareous needles numerous in every part of the cutis, none very large. Polyps disposed alternately, colourless, small, rather hard. Zooids none.

Stalk cylindrical, thin, with a moderately thick sarcosoma. Axis quadrangular, with concave surfaces and rounded edges.

The only specimen of this *Umbellula* brought home by the Challenger is evidently young. Fig. 36 gives a clear idea of its appearance, so I mention only the following details :—

The length of the whole polypidom is 108 mm., and that of the rachis with the polyps 23 mm. The polyps, four in number, are situated on both sides of a short and small rachis in such a manner that the rachis with the axis seems to enter the uppermost polyp, whilst the others lie on its sides, two on the left and one on the right side. The needles in the bodies of the polyps are disposed transversely, and measure 0·5 mm. in length and 0·030 to 0·041 mm. in breadth. Those of the tentacles are smaller, 0·27 and 0·21 mm. placed longitudinally at the aboral side of their axes and pinnules, and transversely on the oral face of the axes. All the needles are three-edged, and granulated only at their ends. The calcareous bodies of the stem are short and broad, 0·10 to 0·18 mm. long, and 0·027 to 0·054 mm. wide oblong, slightly constricted in the middle, flat, and covered with strong prominent warts.

Habitat.—Station 246, North Pacific Ocean, between San Francisco and Yeddo, lat. 36° 10′ N., long. 178° 0′ E. Depth, 2050 fathoms. Bottom temperature, 1°·3 C. Grey ooze. July 2, 1875.

6. *Umbellula huxleyi*, n. sp. (Pl. IX. fig. 37).

Indistinctly bilateral in the fully-developed state. Calcareous corpuscles none, except in the end-bulb of the stalk. Polyps forming a cluster at the end of the stalk, with traces of a bilateral arrangement, small, brown. Stalk with a long enlargement below, ending in a kind of bulb, and a large thickening at its upper end, where it appears flattened and curved in such a manner that the axis lies at the convex side. Zooids numerous on the whole stalk and between the bases of the polyps, but none on the dorsal side of the rachis between the polyps, all provided with one single tentacle. Axis indistinctly quadrangular.

The Challenger brought home four specimens of this curious form, which being different in size and age, gave me an insight into the development of the polypiferous part.

Two younger specimens had four and five polyps. One of these may be named the terminal polyp, as the axis ends in its body, and in one specimen reaches even as far as the line of attachment of the tentacles. Of the other polyps, two, which may be termed the lateral polyps, are placed below and on the sides of the terminal polyp, and the rest (one or two), which I call the dorsal polyps, on the dorsal side of the lateral polyps.

Of the more developed specimens, one had seven more or less developed polyps, five small ones, and three wart-shaped and undeveloped. The terminal polyp was bent in such a manner that it lay apparently at the dorsal side of the two uppermost lateral polyps. Then succeeded three well-developed lateral polyps on the right side, and on the left only one smaller. The dorsal polyps were six in number, five of which had tentacles, but were small, the sixth being only rudimentary. Other two rudimentary polyps were placed at the ventral side of the right lateral lower individuals.

The best developed polypidom of all (fig. 37) showed in the middle on its ventral side the terminal polyp in which the axis was not visible with the exception of its end. Two large lateral polyps appeared on both sides, and between these and the terminal individuals, but on the ventral side of the lateral, five young polyps and a rudimentary one, the position of which is well shown by the figure. On the dorsal side four pretty well-developed polyps lay between the lateral ones, two larger in the middle, one above the other, and two smaller at the sides. Besides these, two very small polyps were situated between the left dorsal, the left lateral, and the terminal polyp, and two rudimentary ones at the same place on the other side.

Taken altogether, we may say that in the younger specimens the polyps show a regular bilateral arrangement. A terminal and two lateral polyps are the first expression of it. Then new buds arise, first on the dorsal, and then on the ventral side, and these are in part also decidedly bilateral. But such buds seem likewise to grow on the dorsal middle line, which fact would alter the symmetry. It may, however, be supposed that these are also in reality lateral, and that the polyps of *Umbellula* are essentially disposed in series on both sides of the rachis, which arrangement is veiled by the shortness of their seat of attachment.

The polyps of *Umbellula huxleyi* are dark brown in their upper parts and lighter below; they have the tentacles shorter than the bodies of the polyps, and regularly beset with short pinnulæ. A peculiar fact which was new to me is, that these polyps are retractile, but this retraction takes place very seldom, and was only to be seen in one specimen.

The stalk is somewhat rich in sarcosoma, especially at its enlargements, and shows only faint traces of colour, both ends being pale. Its most remarkable feature is the arrangement of the zooids, which are most numerous on the upper enlargement, which they cover on every side, with the exception only of the dorsal and ventral middle line. From this point, the zooids throng to the polypiferous portion and pass on to the terminal polyp nearly as far as the axis, whilst they end at the bases of the other polyps entering for a certain distance in the spaces which separate them. In the interior of the bunch of polyps no zooids are present.

The zooids just mentioned are visible to the naked eye, but the microscope is required to ascertain that, as in the *Umbellula güntheri*, they are also present on the remainder of the stalk and even on its lower enlargement. As far as I could ascertain without destroying the best specimen, they diminish gradually in number, and form a little below the middle of the stalk, one row only on each side, the individuals of which are 1·5 to 1·7 mm. apart.

The zooids of this *Umbellula* are large, 0·22 to 0·34 mm. in diameter, and have all one cylindrical tentacle, 0·28 to 0·58 mm. long, and 0·057 to 0·085 to 0·014 mm. broad. These tentacles were found in a very good state of preservation on the largest specimen, whilst the others did not show them at all, or only traces of them. I presume that they were not yet developed in the younger specimens; or that they are easily lost or not easily seen in certain cases because they are retractile.

Calcareous corpuscles of oblong form, with even surfaces, are only found in the muscular layers of the lowest part of the lower enlargement of the stalk. Their maximum length and width is 26 μ and 8 μ.

Size of the four specimens in millimeters—

	A.	B.	C.	D.
Length of the whole, ...	107 mm.	153	160	180
Length of the polypiferous part, . . .	12	11[1]	19	16
Length of the upper enlargement of the stalk, .	8	10	30	41
Breadth of the same, ...	1·5	1·5	3	2·5
Length of the lower swelling, ...	19	23	31	34
Breadth of the same, ...	1	2·3	1·9	2·5
Length of the polyps, ...	01	...	17	13

Habitat.—Station 235, North Pacific Ocean, south of Yeddo, lat. 34° 71′ N., long. 135° 39′ E. Depth, 565 fathoms. Bottom temperature, 3°·3 C. Mud. June 4, 1875.

7. *Umbellula carpenteri*,[2] n. sp. (Pl. X. figs. 38–40).

Indistinctly bilateral in the fully-developed state. Calcareous corpuscles only in the lowest part of the stalk. Polyps forming a rosette at the end of the stalk, long, colourless. Stalk with an enlargement at its upper end, which is directly continuous with the club-shaped rachis, and having a long enlargement at its lower end. Stalk here and there, but not in all specimens, with brown-red streaks and patches. Zooids numerous on the dorsal and ventral sides of the rachis, and along the whole stalk; all provided with one singly branched tentacle. Axis quadrangular, with deeply excavated surfaces and rounded edges.

Five specimens of this *Umbellula* showed a very interesting gradation from a bilateral to an apparently irregular arrangement of the polyps. One terminal and two lateral polyps are shown in fig. 39, *A*, *B*. Four polyps all lateral, with a free end of the rachis are visible in fig. 39, *C*. A third specimen had one terminal polyp, two lateral on the right and one only on the left side. In a fourth there were eight polyps, of different sizes, so disposed that they formed a rosette surrounding a small dorsal area of the rachis of a stellate

[1] Tentacles retracted.

[2] Named after my old frien[illegible] Carpenter, C.B., F.R.S.

form, but amongst these polyps the terminal one was easily recognisable, as the axis ended in its base, and the other seven could be interpreted as lateral polyps arising from a shortened rachis. The fifth specimen finally showed eight polyps, arranged in the form of a rosette, and surrounding like a cup a ninth middle polyp; but this was not the terminal one in which the axis ended, one of the eight had this signification.

The stalk has at its lower end a small bulb, which is continuous with a long enlargement, the transverse section of which is very evidently quadrangular. At the upper end the stalk begins again to enlarge at a certain distance from the polyps, and forms a club-shaped swelling directly continuous with the rachis. At this point the ventral surface is convex from right to left, whilst the dorsal aspect is flat or slightly concave. The whole upper swelling is also generally curved longitudinally, convex on the ventral, concave on the dorsal side.

The zooids show the same arrangement as those of *Umbellula huxleyi;* the only differences are, (1) that zooid-like bodies are situated between the polyps of the dorsal side of the rachis, (2) that their tentacles, the length of which is 0·3 to 0·5 mm., are generally, but perhaps not in every case, provided with two to three branchlets, and (3) that the zooids seem to be fewer on the lowest part of the stalk. The calcareous corpuscles of the end-bulb are of the same kind as those of *Umbellula huxleyi* but smaller, scarcely surpassing 15 μ in length.

	A.	B.	C.	D.	E.
Length of the whole polypidom, . .	51·5 mm.	105	280	393	485
Length of the polypiferous part, . .	5	16	...	47	...
Length of the polyp bodies, . . .	7·5	11	15	16	14
Length of the polyps with tentacles, . .	...	...	43	...	83
Breadth of the upper swelling of the stalk, .	...	...	5·5	3	6
Breadth of the lower swelling of the stalk, .	...	...	2·0	2·3	3·5
Breadth of the stalk in the middle, . .	...	...	0·6	1·0	1·3

Habitats.—Station 156, South Polar Sea, south-west of Australia, lat. 62° 26′ S., long. 95° 44′ E. Depth, 1975 fathoms. Diatomaceous ooze. February 26, 1874.

Station 157, lat. 53° 55′ S., long. 108° 55′ E. Depth, 1950 fathoms. Diatomaceous ooze.

8. *Umbellula magniflora*, n. sp. (Pl. XI. figs. 41, 42).

General appearance of *Umbellula huxleyi.* Polyps forming a bunch at the end of the stalk, without any trace of bilateral arrangement, and no distinct rachis. Stalk with a long swelling below, and a flattened and curved enlargement at its upper end. Zooids numerous on the upper enlargement of the stalk at the bases of the polyps, and also on the lower swelling of the stalk and in its neighbourhood. Calcareous bodies none. Axis quadrangular, with concave surfaces and rounded edges.

The only specimen of this *Umbellula* brought home by the Challenger is in a very bad state of preservation; nevertheless it is of great interest, as it is the only known *Umbellula* which resembles the *Umbellula* of Ellis and Mylius so much that it seems to be the same species, or at least to come very near it. The lower enlargement of the stalk is cylindrical below, and ends in a small bulb, in which the pointed end of the axis is contained. The upper portion of the lower swelling is quadrangular, of the same form as the axis, and larger than the lower portion. From the top of this swelling the stalk diminishes gradually in thickness, assuming its smallest diameter about the middle of the whole length, and enlarges slowly upwards, forming finally the upper enlargement at a short distance below the polyps. The upper swelling is flattened nearly to the point where the polyps are attached, and only in their immediate neighbourhood becomes more cylindrical, so as to form a kind of short peduncle for their attachment.

The polyps form a compact bunch, and seem to be placed all on one level. On a closer inspection the axis is seen to run into the base of one of them, and here a kind of short rachis is formed, which, however, is very different from the ordinary structures of this kind. The real arrangement of the polyps is such that the nine polyps visible from the outside surround a small inner area, which may be regarded as the dorsal side of the rudimentary rachis, and from the middle of this space one single full-grown central polyp arises, surrounded at its base by large wart-like zooids, which I am inclined to interpret as rudimentary polyps.

The zooids are very numerous on the upper part of the flattened enlargement, and leave only the two middle lines free. They then advance towards the bases of the polyps in such a manner as to form four pointed areas corresponding to the interspaces between them. These pointed areas, which are visible to the naked eye, appear to have been seen also by Ellis, and are figured by him at letter *N*. On the lower part of the upper enlargement of the stalk the zooids become less numerous, and, so far as I have been able to ascertain, they at length disappear, but they reappear on the lower swelling of the stalk and in its neighbourhood, where they seem to be pretty numerous, and to be arrayed in longitudinal lines. But I am not in a position to clear up totally their relations, as I could not destroy the only specimen of this interesting form.

The colour of this *Umbellula* is different shades of brown.

Length of the whole,	740 mm.
Length of the polypiferous portion,	50
Length of the upper swelling of the stalk,	85
Breadth of the upper swelling of the stalk,	7
Length of the lower swelling,	77
Breadth of the lower swelling,	6
Breadth of the stalk in the middle,	1·3–1·5
Length of the polyps,	45
Length of the tentacles of the polyps,	19
Length of the bodies of the polyps,	26

Habitat.—Station 147, South Sea, east of Kerguelen Island, lat 46° 16′ S., long. 48° 97′ E. Depth, 1600 fathoms. Bottom temperature, 0°·8 C. Globigerina ooze. December 30, 1873.

A fragment of an *Umbellula* in two pieces, dredged at Station 146—lat. 46° 46′ S., long. 45° 31′ E.; depth, 1375 fathoms; bottom temperature, 1°·5 C.; globigerina ooze—seems to belong to *Umbellula magniflora*. The principal argument in favour of this supposition, besides the habitat, is that the lower swelling of the stalk shows zooids as in that species, which are so well developed that I thought it right to show them in fig. 12. The upper part of the stalk is in so bad a condition that not a single polyp is preserved, so that nothing can be said of these parts. The length of both fragments, 251 mm.; breadth of the lower swelling of the stalk, 0·83 mm.; of the thinner part of the stalk, 0·42 mm.; diameter of zooids, 0·17 to 0·19 mm.

Family 3. Protocaulidæ.

Protocaulon, n. gen.

Sea-pens of the group of the Protocauleæ. Polyps sessile, without cells, disposed alternately on each side of the rachis in one single row. No calcareous corpuscles.

1. *Protocaulon molle*, n. sp. (Pl. VII. fig. 23).

The whole pen 26 mm. long. Stalk, 15 mm. long, 8·28 mm. thick, with the exception of the lower half, which has a maximum thickness of 0·57 mm. Rachis, 0·26 mm. Polyps, fourteen in number, four of which are rudimentary, with the partially retracted polyps not much longer than 0·58. Zooids (?). I think I have seen one zooid below each polyp, but as I could not destroy the only specimen of this sea-pen, this point was not ascertained. Axis round, 0·11 mm. thick, with shorter stout radiating fibres. Generative organs in the more developed polyps.

Habitat.—Station 169, north-east of New Zealand, lat. 37° 34′ S., long. 179° 22′ E. Depth, 700 fathoms. Bottom temperature, 4°·2 C. Grey ooze. July 10, 1874.

Family 4. Protoptilidæ.

Microptilum, n. gen.

Sea-pens of the family of the Protoptilidæ. Polyps with cells, sessile, disposed alternately on each side of the rachis in one single row. Cells triangular, with one strong spine on their ventral side. Zooids small, one single individual at the base of each cell on its ventral side. Axis round. Calcareous corpuscles in the rachis, the stalk, the cells, and the tentacles of the polyps.

1. *Microptilum willemöesi*, n. sp. (Pl. VII. fig. 27).

Small, rachis longer than the stalk. Stalk with very inconspicuous swellings. Polyp-cells of two kinds, larger and smaller; the larger, 2·8 to 3·4 mm. in length, alternate pretty regularly with the smaller, the size of which is about 0·8 mm., and which are to be regarded as belonging to developing polyps. Number of larger cells 12; underneath the lowest, three smaller cells follow, visible with the naked eye, and three or four zooid-like undeveloped polyps, which are only to be seen with the microscope. The polyps are the only coloured parts of the polypidom, and have brownish stomachs, while the rest of their bodies has a yellowish tint.

Zooids flat, oval, 0·37 mm. long, without spines.

Calcareous corpuscles of the form of needles, 0·86 mm. long on the rachis, and decreasing to from 0·080 to 0·14 mm. and less on the stalk.

Rachis broad, 0·70 mm.

Stalk 0·45 to 0·48 mm.

Length of the whole polypidom 65 mm., of the stalk 25 mm.

Habitat.—One single specimen from Station 235, south of Yeddo, lat. 34° 7′ N., long. 138° 0′ E. Depth, 565 fathoms. Bottom temperature, 3°·3 C. Mud. June 4, 1875.

Leptoptilum, n. gen.

Sea-pens of the family of Protoptilidæ. Polyps with cells, sessile, disposed alternately in one single row on each side of the rachis. Cells cylindrical, with eight long spines. No real zooids, but a certain number of rudimentary polyps between each pair of the full-grown individuals. Axis round, pointed, and straight at both ends. Calcareous corpuscles in the stalk, rachis, the cells, and the tentacles of the polyps

1. *Leptoptilum gracile*, n. sp. (Pl. VII. fig. 28).

Small, rachis longer than the stalk.

Stalk with a small enlargement at its upper end, and a little end-bulb.

Polyp-cells 2 to 3 mm. long, and 0·85 mm. broad, with eight well-developed spines at their opening, but disposed in such a manner that many of them appear to be opposite, which is in reality nowhere the case. Another peculiar feature is that the size of the polyp-cells does not decrease regularly towards both ends of the rachis, as is usually the case, but that in the centre smaller and larger cells are found without any rule in their distribution.

The polyps are the only coloured part of this sea-pen, their stomachs being brown, and the other parts yellow. The axis of the tentacles bears a row of calcareous needles 0·11 mm. in length.

The rudimentary polyps lie two to five in number, and 0·16 to 0·32 mm. and upwards in size, between each pair of developed polyps. They possess similar cells, but the tentacles are simple and have no calcareous needles. Between these rudimentary individuals and the full-grown polyps many intermediate stages may be found, and I have no doubt that this sea-pen grows not only at the end, but also by the formation of new individuals between the old ones.

The calcareous corpuscles are very numerous in the cells, and in the integument of the rachis, and have the form of long needles 0·35 mm. and upwards in length. On the stalk the needles are also very numerous, but they diminish gradually in size, and measure only 38 to 58 μ in its lower parts. In the end-bulb itself the muscular layer contains the same small oval bodies of 3 to 15 μ, which have been described in the genus *Anthoptilum*.

In the axis radiating fibres are wanting, and are represented by the same oval plates, which I have described in other Pennatulida.

Measurement of the largest specimen—

Length of the whole, ...	75 mm.
Length of the stalk, ...	23
Breadth of the stalk above and below, ...	0·58
Breadth of the rachis, ...	0·23–0·34
Breadth of the axis, ...	0·20

Habitat.—Several well-preserved specimens from Station 169, north-east of New Zealand; lat. 37° 36′ S., long. 179° 24′ E. Depth, 700 fathoms. Bottom temperature, 4°·2 C. Grey ooze. 10th July 1874.

Protoptilum, Köll.

1. *Protoptilum aberrans*, n. sp. (Pl. VIII. fig. 30).

General appearance of *Protoptilum carpenteri*, Köll. Polyps larger, disposed in one row only on each side of the rachis. Polyp-cells truncate at their upper end, without spines. Zooids dorsal, lateral, and ventral, larger than in *Protoptilum carpenteri*. Rachis with a swelling in which the sexual products are found, in the lower part, in the region of the undeveloped polyps.

Polyps disposed, partly alternately, partly nearly opposite, forming in general a single row on each side, but in some places showing a tendency to an arrangement in series of two; polyp-cells of the form of a cornucopia, 2·85 mm. long, and 1·14 mm. wide at the opening. Zooids of the form of the polyp-cells, 0·57 to 1·0 mm., with cells like the polyps. The number of zooids is much more numerous than that of the polyps, and they are placed without any apparent rule except at the lowest, thickest part of the rachis, where the zooids alternate with the here rudimentary polyps in such a manner that one dorsal and one ventral zooid is placed between two polyps.

Rachis, 0·85 mm. broad in the upper parts, increasing below to 1·7 mm. and 2·0 mm.

Colour of the cells of the polyps and zooids light red, and of the stems of the tentacles of the polyps pale red, which colour is occasioned by red calcareous needles. Besides these, colourless needles occur in all uncoloured parts of the rachis, and in the stems of the tentacles at their ends.

Axis cylindrical, 0·37 mm.

Habitat.—One single specimen from Station 44, North Atlantic, south of New York, lat. 37° 25′ N., long. 71° 40′ W. Depth, 1700 fathoms. Bottom temperature, 1°·7 C. Grey ooze. May 2, 1873.

2. *Protoptilum*, sp.

A fragment of a *Protoptilum* differing from *Protoptilum aberrans,* (1) by the more intense colour of the cells, (2) by the longer row of undeveloped polyps, (3) by the occurrence of only dorsal and ventral zooids, (4) by the smaller size of the polypidom, (5) by the more intense colour of the needles of the stems of the polyps, (6) by the absence of a swelling at the lower part of the rachis.

The fragment in question consists of a stalk, which has an upper swelling, and a large end-bulb.

Habitat.—Station 45, North Atlantic, south of New York, lat. 38° 34′ N., long. 72° 10′ W. Depth, 1240 fathoms. Bottom temperature, 2°·4 C. Mud. May 3, 1873.

3. *Protoptilum*, sp.

A second fragment comes nearer to *Protoptilum aberrans,* and differs from it only in the want of colour of the needles in the tentacles of the polyps, and in the absence of generative organs in the swelling of the rachis.

Habitat.—Station 46, North Atlantic, east of New York, lat. 40° 17′ N., long. 66° 48′ W. Depth, 1350 fathoms. Bottom temperature, 2°·3 C. Mud. May 6, 1873.

Trichoptilum, n. gen.

Sea-pens of the family of the Protoptilidæ. Polyps with cells, sessile, disposed alternately in one single row on each side of the rachis. Cells cylindrical, with eight strong spines. Zooids dorsal, one to three between the polyps, small, without spines. Axis quadrangular. Calcareous bodies numerous in the cells and tentacles of the polyps, very scarce in the sarcosoma of the rachis, abundant in that of the stalk.

1. *Trichoptilum brunneum*, n. sp. (Pl. VIII. fig. 31).

Long and slender. Rachis more than five times the length of the stalk. Length of rachis, 29 mm. of stalk, 5·3 mm. Stalk, with an upper enlargement of 1·6 mm. and an end-bulb of 2·6 mm. diameter, with short calcareous needles of 42 to 68 μ, which are very numerous in the upper parts, and diminish in number towards the end-bulb.

The polyps begin below with a long row of undeveloped individuals the real length of which cannot be ascertained owing to the bad state of preservation of this part of the polypidom. The developed polyps measure 1·2 to 3·2 mm. in length, are rather crowded, and so placed that smaller and larger are intermingled without any rule. Colour of the polyps brown, with the exception of the tentacles which are colourless, and contain calcareous needles of 0·15 mm. in length. Polyp-cells with strong colourless needles of 0·5 mm.

Rachis quadrangular, 0·76 mm. broad, brown on all four sides, from the colour of the epithelium of the longitudinal canals. Sarcosoma in small quantity, with some needles in its dorsal side.

Habitat.—One single specimen from Station 192, south-east of Ceram, west of New Guinea, lat. 5° 42′ S., long. 132° 25′ E. Depth, 129 fathoms. Mud. September 26, 1874.

Scleroptilum, n. gen.

Sea-pens of the family Protoptilidæ. Polyps without cells, sessile with broad bases, disposed on each side of the rachis in a single row. Zooids dorsal, apparently in one row. Axis round. Calcareous corpuscles of large size, abundant in the polyps and their tentacles, and in the sarcosoma of the rachis; those of the stalk numerous, but smaller.

1. *Scleroptilum grandiflorum*, n. sp. (Pl. VII. fig. 29).

Calcareous corpuscles in the smaller branches of the tentacles very few in number. Polypidom of medium size, uncoloured. Rachis longer than the stalk. Stalk, with an upper swelling, and an end-bulb. Polyps usually disposed in pairs, apparently opposite, while, on a closer inspection, it becomes evident that the two polyps of a pair never lie on the same level; nevertheless, regular alternation does not take place, the more so as in many places a single polyp is interposed between two pairs. The intermediate polyps, which are smaller than the others, may be looked upon as indications of new developing pairs, as we have seen that in several genera of the *Protoptilidæ* young polyps are developed between the old ones.

The single polyps are large and hard and stiff, from the great number of strong calcareous needles in their sarcosoma. Their length is about 5 mm.,—with extended tentacles, 6 mm.; and their breadth at the base 3 mm., and higher up, just below the tentacles, 1·5 mm. Nearly all are curved in such a manner that the tentaculiferous part is bent upwards; in some instances the curve is even stronger, and then the tentacles look towards the stalk.

The zooids measure at their base 0·42 mm., and are small conical prominences, with an elevation of not more than 0·2 mm. They are all dorsal, and form one single row, which is so disposed that one portion lies on the right, and the other on the left of the dorsal middle line. Their number is so small that it does not much surpass that of the polyps.

The rachis is cylindrical, with very little sarcosoma.

The axis is round, and measures in the lower part of the rachis 0·9 mm. in diameter.

The maximum length of the calcareous needles is 0·70 to 0·74 mm., and the breadth 0·14 mm. In the tentacles, needles of 0·40 to 0·45 mm. run up the aboral side of the stem, forming a strong axis, and two or three smaller needles are found in the base of each secondary tentacle. In the sarcosoma of the stalk and the rachis itself the needles are shorter and more slender, and go down to a size of 0·085 to 0·14 mm. in length, and 0·028 mm. in breadth.

Of three specimens of this sea-pen only one was entire, the second wanted the stalk, and the third the end of the rachis.

	A.	B.	C.
Length of the whole polypidom,	100 mm.	...	...
Length of the rachis,	62	140	...
Length of the stalk,	38	...	51·5
Upper swelling of stalk,	1·7	...	2·0
Upper swelling of end-bulb,	1·3	...	2·5

Habitat.—Station 241, North Pacific, east of Japan, lat. 35° 41′ N., long. 157° 42′ E. Depth, 2300 fathoms. Bottom temperature, 1·1° C. Red clay. June 23, 1875.

2. *Scleroptilum durissimum*, n. sp.

All smaller branches of the tentacles studded with calcareous corpuscles.

The Challenger collection contains only one imperfect specimen of this form, which comes very near *Scleroptilum grandiflorum*. The principal differences are the following :—

a. The polyps are smaller.

b. The smaller branches of the tentacles possess in their whole length at their aboral side a strong axis or train of needles of 0·054 mm. in length.

c. The needles of the sarcosoma of the polyps are a little shorter (0·28 mm. in length, 0·085 mm. to 0·11 in breadth).

d. The needles of the sarcosoma of the rachis are more numerous and longer.

Habitat.—Station 235, North Pacific, south of Yeddo, lat. 30° 7′ N., long. 138° 0′ E. Depth, 564 fathoms. Bottom temperature, 3°·3 C. Mud. June 4, 1875.

Section II.—RENILLEÆ.

Renilla, Lam.

1. *Renilla mülleri*, M. Schultze (Pl. XI. fig. 46).

The Challenger brought home a great number of this *Renilla*, of which I give in fig.

46 a more characteristic representation than those contained in my monograph of the Pennatulidæ.

Habitat.—Station 321, off Buenos Ayres, lat. 35° 2′ S., long. 55° 15′ W. Depth, 13 fathoms. Mud. February 25, 1876.

Section. III.—VERETILLEÆ.

Family 1. Cavernularidæ.

Cavernularia, Val.

1. *Cavernularia obesa*, Val.

Habitat.—Station 163*a*, off Port Jackson, Australia. Depth, 30 to 35 fathoms. June 3, 1874.

This *Cavernularia*, of which I had two specimens, is in its exterior forms so like *Clavella australasiæ* with which it was collected that it was necessary to investigate the calcareous corpuscles in order to distinguish them.

Family 2. Lituaridæ.

Lituaria, Val.

1. *Lituaria phalloides*, Pall. (?)

One single specimen of a *Lituaria* dredged by the Challenger agrees pretty well with *Lituaria phalloides.* Nevertheless, it differs in the following points, and may perhaps in future, when both *Lituariæ* are better known, be recognised as a new species :—

1. The sarcosoma of the bodies of the polyps is much thinner than in *Lituaria phalloides,* and contains some calcareous corpuscles.
2. The tentacles also contain some, but very few calcareous bodies.
3. The axis is provided with two excavations only at its uppermost part.
4. The calcareous bodies are furnished with longer excrescences and branches at their ends.

Habitat.—Station 233*a*, Kobi, Japan, lat. 34° 35′ N., long. 135 10′ E. Depth, 8 to 50 fathoms. Mud, sand. May 17–19, 1875.

Clavella, Gray.

1. *Clavella australasiæ*, Gray.

Of this rare Pennatulid the Challenger brought home two well-preserved specimens and several fragments. They agree with the typical form with this exception only, that the axis passes in some specimens very nearly to the lower end of the stalk.

Habitat.—Station 163*a*, off Port Jackson, Australia. Depth, 30 to 35 fathoms. Rock. June 3, 1874.

General Remarks.—After having described the Pennatulida collected by the Challenger, which consist of at least thirty-eight species and nineteen genera, amongst which seven genera and twenty-seven species are new to science, I think it right to conclude with some general remarks.

First of all I wish to propose a new systematic arrangement of the Pennatulida, as the one given by me in my monograph (pages 14, 295, and 436) has become incomplete in consequence of the newly-discovered forms and the addition to our knowledge derived from their study. The system I now propose is the following:—

Order PENNATULIDA.

I. Rachis with a bilateral arrangement of the polyps.
A. Rachis elongated, cylindrical.
AA. With pinnules or leaves.
Section I. PENNATULEÆ.

Pinnules well developed.
Sub-section I. PENNIFORMES.

Zooids situated on the pinnules.
Family 1. Pteroeididæ.

Genera *Pteroeides*, Herkl.
Godefroyia, Köll.
Sarcophyllum, Köll.

Zooids on the ventral and lateral sides of the rachis.
Family 2. Pennatulidæ.

Genera *Pennatula*, Lam.
Leioptilum, Verr.
Ptilosarcus, Gray.
Halisceptrum, Herkl.

Pinnules small.
Sub-section II. VIRGULARIEÆ.

Pinnules without a calcareous plate.
Family 1. Virgularidæ.

Genera *Virgularia*, Lam.
Scytalium, Herkl.
Pavonaria, Köll. (sp. *P. finmarchica*).

Pinnules with a calcareous plate.
Family 2. STYLATULIDÆ.

Genera *Stylatula*, Verr.
Dubenia, Kor. and Dan.
Acanthoptilum, Köll.

BB. Rachis without pinnules, polyps sessile.
Section II. SPICATÆ.

a. Polyps on both sides of the rachis in distinct rows
Sub-section I. FUNICULINEÆ.

aa. Polyps with cells.

α No ventral zooids.
Family 1. FUNICULINIDÆ.

Genera *Funiculina*, Lam. (sp. *F. quadrangularis*).
Halipteris, Köll. (sp. *H. christii*).

β. With ventral zooids.
Family 2. STACHYPTILIDÆ.
Genus *Stachyptilum*, Köll.

bb. Polyps without cells.
Family 3. ANTHOPTILIDÆ.
Genus *Anthoptilum*, Köll.

b. Polyps on both sides of the rachis in a single series or in indistinct rows.
Sub-section II. JUNCIFORMES.

aa. Polyps without cells.
a. Polyps large.
aa. Rachis elongated, cylindrical.
Family 1. KOPHOBELEMNONIDÆ.
Genera *Kophobelemnon*, Asb.
Sclerobelemnon, Köll.
Bathyptilum, Köll.

ββ. Rachis short.
Family 2. UMBELLULIDÆ.
Genus *Umbellula*, Lam.

β. Polyps small.
Family 3. PROTOCAULIDÆ.
Genera *Protocaulon*, Köll.
Cladiscus, Kor. and Dan.

bb. Polyps with cells.
Family 4. PROTOPTILIDÆ.
Genera *Protoptilum*, Köll.
Lygomorpha, Kor. and Dan.
Microptilum, Köll.
Leptoptilum, Köll.
Trichoptilum, Köll.
Scleroptilum, Köll.

B. Rachis expanded in the form of a leaf.

Section II. RENILLEÆ.
Family 1. RENILLIDÆ.
Genus *Renilla*, Lam.

II. Rachis with a radiating arrangement of the polyps.

Section III. VERETILLEÆ.

Calcareous bodies long.
Family 1. CAVERNULARIDÆ.
Genera *Cavernularia*, Val.
Stylobelemnon, Köll.

Calcareous bodies short.
Family 2. LITUARIDÆ.
Genus *Lituaria*, Val.
Veretillum, Cuv.
Policella, Gray.
Clavella, Gray.

With regard to the GEOGRAPHICAL DISTRIBUTION of the Pennatulida the new forms of the Challenger Expedition are of great interest, and confirm and extend the conclusion at which I arrived in my monograph.

As to their *horizontal* distribution, I wish to point out first of all the interesting fact that the Challenger Expedition seems to prove that the Pennatulida are not distributed over all seas in a regular manner. Over great tracts the Challenger did not find a single specimen of this order; for instance, in the Atlantic, between Buenos Ayres and Cape Finisterre (Stations 322 to 354), between the Canaries and the West Indies (Stations 1 to 42), between Bermuda, Madeira,[1] and the Cape de Verde Islands,[2] till near the Equator (Stations 58 to 105).

One *Umbellula* was found at Station 106,[3] and then nothing across the Atlantic to Cape St Roque, along the coast to Bahia, and again back across the Atlantic to Station 132, near Tristan d'Acunha. Nothing again on the way to the Cape of Good Hope, and up to Stations 146 and 147, where two *Umbellulæ* were found. From Station 147 to Melbourne, through the South Polar Sea, two *Umbellulæ* were dredged at Stations 156 and 157. No Pennatulidæ were found between Australia and New Zealand (Stations 164 to 168), none between these islands, past the Fiji and New Hebrides groups, to New Guinea (Stations 170 to 180), none between the Philippines and New Guinea, and thence to Japan (Stations 213 to 231), only two forms, an *Umbellula* and a *Scleroptilum* between Japan and the Sandwich Islands, and nothing from Hawaii through the whole Pacific Ocean to Valparaiso, through the Straits of Magellan, past the Falkland Islands to near Buenos Ayres (Stations 237 to 239).

It seems, therefore, reasonable to conclude, so far as our present knowledge goes, that the deeper portions of the Pacific and the Atlantic Oceans, and the South Polar Sea, contain very few or none at all of the Pennatulida at a certain distance from the shore.

I may add that Professor T. H. Studer, of Bern, who went with the German ship "Gazelle" round the world, and dredged in a good many places, found only six Pennatulida, which is the more worth mentioning as he dredged especially in shallow water and along the shore.

As to the horizontal distribution of the families of the Pennatulida, the following may be remarked:—

As I showed in my monograph, the Pteroeididæ have a well-defined centre in the south-east coasts of Asia, the Sunda Islands, and the Philippines, from which they spread, with few forms, as far as Japan, Australia, New Guinea, New Caledonia, the Carolines, the west coast of Africa and the Red Sea; *Pteroeides griseum* of the Mediterranean being quite an exception. The results of the Challenger confirm these data, as they make only three Pteroeididæ from the Philippines, Australia, and Japan.

The Pennatulidæ, on the contrary, have a wide distribution along the coast of Europe, the west coast of North America, the coasts of China, Japan, India (south-east coast), Australia, New Guinea, Africa (east coast). No Pennatulidæ are known from the east coast of North America, the west coast of South America, nor the west coast of

[1] Studer found at Madeira, *Cavernularia madeirensis.*

[2] Studer found here *Veretillum cynomorium*, var. *astyla.*

[3] Studer found an *Umbellula* and *Pavonaria africana*, Stud., near Station 97.

Africa. The Challenger found five new forms of Pennatulidæ from Australia, New Guinea, the Philippines, and Japan, amongst them four species (*Pennatula moseleyi, murrayi, naresi,* and *pearceyi*) which are nearer the known European types, and only one species with the soft leaves of the typical Asiatic and west American forms (*P. sulcata*).

The knowledge of the VIRGULARIDÆ has been augmented by the discovery of the habitat of *Scytalium sarsi* (Philippines), and the discovery of a new *Scytalium* from the same locality. The Virgularidæ, as I now define them, are widely distributed in the European seas (three species of *Virgularia,* two of *Dubenia*), the east and west coasts of America (all the species of *Stylatula* and of *Acanthoptilum*), the east coast of Africa (*Pavonaria africana,* Stud.), and the south-east Asiatic seas, as far as Australia (eight species of *Virgularia,* two of *Scytalium*).

The STACHYPTILIDÆ, PROTOCAULIDÆ, and PROTOPTILIDÆ, belonging to the simplest forms of the Pennatulida, have two centres, one in the Pacific Ocean, on the coasts of New Guinea (*Stachyptilum, Trichoptilum*), New Zealand (*Protocaulon, Leptoptilum*), and Japan (*Scleroptilum, Microptilum*), and one in the North Atlantic (*Protoptilum*), and North Sea (*Lygomorpha, Cladiscus*).

The ANTHOPTILIDÆ are limited to the east coast of America, but have a wide range from Halifax to Buenos Ayres and Tristan d'Acunha.

With regard to the KOPHOBELEMNONIDÆ, the VERETILLIDÆ, and the RENILLIDÆ, little new has been added to our knowledge through the investigations of the Challenger, with the exception of a new *Kophobelemnon* from Japan. Nevertheless, it is interesting to know that the limited distribution of these families has been confirmed. Professor Studer has lately found a *Veretillum* at the Cape de Verde Islands, and a *Cavernularia* at Madeira.

The distribution of the UMBELLULIDÆ is most remarkable. After having known for more than a century only one locality, the North Polar Sea, near the coast of Greenland, we have now learned that this form is far and widely distributed. *Umbellulæ* have now been obtained from the North Atlantic Ocean (between Portugal and Madeira); from the North Polar Sea, coast of Greenland; from the Atlantic Ocean, under the Equator, between Africa and America, and from the west coast of Africa, north of Sierra Leone (Stud.); from the South African Sea, west of Kerguelen Island; from the South Polar Sea; from the coasts of New Guinea and of Japan; and from the middle of the North Pacific Ocean (Station 246). *Umbellula* has, therefore, of all genera of Pennatulida the widest distribution.

Our knowledge of the *vertical* distribution of the Pennatulida has made great progress through the explorations of the Challenger. When I published my monograph I was justified in saying that the great majority of the Pennatulida were shallow-water animals, living in the vicinity of the coasts, at a depth of 6 to 10 or 20 fathoms; but now the number living at great depths has so increased that it is nearly equal to that of the shallow-water forms.

If we compare the two groups, it is obvious that the great majority of the higher forms of the families Pteroeididæ, Pennatulidæ, Virgularidæ, and Renillidæ live in shallow water. The only species going deeper than 100 fathoms, are—

	Fathoms.
Pennatula grandis, Ehrenb.,	150–200
P. phosphorea, var. *aculeata*, Köll.,	30–300
Dubenia abyssicola, Kor. and Dan.,	100–120
Pavonaria africana, Stud.,	360–
P. finmarchica, Sars,	240–300
Virgularia bromleyi, Köll.,	565–

Of the lower groups of the Pennatulida, only the Veretillidæ seem to live in shallow water (*V. cynomorium*, var. *astyla* was found by Studer, at the Cape de Verde Islands, in 115 fathoms). All the others are, with very few exceptions, deep-sea forms, as shown by the following list:—

	Fathoms.
Funiculinidæ.	
Funiculina quadrangularis, Blainv.,	20–350
Halipteris christii, Kor. and Dan.,	200
Stachyptilidæ.	
Stachyptilum macleari, Köll.,	129
Anthoptilidæ.	
Anthoptilum thomsoni, Köll.,	600
murrayi, Köll.,	1250
simplex, Köll.,	1900
Kophobelemnonidæ.	
Kophobelemnon stelliferum, var. *durum*, Müll.,	40–300
stelliferum, Köll.,	458–690
ferrugineum, Köll.,	345
(sp.),	700
Bathyptilum carpenteri, Köll.,	650
Umbellulidæ.	
Umbellula güntheri, Köll.,	1850
simplex, Köll.,	2050
leptocaulis, Köll.,	2440
durissima, Köll.,	565
huxleyi, Köll.,	565

	Fathoms.
Umbellula magniflora, Köll.,	1600
magniflora (?), Köll.,	1375
carpenteri, Köll.,	1950–1975
thomsoni, Köll.,	2125
lindahli, Köll.,	122–410
(sp. Studer),	360

PROTOCAULIDÆ.

Protocaulon molle, Köll.,	700
Cladiscus gracilis, Kor. and Dan.,	40

PROTOPTILIDÆ.

Protoptilum thomsoni, Köll.,	322
carpenteri, Köll.,	690
smitti, Köll.,	223
aberrans, Köll.,	1700
aberrans, var. Köll.,	1240
aberrans, var. Köll.,	1350
Lygomorpha sarsi, Kor. and Dan.,	80–100
Microptilum willemöesi, Köll.,	565
Leptoptilum gracile, Köll.,	700
Trichoptilum brunneum, Köll.,	129
Scleroptilum grandiflorum, Köll.,	2300
durissimum, Köll.,	565

It follows from all these facts, as I have already pointed out in my monograph (page 449), that the simpler forms of the Pennatulida, especially those with sessile polyps, inhabit great depths. The presence of their less complex representatives in deep water has also been shown in other invertebrate groups. These simpler forms are probably also the oldest, and may be regarded as the last remnants of an extinct primary creation. The Protoptilidæ and the Umbellulidæ are the principal representatives of these old forms, and of these two families especially the Challenger Expedition has discovered a large number of species with a wide distribution. This addition to our knowledge makes it possible to gain a better insight than formerly into the development of the whole group. On this point I may refer the reader to my often-quoted monograph, in which the phylogenetic development of the Pennatulida is treated on the 449th and following pages.

EXPLANATION OF THE PLATES.

Fig.

1. *Pennatula naresi,* Köll., from the ventral side.
2. The same from the dorsal side.
3. *Pennatula sulcata,* Köll., *a,* from the dorsal; *b,* from the ventral side.
4. A part of the dorsal side of *Pennatula sulcata* twice the natural size.
5. *Pennatula pearceyi,* Köll., twice the natural size.
6. *Pennatula murrayi,* Köll., from the dorsal side.
7. The same from the ventral side.
8. *Pennatula moseleyi,* Köll., from the dorsal side.
9. A part of *Pennatula moseleyi,* from the ventral side.
10. *Virgularia bromleyi,* Köll., fig. 1, natural size; fig. 2, from the ventral aspect fig. 3, from the sides,—four times the natural size.
11. *Virgularia gracillima,* Köll.
12. *Scytalium tentaculatum,* Köll., *d,* dorsal; *v,* ventral side.
13. A young leaf of *Scytalium tentaculatum* magnified; (*) the tentacles at the end of the not yet developed polyp-cells.
14. A smaller but developed leaf of *Scytalium sarsi.*
15. Undeveloped leaf of *Scytalium sarsi.*
16. *Anthoptilum thomsoni,* Köll., *v,* ventral side.
17. A part of the same from the side, the polyps cut to show the lateral zooids.
18. A tentacle of *Anthoptilum thomsoni.*
19. *Anthoptilum murrayi,* Köll.
20. Part of the same from the ventral side, three times the natural size.
21. The same from the dorsal side.
22. *Anthoptilum simplex,* Köll., *v,* ventral; *d,* dorsal side.
23. *Protocaulon molle,* Köll., three times the natural size.
24. *Stachyptilum macleari,* Köll., *A,* ventral; *B,* dorsal aspect.
25. A part of the dorsal side of the same, three times the natural size.
26. Calcareous corpuscles of the tentacles of *Stachyptilum.*
27. *Microptilum willemœsi,* Köll., *A,* natural size; *B,* three times the natural size.
28. *Leptoptilum gracile,* Köll., *A,* natural size; *B,* three times the natural size.

Fig.

29. *Scleroptilum grandiflorum*, Köll., *A*, natural size ; *B*, a part of the rachis three times the natural size.
30. *Protoptilum aberrans*, Köll., *A*, natural size ; *B*, three times the natural size ; 1, dorsal, 2, ventral side.
31. *Trichoptilum brunneum*, Köll., *A*, natural size ; *B*, part of the rachis three times the natural size.
32. *Umbellula durissima*, Köll., *A*, dorsal ; *B*, ventral side.
33. The same, upper part, three times the natural size.
34. *Umbellula güntheri*, Köll., *A*, ventral aspect of the whole fragment ; *a*, swelling of the stalk with zooids ; *B*, dorsal side of the upper part.
35. *Umbellula leptocaulis*, Köll., fragment from the ventral side.
36. *Umbellula simplex*, Köll., from the ventral side.
37. *Umbellula huxleyi*, Köll., *A*, natural size ; *B*, upper part three times the natural size.
38. *Umbellula carpenteri*, Köll., *A*, dorsal aspect ; *B*, ventral side of the upper part.
39. Three young forms of *Umbellula carpenteri*, Köll., *A* and *B* from the ventral side, *C* from the dorsal side.
40. *Umbellula carpenteri*, part of the stalk, about twelve times the natural size, to show the ramified tentacles (*t*) of the zooid. The shorter tentacles are in part broken.
41. *Umbellula magniflora*, Köll., upper part, natural size.
42. Part of the lower swelling of the stalk of *Umbellula magniflora*, from Station 146, to show the zooids, three times and a half the natural size.
43. *Kophobelemnon ferrugineum*, Köll., from the dorsal side.
44. *Kophobelemnon*, sp., from the side.
45. *Kophobelemnon burgeri*, Herkl., *A*, from the dorsal ; *B*, from the ventral side.
46. *Renilla mülleri*, M. Sch., part of frond ten times the natural size ; *p*, polyps retracted ; *q*, groups of zooids.

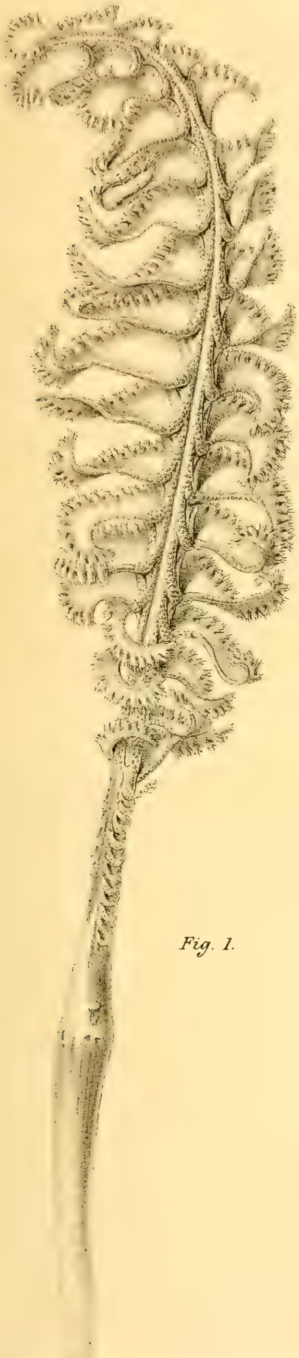


Fig. 1.

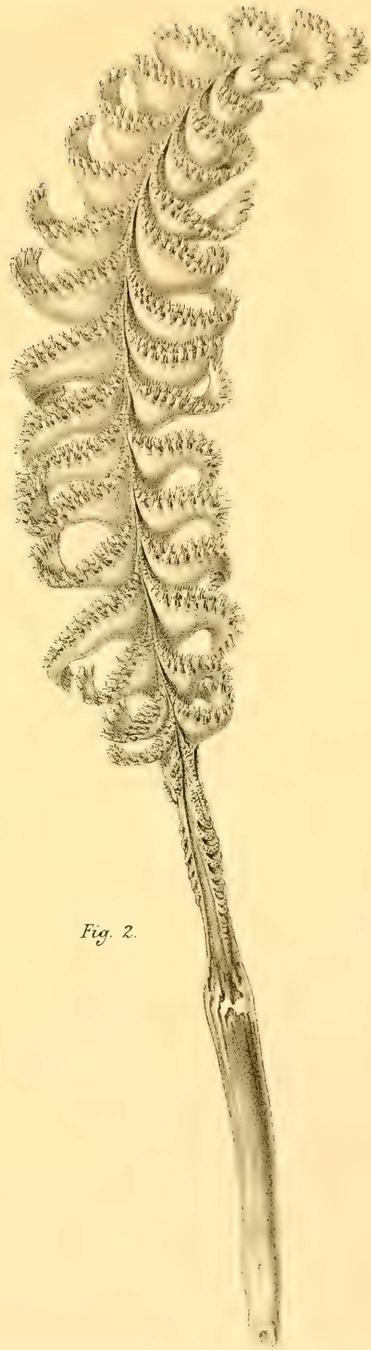
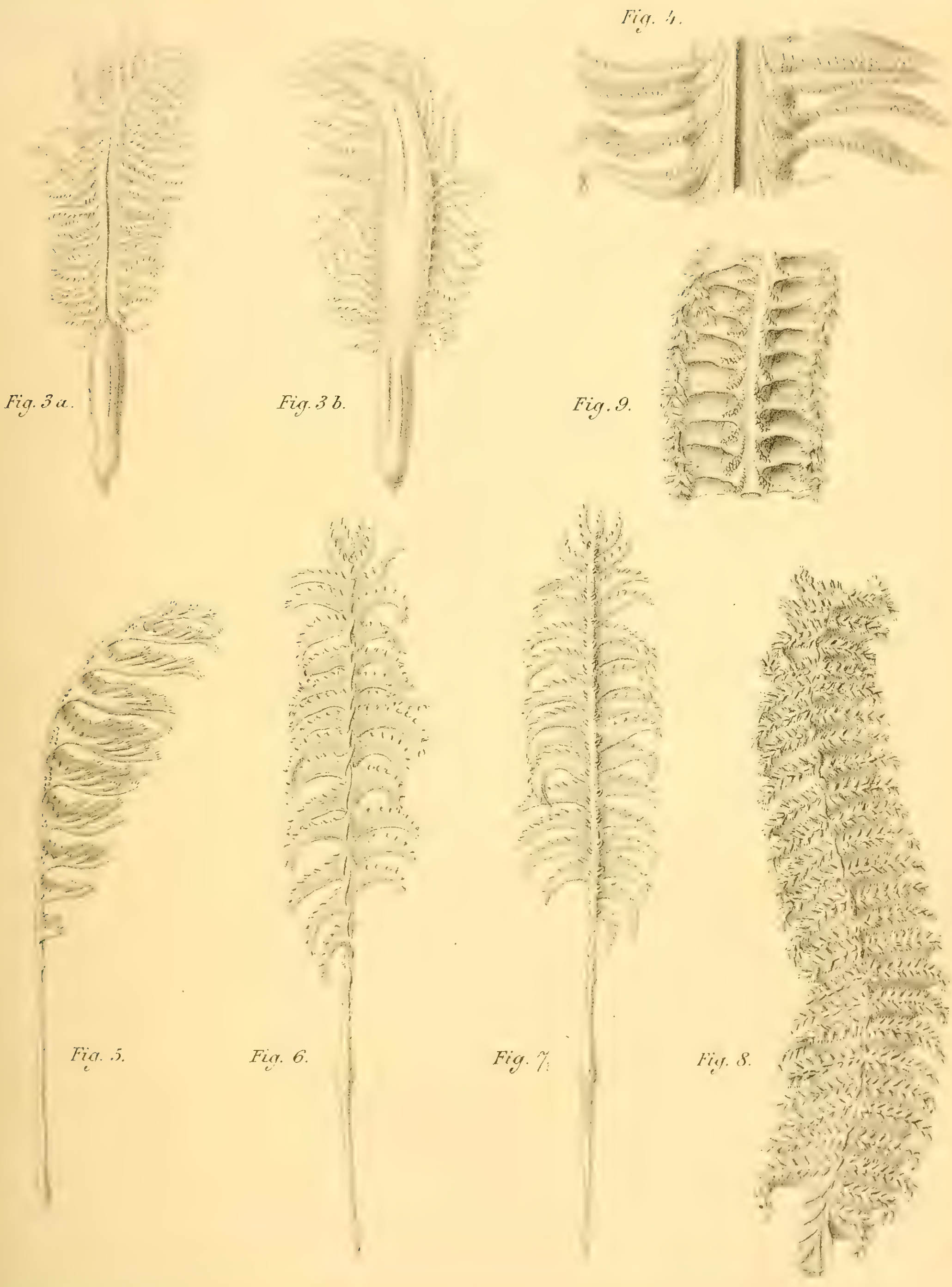


Fig. 2.

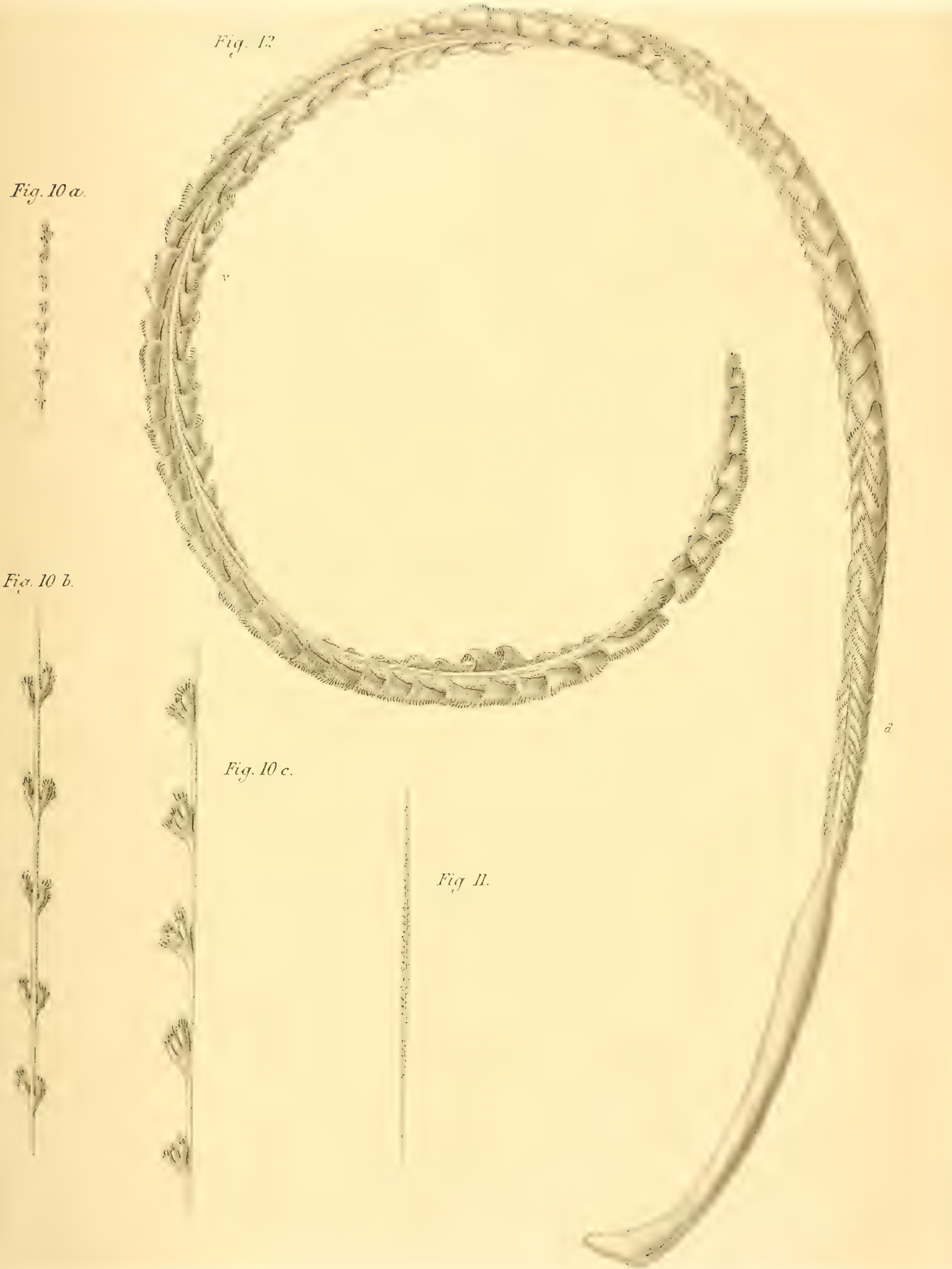
A. Rabus, del.

F. Huth, Lith.r Edin.r

PENNATULA.



PENNATULA.



A. Rabus, del.
F. Huth, Lith^r Edin^r

VIRGULARIA. SCYTALIUM.

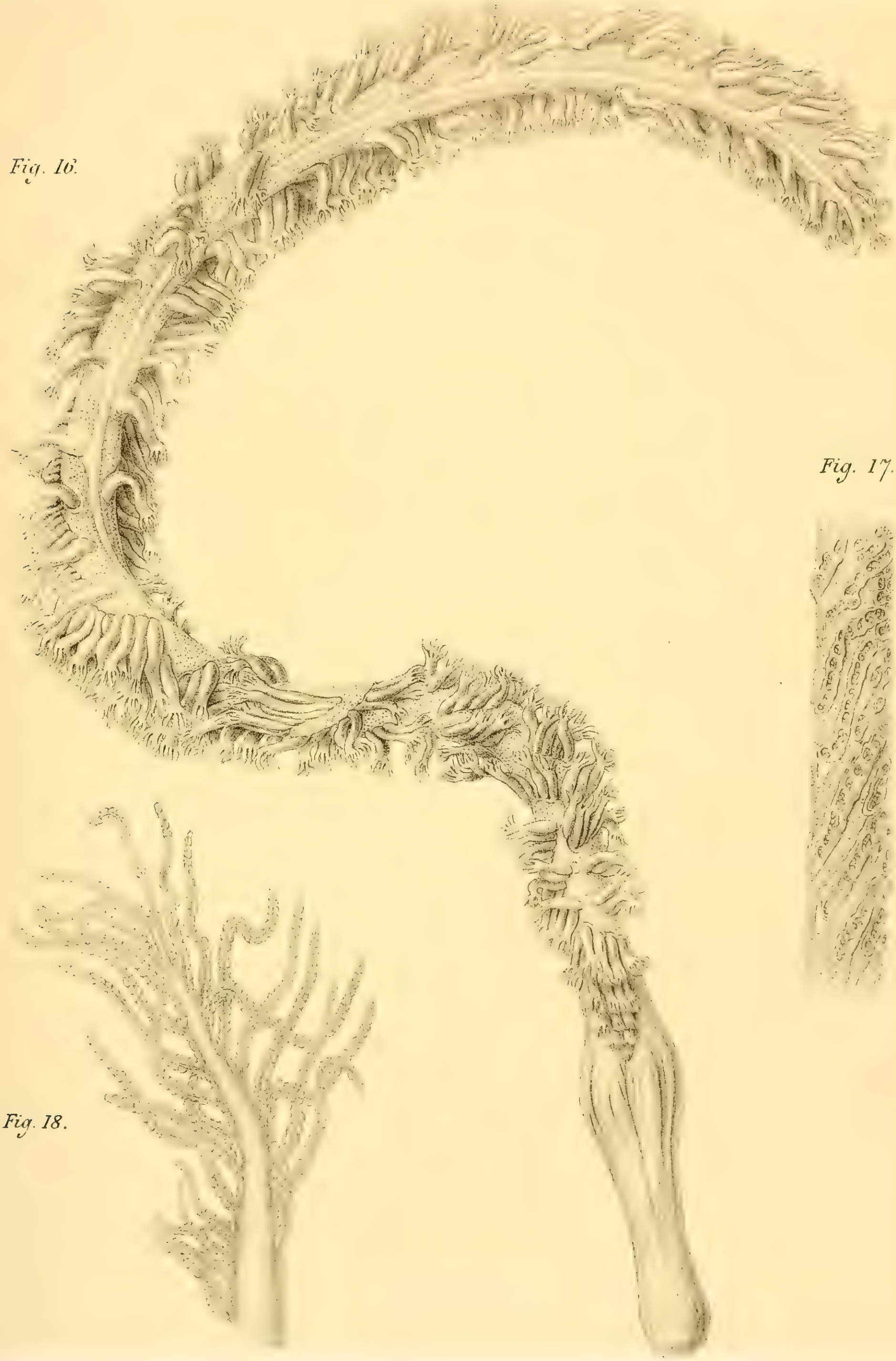


Fig. 16.

Fig. 17.

Fig. 18.

A. Rabus, del.

F. Huth, Lith^{r} Edin^{r}

ANTHOPTILUM.

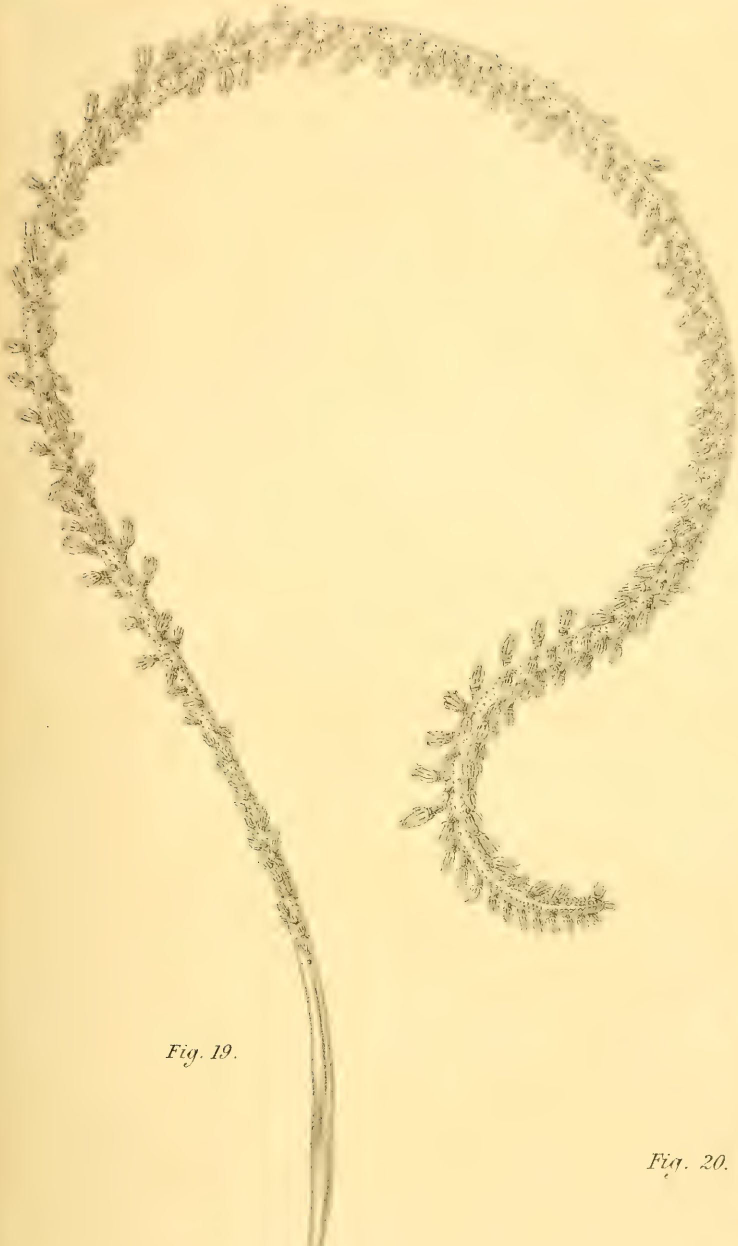


Fig. 19.

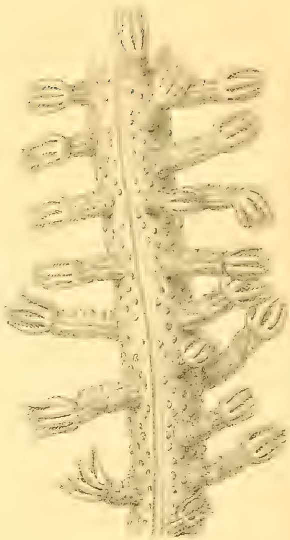


Fig. 21.

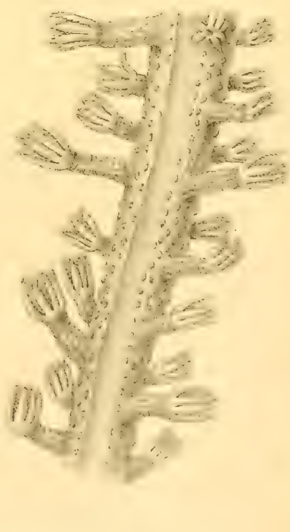


Fig. 20.

A. Rabus, del.

F. Huth, Lith. Edin.

ANTHOPTILUM.

Fig. 13.

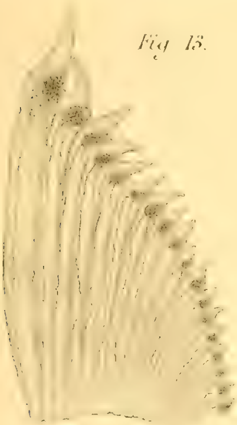
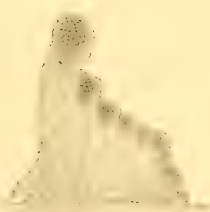


Fig. 22.

Fig. 14.

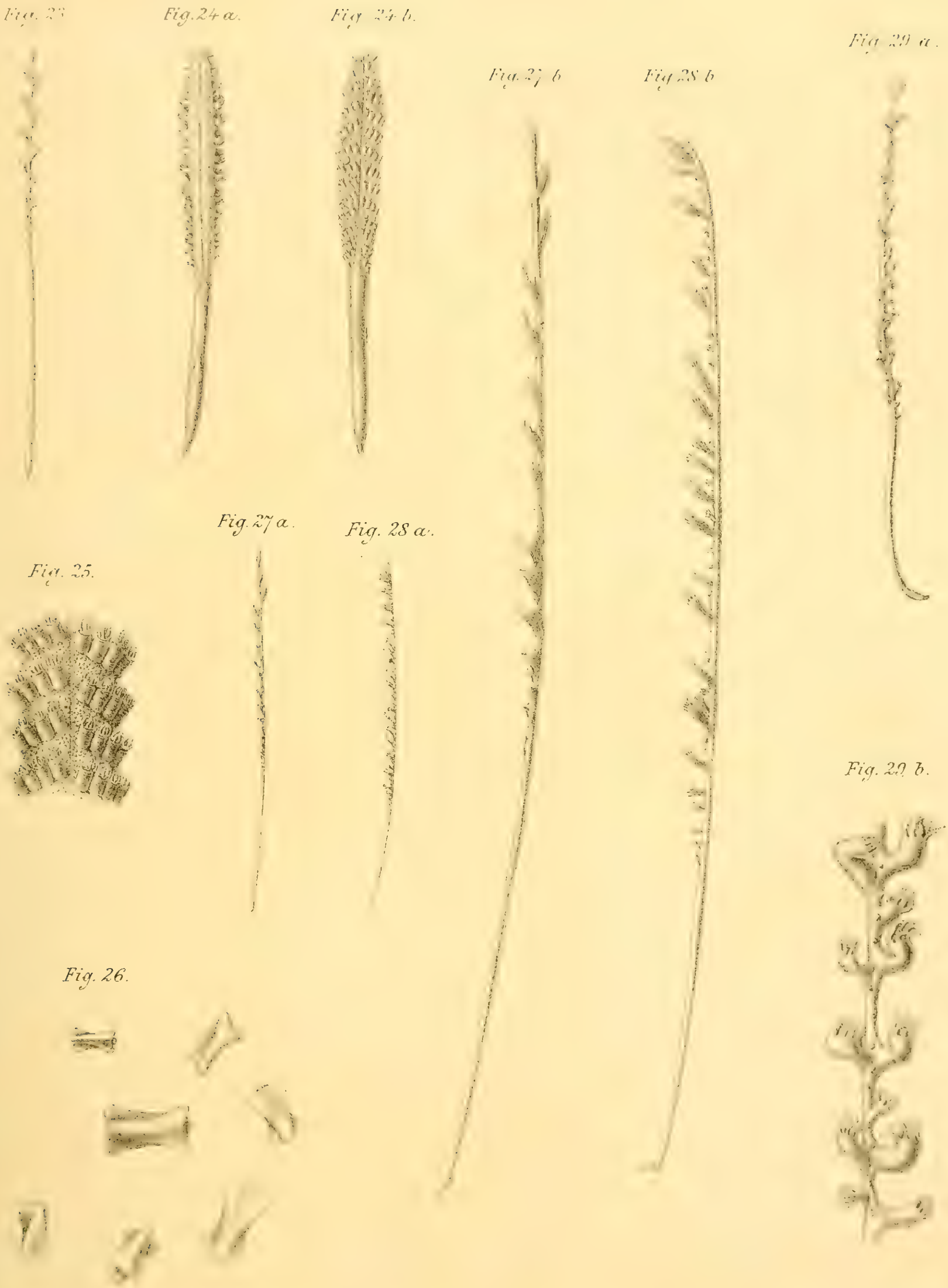
Fig. 15.



A. Rabus, del.

F. Huth, Lith. Edin.

SCYTALIUM. ANTHOPTILUM.

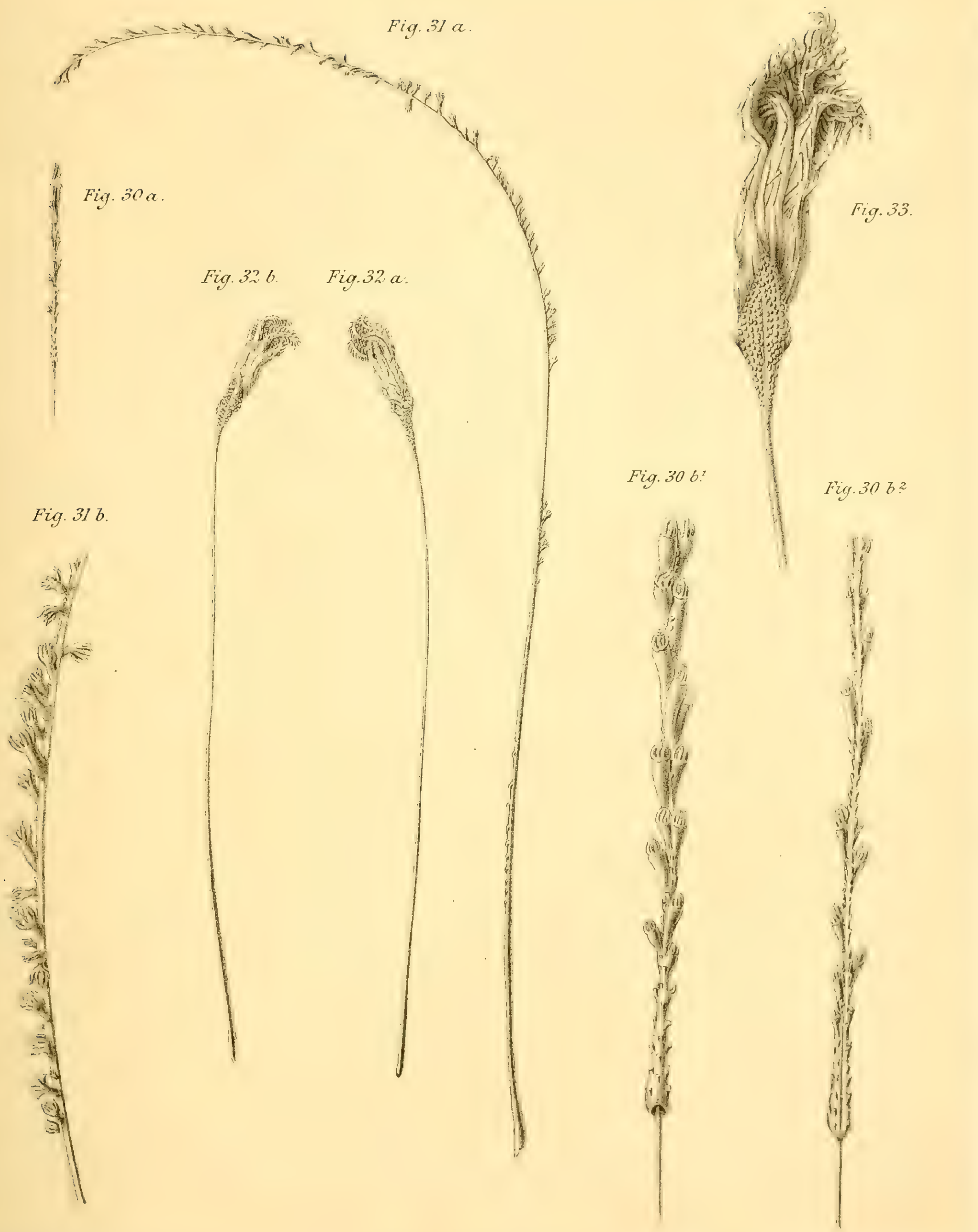


A. Rabus, del.

Huth, Lith.r Edin.r

PROTOCAULON. STACHYPTILUM. MICROPTILUM.

LEPTOPTILUM. SCLEROPTILUM.



A. Rabus, del.

F. Huth, Lith.r Edin.r

PROTOPTILUM. TRICHOPTILUM. UMBELLULA.

Fig. 34 a.

Fig. 35.

Fig. 36.

Fig. 37 a.

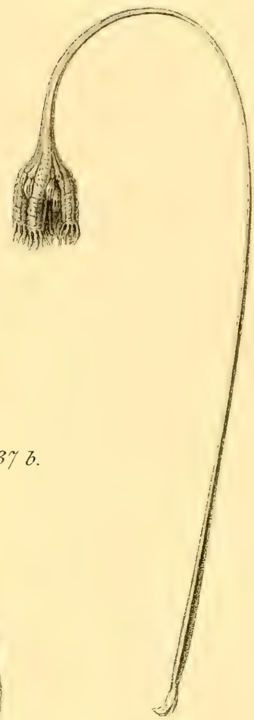


Fig. 37 b.

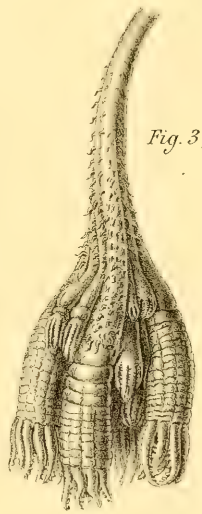
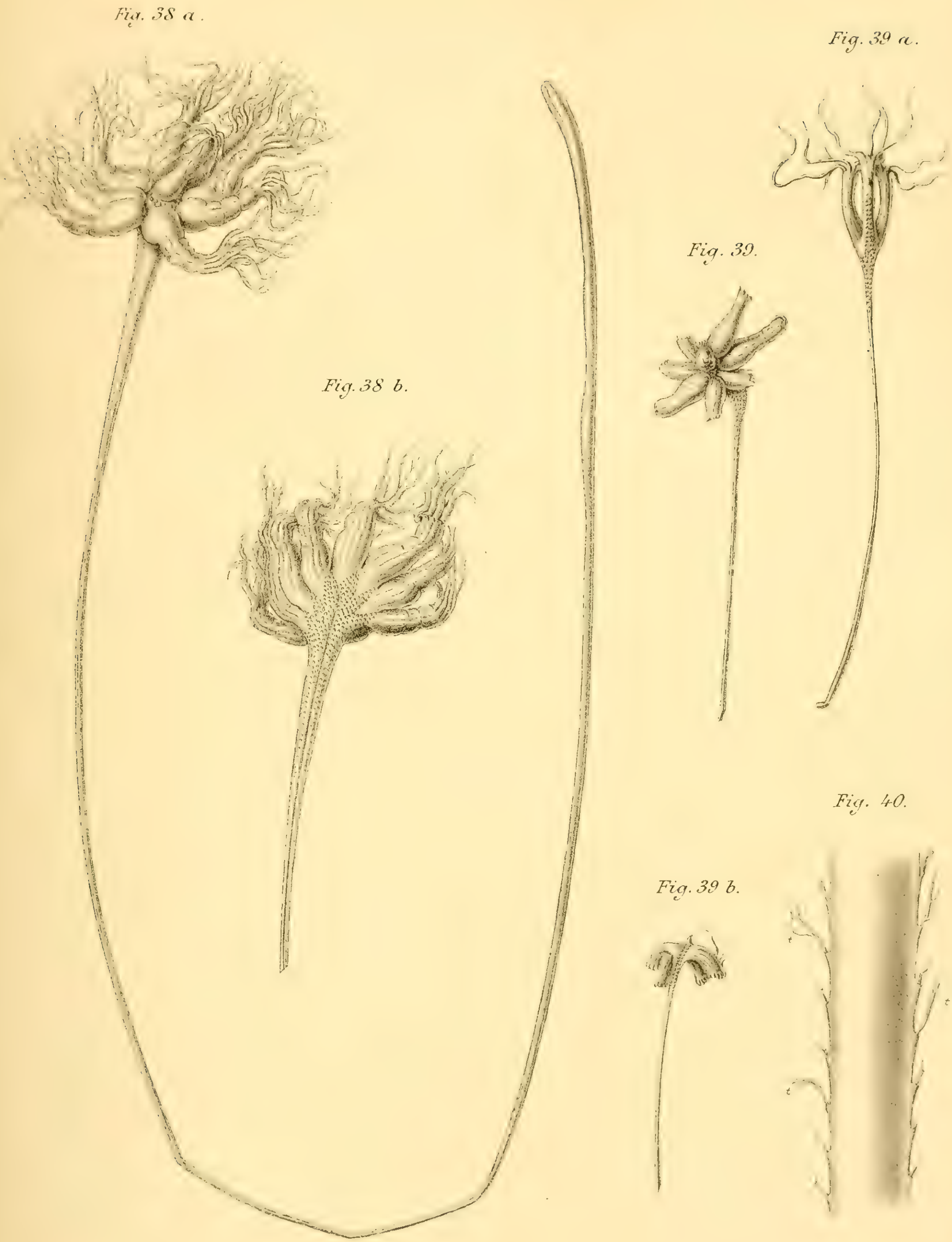


Fig. 34 b.

A. Rabus, del.

F. Huth, Lith.r Edin.r

UMBELLULA.



A. Rabus, del.

F. Huth, Lith^r Edin^r

UMBELLULA.

Fig. 41.

Fig. 45.

Fig. 43.

Fig. 42.

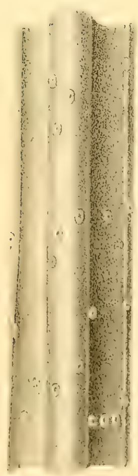
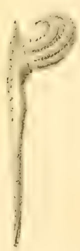


Fig. 46.

Fig. 44.



A. Rabus, del.

F. Huth, Lith^r Edin^r

UMBELLULA. KOPHOBELEMNON. RENILLA.

THE

VOYAGE OF H.M.S. CHALLENGER.

ZOOLOGY.

REPORT on the OSTRACODA dredged by H.M.S. Challenger during the years 1873–1876. By G. STEWARDSON BRADY, M.D., F.L.S.

INTRODUCTORY.

THE extreme depths of the sea, though supporting an abundance of animal life of many kinds, nevertheless present conditions very unfavourable, it would seem, to the existence of the particular group which forms the subject of this report. So that in those large abyssal areas where, as commonly happens, the ocean-bed consists of pure globigerina ooze or of "red clay," one searches usually in vain for traces of OSTRACODA; and when these do occur their numbers are extremely small, the specimens usually consisting of detached valves, frequently much worn or broken. It would not, however, be fair to assume from these appearances that the specimens had been transported, by currents or otherwise, from shallower waters,—still less that they had subsided, as is probable in the case of many Foraminifera, from the water above; seeing that the species found in these abysses are usually quite incapable of swimming. We must, therefore, conclude that Ostracoda do live, though in very limited numbers, in the most profound depths of the sea.

The list given below includes the names of all species found in dredgings beyond a depth of 500 fathoms, the total number being fifty-two species from twenty-nine dredgings, the number of individuals being likewise very small. And if we exclude from consideration all but the very greatest depths, from 1500 fathoms downwards, the paucity of species becomes still more apparent. To exhibit this clearly, I print a list of the species found in thirteen dredgings, from depths of more than 1500 fathoms; the number of species here is nineteen,[1] a result sufficiently striking when compared with such single shallow-water dredgings as that from near Booby Island (see list, p. 21), which shows twenty-eight species; from Torres' Straits (p. 21), nineteen; Balfour Bay, Kerguelen Island (p. 16), nineteen; or Port Jackson (p. 19), twenty-three species.

[1] Two out of the nineteen are species of *Halocypris*, which in all probability got into the dredge during the process of hauling in, so that the number might not unfairly be put down as seventeen.

List of Abyssal Species found in Depths exceeding 500 Fathoms.

Bythocypris reniformis, n. gen. and sp.
elongata, n. gen. and sp.
Argillœcia eburnea, n. sp.
Bairdia acanthigera, G. S. Brady.
abyssicola, n. sp.
exaltata, n. sp.
formosa, G. S. Brady.
foveolata, G. S. Brady.
hirsuta, n. sp.
milne-edwardsi, G. S. Brady.
minima, n. sp.
victrix, G. S. Brady.
Macrocypris canariensis, n. sp.
similis, n. sp.
Cythere acanthoderma, n. sp.
adunca, G. S. Brady.
circumdentata, n. sp.
dasyderma, n. sp.
dictyon, n. sp.
dorsoserrata, n. sp.
ericea, n. sp.
irpex, n. sp.
normani, G. S. Brady.
pyriformis, n. sp.
radula, n. sp.
serratula, n. sp.
Cythere speyeri, G. S. Brady.
squalidentata, n. sp.
scutigera, G. S. Brady.
stolonifera, n. sp.
suhmi, n. sp.
sulcato-perforata, n. sp.
viminea, n. sp.
Krithe bartonensis, Jones.
producta, n. sp.
tumida, n. sp.
Loxoconcha africana, n. sp.
Xestoleberis curta, G. S. Brady.
expansa, n. sp.
variegata, n. sp.
Cytheropteron abyssorum, n. sp.
fenestratum, n. sp.
mucronalatum, n. sp.
Pseudocythere caudata, G. O. Sars.
Cytherideis nana, n. sp.
Xiphichilus arcuatus, n. sp.
Cypridina gracilis, n. sp.
Crossophorus imperator, n. gen. and sp.
Cytherella lata, n. sp.
punctata, G. S. Brady.
Halocypris imbricata, n. sp.
atlantica, Lubbock.

List of Species obtained from Dredgings exceeding 1500 Fathoms in Depth.

Bairdia abyssicola, n. sp.
minima, n. sp.
hirsuta, n. sp.
Argillœcia eburnea, n. sp.
Cythere acanthoderma, n. sp.
circumdentata, n. sp.
dasyderma, n. sp.
dictyon, n. sp.
squalidentata, n. sp.
normani, G. S. Brady.
Cythere suhmi, n. sp.
Krithe producta, n. sp.
tumida, n. sp.
Xestoleberis expansa, n. sp.
Pseudocythere caudata, G. O. Sars.
Cytheropteron abyssorum, n. sp.
mucronalatum, n. sp.
Halocypris imbricata, n. sp.
atlantica, Lubbock.

The total number of dredgings examined for the purposes of this memoir is about 150, besides a considerable number of surface-gatherings from the tow-net. A large number of the samples, more especially those from great depths, consist largely of globigerina ooze or red clay, and in these Ostracoda are usually quite wanting. No account has been kept of such barren dredgings, but lists are given in all cases where even one species in recognisable condition was found. The number of such lists here printed (pp. 12–30) is seventy-one, exclusive of the surface-net gatherings, so that it may be accepted as pretty nearly the fact, that one-half of the dredgings contain no traces of the existence of living Ostracoda. In by far the greater number of cases the specimens consist of detached valves, or of perfect, though empty, shells. When any vestige of the soft parts remained it was carefully examined, and three new genera, *Phlyctenophora, Bythocypris,* and *Crossophorus* are here described as a result of such investigation; some little new knowledge has also been gained of the characters of other genera. Still, as a whole, the results of the Challenger's work in this department are disappointing. I had thought it possible that in this, as in other departments of zoology, forms might have been found connecting our own age more distinctly than has hitherto been done, with bygone geological epochs, or, even more probably, showing new and remarkable variations of structural type. But these anticipations have in no way been realised. Amongst the marine Ostracoda of the British Islands alone we have at least thirty different genera represented. The whole of those brought home by the Challenger are distributed amongst twenty-eight genera, the British genera absent from the Challenger lists being *Potamocypris, Sarsiella, Darwinella, Eucythere, Bradycinetus,* and *Conchœcia.* But the comparison is scarcely, in this form, a fair one. The work of the Challenger gave us no collections whatever from between tide marks, nor from the laminarian zone, and these two zones usually swarm with microzoic life of all kinds. The genus *Paradoxostoma,* in British seas, is almost exclusively a littoral one, and it is in this zone that many members of other genera attain their best development. I do not doubt that shore-collecting in the tropical and sub-tropical seas would yield rich results to a student of the Ostracoda; and it has this great advantage over the dredge, that specimens are readily obtained living and unmutilated.

Geographical distribution may most readily be studied by dividing the area explored into several districts, arranging under each the species met with within its limits. With this view I propose to divide amongst seven areas the whole of the Challenger explorations:—

1. North Atlantic Ocean (Stations 1 to 110 and 348 to 354).
2. South Atlantic Ocean (Stations 111 to 142 and 313 to 347).
3. South Indian Ocean (Stations 143 to 160).
4. Australasia, including the coasts of Australia, New Zealand, and the Eastern Archipelago south of the Equator (Stations 161 to 196 and 217 to 220).
5. South Pacific Ocean (Stations 271 to 312).
6. North Pacific Ocean (Stations 238 to 270).
7. Eastern Asia, including China, Japan, and the Eastern Archipelago north of the Equator (Stations 197 to 216 and 231 to 238).

A glance at the table of distribution will show that only two Ostracoda are found pliant enough to live in all of these seven areas; these are two natatory pelagic species, *Halocypris atlantica,* Lubbock, and *Halocypris breviostris,* Dana. The reason of this wide distribution is sufficiently clear; to animals living mostly near the surface of the sea, and dependent, probably, upon no restricted or specially localised supplies of food, the only impediment to universal distribution must probably be connected with temperature. So far as yet appears the limits of endurance in these creatures are reached at about 50 degrees south, and 35 degrees north of the Equator. Dr Claus, however, describes a Mediterranean[1] species, which is either identical with, or very closely allied to *Halocypris atlantica*, Lubbock. But this habitat, in any case, only very slightly increases its northward range. Next to these *Halocyprides*, the species which most nearly approach a cosmopolitan character are three *Cytheres*—*Cythere acanthoderma*, *mihi*, *Cythere dictyon*, *mihi*, and *Cythere dasyderma*, *mihi*, each of which occurred in five or six of the seven provinces. This statement, however, by no means expresses their ubiquitous distribution in the deep sea,—a fact which only becomes fully apparent when we find that amongst the forty-five lists of dredgings from depths of over 100 fathoms, *Cythere dictyon* is noted twenty-three times, *Cythere dasyderma*, nineteen times, and *Cythere acanthoderma*, seven times. *Krithe producta* appears in six out of the seven provinces, and is certainly one of the most common of deep-water Ostracoda, but the greater number of the examples grouped under this name consist only of separated valves, varying largely in form and size, and, it may be, belonging to more than one species. The difficulty of dealing with imperfect specimens of shells which possess no distinctive character of sculpture or surface-ornament is insuperable. In glancing over the columns of the tables of distribution, one notes instantly that the Australasian province possesses far more than an even share of species; the genera *Macrocypris*, *Bairdia*, and *Cytherella* are especially strongly represented there. Out of eight species of *Macrocypris* this province shows five, of twenty-two *Bairdiæ* it has sixteen, and of thirteen *Cytherellæ* ten. One reason for this abundance of species, I believe to be that we have a large proportion of shallow-water dredgings from this province. As to the relations between the Ostracoda of distant parts of the globe and those of the European seas,—or rather of the British and Scandinavian seas, those being the only districts which, as yet, have been tolerably well explored,—some scanty, though interesting observations, may be made. I have, elsewhere, had occasion to note the occurrence at Kerguelen Island of a very common European copepod, *Harpacticus fulvus*, which in that distant spot inhabits precisely the same sort of places as in Europe. And, now, in the lists of the Kerguelen Island Ostracoda, we may notice an affinity with the European fauna much closer than that of any other locality coming into the scope of this memoir. The British residents found in this distant home are *Pseudocythere caudata*, G. O. Sars; *Sclerochilus contortus* (Norman); *Paradoxostoma abbreviatum*, G. O. Sars; *Krithe bartonensis* (Jones); *Xestoleberis depressa*, G. O. Sars; and *Polycope orbicularis*, G. O. Sars. Some well-known northern forms: *Cythere stimpsoni*, G. S. Brady; *Cythere tenera*, G. S. Brady; *Loxoconcha guttata* (Norman); *Cytheropteron intermedium*, G. S. Brady; and *Paradoxostoma ensiforme*, G.

[1] Ueber die Geschlechtsdifferenzen von *Halocypris*, Prof. Dr C. Claus, Zeitschr. f. wissensch. Zool. Bd. xv. 4 Heft, 1865.

S. Brady, appear in our list only on the strength of their having been seen in anchor-mud from a European Station, Vigo Bay. The fact, however, is instructive, and leads to the inference that these particular species do not much overstep the European boundary; the Vigo specimens, indeed, are in the case of some species depauperated, and have not the well-marked characters which usually belong to British examples. Amongst familiar northern species which reappear in distant parts of the world, besides those which have already been noted as occurring at Kerguelen's Land, are *Paracypris polita*, G. O. Sars; *Pontocypris trigonella*, G. O. Sars; *Bairdia acanthigera*, G. S. Brady; *Bairdia crosskeiana*, G. S. Brady; *Cythere crispata*, G. S. Brady; *Cythere prava*, Baird; and *Cythere speyeri*, G. S. Brady. And this list might be further extended were I to add the names of some which were first described from sponge-sand specimens, supposed to have come from the Levant, but which, I now think, were very probably from the East Indies. Except *Krithe bartonensis*, Jones; *Cythere canaliculata*, Reuss; *Cythere polytrema*, G. S. Brady; and perhaps *Bairdia ovata*, Bosquet, no Ostracoda have been met with which can be referred with certainty to species described by palæontologists;[1] but the somewhat strained and diagrammatic drawings given by many authors render identification extremely difficult, and it is not unlikely that, were the actual specimens at hand for comparison, some further identifications might be made. As to the specimens which I have thought it allowable to refer to *Pontocypris faba*, Reuss (see p. 37), some doubt may be entertained, but they bear a very close likeness indeed to shells so named by me in a memoir on the Ostracoda of the Antwerp Crag, from which formation *Cythere polytrema* also was obtained.

The labour attending the mere preparation of a quantity of dredged material for microscopic investigation—the sifting, picking out, and sorting of specimens—is necessarily very great, and to treat in this way the whole of the samples brought home by the Challenger would have been impossible. The dredgings reported upon in this memoir were, however, carefully selected so as to include representatives of all kinds of bottoms, taken from all parts of the area worked over by the expedition. And, I must add, that, with the limited leisure at my command, I should have been quite unable to get through the work in any reasonable time, had I not been favoured with the kind help of my brother, Mr H. B. Brady, F.R.S., whose materials—carefully prepared for the examination of the Foraminifera, and, therefore, equally available for the Ostracoda—have been entirely placed at my disposal. To him my best thanks are due, and, likewise, to Mr Walter Purkiss, for the care and labour which he has bestowed upon the drawing and lithographing of the plates; all of which, I can attest, give faithful and characteristic representations of the species portrayed.

In the arrangement of the main groups of the Ostracoda I follow G. O. Sars, whose subdivision into sections and families is exhibited in the following synopsis, with the addition only of the DARWINELLIDÆ,—a family described by Mr D. Robertson and myself since the publication of Professor Sars' memoir.

[1] In this statement I leave out of view Post-Tertiary species, of which several might have been named as occurring amongst the Challenger dredgings.

Class *Crustacea*, sub-class *Entomostraca*, order *Gnathostomata*, legion *Lophyropoda*, tribe *Ostracoda*.

Posterior Antennæ.		Feet.		
Simple, subpediform, geniculate, clawed at the apex, not very unlike the anterior antennæ; both pairs either bearing long setæ and adapted for swimming, or shortly setose and not used for swimming. Mandibles distinct, mostly strongly toothed at the lower extremity; palp of moderate size, and bearing a more or less developed branchial appendage. First pair of maxillæ bearing a large branchial plate. Feet.		Two pairs, the last pair bent up within the valves. Postabdomen usually forming two elongated narrow rami, which are usually clawed at the apex.	Cypridæ.	PODOCOPA.
		Two pairs, both ambulatory and nearly alike in structure. Postabdomen rudimentary, forming two small conical processes.	Darwinellidæ.	
		Three pairs, all ambulatory, much alike in structure, and directed forwards. Postabdomen rudimentary, forming two very small lobes. Antennæ very little adapted for swimming.	Cytheridæ.	
Two-Branched.	One branch rudimentary, immobile; the other elongated, cylindrical, flexible, many-jointed, armed with long natatory setæ arranged in a single series; basal portion very large and stout, filled with muscular bands. Anterior antennæ scarcely natatory. Mandible-palp very large, geniculate, subpediform, destitute of a branchial appendage. First pair of jaws without a branchial plate. Postabdomen divided into two broad plates, which are unguiferous behind. Feet.	One pair only, of singular shape, forming an elongated, curved, flexible, annulated, vermiform appendage, which is spiniferous towards the apex. Anterior antennæ large, distinctly jointed, geniculate at the base. Mandibles proper obsolete. Second pair of jaws bearing a large branchial plate. Eyes compound, pedunculated, widely separated; between the two in front a large simple eye and a short, frontal tentacle.	Cypridinidæ.	MYODOCOPA.
		Two pairs, the posterior very small and rudimentary; the anterior provided, like the second pair of jaws, with a small, lobed branchial plate. Anterior antennæ of the female small and weak, immobile, and indistinctly jointed. Mandibles distinct. No eyes. Frontal tentacle very large, and mostly dilated at the apex.	Conchæciadæ.	
	Both branches well developed, movable, and natatory. Anterior antennæ also natatory, not geniculated, ending in a lash of long setæ. Mandibles distinct; palp short and scarcely pediform, provided with a small branchial appendage. Two pairs only of thoracic appendages; the anterior large, bifid, natatory; the posterior membranaceous and branchial. Eyes wanting. Postabdomen divided into two short laminæ, spinous behind.		Polycopidæ.	CLADOCOPA.
	Flattened, similar to the feet of the *Copepoda*, basal portion bi-articulate and geniculated; branches flattened, composed of few joints, and bearing numerous setæ on both margins. Anterior antennæ very large and strong, many-jointed, geniculated at the base, shortly spiniferous. Mandibles small and weak, palps large. Three pairs only of thoracic appendages, all maxilliform. Palp of mandible and first maxilla bearing on the inner side a comb of large setæ. First and second pairs of maxillæ provided with a large branchial plate; third pair rudimentary in the female, in the male well developed and prehensile. Postabdominal rami small and narrow, distinctly separated, and spiniferous at the apex.		Cytherellidæ.	PLATYCOPA.

Geographical Distribution of the Ostracoda obtained by H.M.S. Challenger.

Cypridæ.	1 North Atlantic.	2 South Atlantic.	3 South Indian Ocean.	4 Australasia.	5 South Pacific.	6 North Pacific.	7 Eastern Asia.
Paracypris polita, G. O. Sars,	+			+	(?)		
Phlyctenophora zealandica, n. gen. and sp.,				+			
Aglaia clavata, n. sp.,				+			
meridionalis, n. sp.,		+					
obtusata, n. sp.,			+				
pusilla, n. sp.,				+			
Pontocypris attenuata, G. S. Brady,				+			+
faba (?) (Reuss),				+		+	
simplex, n. sp.,		+					
subreniformis, n. sp.,		+		+			
trigonella, G. O. Sars,	+						
Argillœcia badia, n. sp.,				+			
eburnea, n. sp.,		+	+				
Macrocypris canariensis n. sp.,	+						
decora, G. S. Brady,	+		+	+			
maculata, G. S. Brady,		+	+	+			
orientalis, G. S. Brady,				+			
setigera, n. sp.,				+			
similis, n. sp.,		+			+		
tenuicauda, n. sp.,	+						
tumida, n. sp.,			+	+			
Bythocypris compressa, n. gen. and sp.,				+			
elongata, n. sp.,		+					
reniformis, n. sp.,	+	+	+	+			+
Bairdia abyssicola, n. sp.,						+	
acanthigera, G. S. Brady,	+						
amygdaloides, G. S. Brady,				+	+	+	
angulata, G. S. Brady,	+			+	+		
attenuata, n. sp.,				+		+	
crosskeiana, G. S. Brady,				+		+	
exaltata, n. sp.,				+			
expansa, n. sp.,						+	
formosa, G. S. Brady,	+	+		+			
fortificata, n. sp.,				+			
foveolata, G. S. Brady,	(?)			+	+		+
fusca, G. S. Brady,				+			
globulus, n. sp.,				+			
hirsuta, n. sp.,					+		
milne-edwardsi, G. S. Brady,	+						
minima, n. sp.,				+		+	
ovata (?), Bosquet,		+		+			

Cypridæ—*continued*.	1 North Atlantic.	2 South Atlantic.	3 South Indian Ocean.	4 Australasia.	5 South Pacific.	6 North Pacific.	7 Eastern Asia.
Bairdia simplex, n. sp.,			+				
tuberculata, G. S. Brady,				+			
victrix, G. S. Brady,	+	+	+	+			
villosa, n. sp.,		+	+	+			+
woodwardiana, n. sp.,				+			
Cytheridæ.							
Cythere acanthoderma, n. sp.,	+		+	+	+	+	
acupunctata, n. sp.,							+
adunca, G. S. Brady,				+			
arata, n. sp.,				+			
audei, G. S. Brady,		+	+				
bermudæ, G. S. Brady,	+						
bicarinata, n. sp.,							+
canaliculata (Reuss),				+			
cancellata, G. S. Brady,				+			
circumdentata, n. sp.,					+	+	
clavigera, n. sp.,				+			
convoluta, G. S. Brady,				+		+	
craticula, n. sp.,		+					
cribriformis, G. S. Brady,							+
crispata, G. S. Brady,				+			+
cristatella, G. S. Brady,				+			
cumulus, n. sp.,				+			
curvicostata, G. S. Brady,				+			
cymba, G. S. Brady,							+
cytheropteroides, n. sp.,		+					
darwini, G. S. Brady,							+
dasyderma, n. sp.,	+	+		+	+	+	
demissa, G. S. Brady,				+			
dictyon, n. sp.,	+	+	+	+	+	+	
dorsoserrata, n. sp.,		+					
ericea, n. sp.,		+					
euplectella, G. S. Brady,				+			
exilis, n. sp.,		+					
falklandi, n. sp.,		+					
flabellicostata, n. sp.,		+					
flos-cardui, n. sp.,						+	
fortificata, n. sp.,					+		
foveolata, n. sp.,			+				
fulvotincta, n. sp.,		+					
fungoides, G. S. Brady,	+			+			
goujoni, G. S. Brady,				+			+

Cytheridæ—*continued.*	1 North Atlantic.	2 South Atlantic.	3 South Indian Ocean.	4 Austral-asia.	5 South Pacific.	6 North Pacific.	7 Eastern Asia.
Cythere hodgii, G. S. Brady, ...							+
impluta, n. sp., ...		+					
inconspicua, n. sp., ...				+			
irpex, n. sp., ...	+	+					
irrorata, n. sp., ...				+			
kerguelenensis, n. sp., ...			+	+			+
lactea, G. S. Brady, ...					+		
laganella, n. sp., ...				+			
lauta, n. sp., ...				+			
lepralioides, n. sp., ...		+					
lubbockiana, n. sp., ...				+			
melobesioides, G. S. Brady, ...		+		+			
moseleyi, n. sp., ...		+					
murrayana, n. sp., ...				+			
normani, G. S. Brady, ...			+		+		
ovalis, n. sp., ...				+			
obtusalata, n. sp., ...				+			
packardi, n. sp., ...				+			
papuensis, n. sp., ...				+			
parallelogramma, n. sp., ...			+				
patagoniensis, n. sp., ...					+		
polytrema, G. S. Brady, ...			+				
prava, Baird, ...				+			
pyriformis, n. sp., ...		+					
quadriaculeata, n. sp., ...						+	+
radula, n. sp., ...				+			
rastromarginata, n. sp., ...				+		+	
reussi, G. S. Brady, ...		+		+		+	
sabulosa, n. sp., ...				+			
scabrocuneata, n. sp., ...				+			+
scalaris, n. sp., ...				+	+		
scintillulata, n. sp., ...		+					
scutigera, G. S. Brady, ...				+	+		
securifer, n. sp., ...			+				
serratula, n. sp., ...	+	+					
speyeri, G. S. Brady, ...	+	+					
squalidentata, n. sp., ...		+					
stimpsoni, G. S. Brady, ...	+						
stolonifera, n. sp., ...					+		
subrufa, n. sp., ...			+				+
suhmi, n. sp., ...						+	+
sulcatoperforata, n. sp., ...					+		
tenera, G. S. Brady, ...	+						
tetrica, n. sp., ...				+			
torresi, n. sp., ...				+			

Cytheridæ—*continued.*	1 North Atlantic.	2 South Atlantic.	3 South Indian Ocean.	4 Australasia.	5 South Pacific.	6 North Pacific.	7 Eastern Asia.
Cythere tricristata, n. sp.,				+			
velivola, n. sp.,				+			
vellicata, n. sp.,				+			
viminea, n. sp.,			+				
wyville-thomsoni, n. sp.,			+	+			
Cytheridea spinulosa, G. S. Brady,				+	+		
Krithe bartonensis (Jones),			+	+			
hyalina, n. sp.,							+
producta, n. sp.,	+	+	+	+	+		
tumida, n. sp.,		+					
Loxoconcha africana, n. sp.,	+						
alata, G. S. Brady,						+	
anomala, n. sp.,						+	
australis, n. sp.,				+			
avellana, G. S. Brady,				+			
guttata (Norman),	+						
honoluliensis, n. sp.,						+	
pumicosa, n. sp.,				+			
sculpta, G. S. Brady,				+			
sinensis, G. S. Brady,							+
subrhomboidea, n. sp.,		+					
variolata, G. S. Brady,				+			
Xestoleberis africana, n. sp.,		+					
curta, G. S. Brady,	+		+	+	+	+	
depressa, G. O. Sars,			+				
expansa, n. sp.,		+					
foveolata, n. sp.,				+			
granulosa, n. sp.,				+			
intermedia (?), G. S. Brady,				+			
margaritea, G. S. Brady,				+			
nana, n. sp.,				+			
polita, G. S. Brady,		+					
setigera, n. sp.,			+				
tumefacta, n. sp.,				+			
variegata, n. sp.,	+			+			
Cytherura clausi, n. sp.,		+					
clavata, n. sp.,		+					
costellata, n. sp.,			+				
cribrosa, n. sp.,					+		
cryptifera, n. sp.,				+			
curvistriata, n. sp.,				+			
lilljeborgi, n. sp.,			+				
mucronata, n. sp.,		+					
obliqua, n. sp.,			+				
rudis (?), G. S. Brady,		+					

	1 North Atlantic.	2 South Atlantic.	3 South Indian Ocean.	4 Austral-asia.	5 South Pacific.	6 North Pacific.	7 Eastern Asia.
CYTHERIDÆ—*continued*.							
Cytheropteron abyssorum, n. sp.,			+				
angustatum, n. sp.,			+	+			
assimile, n. sp.,			+				
fenestratum, n. sp.,		+	+				
intermedium, G. S. Brady,	+						
mucronalatum, n. sp.,	+				+	+	
patagoniense, n sp.,					+		
scaphoides, n. sp.,			+				
wellingtoniense, n. sp.,				+			
Bythothcyere arenosa, n. sp.,				+			
exigua, n. sp.,		+					
orientalis, G. S. Brady,				+			+
pumilio, n. sp.,			+				
velifera, n. sp.,				+			
Pseudocythere caudata, G. O. Sars,			+				
fuegiensis, n. sp.,					+		
Cytherideis lævata, n. sp.,			+				
nana, n. sp.,				+			
Sclerochilus contortus (Norman),			+	+			
Xiphichilus arcuatus, n. sp.,				+			
complanatus, n. sp.,			+				
Paradoxostoma abbreviatum, G. O. Sars,			+				
ensiforme, G. S. Brady,	+						
CYPRIDINIDÆ.							
Cypridina danæ, n. sp.,			+				
formosa (?), Dana,							+
gracilis, n. sp.,	+						
Asterope, sp.,	+						
Philomedes gibbosa (Dana),							+
wyville-thomsoni, n. sp.,				+			
Crossophorus imperator, n. gen. and sp.,				+			
CONCHŒCIADÆ.							
Halocypris atlantica, Lubbock,	+	+	+	+	+	+	+
brevirostris, Dana,	+	+	+	+	+	+	+
imbricata, n. sp.,		+				+	+

	1 North Atlantic.	2 South Atlantic.	3 South Indian Ocean.	4 Austral-asia.	5 South Pacific.	6 North Pacific.	7 Eastern Asia.
POLYCOPIDÆ.							
Polycope cingulata, n. sp.,							
favus, n. sp.,				+			
orbicularis, G. O. Sars,	+	+	+	+			
CYTHERELLIDÆ.							
Cytherella cavernosa, G S. Brady,				+			
cingulata, G. S. Brady,				+			+
cribrosa, n. sp.,				+			
dromedaria, n. sp.,		+					
irregularis, n. sp.,	+						
lata, n. sp.,	+	+		+			
latimarginata, n. sp.,				+			
polita, G. S. Brady,		+		+			
pulchra, G. S. Brady,	+	+		+			
punctata, G. S. Brady,		+		+	+		
semitalis, G. S. Brady,				+			
truncata, G. S. Brady,				+			
venusta, n. sp.,						+	

LIST OF DREDGINGS AND TOW-NET GATHERINGS EXAMINED, WITH THE SPECIES OF OSTRACODA FOUND IN EACH.

Vigo Bay. 11 fathoms. Mud from anchor. May 21, 1876.

Paracypris polita, G. O. Sars.
Cythere stimpsoni, G. S. Brady.
tenera, G. S. Brady.
Loxoconcha guttata (Norman).
Cytheropteron intermedium, G. S. Brady.
Paradoxostoma ensiforme, G. S. Brady.
Polycope orbicularis, G. O. Sars.

Off Gomera, Canaries. 620 fathoms. Sandy mud and shells. February 12, 1873.

Macrocypris canariensis, n. sp.
Bairdia, sp.

STATION 5.—South-west of Canaries. 2740 fathoms. February 21, 1873.

Cythere dasyderma, n. sp.

STATION 24.—Off Culebra Island, West Indies. 390 fathoms. Mud. March 25, 1873.

Bythocypris reniformis, n. gen. and sp.
Macrocypris tenuicauda, n. sp.
decora, G. S. Brady.
Bairdia victrix, G. S. Brady.
Cythere serratula, n. sp.
dictyon, n. sp.
Cytherella lata, n. sp.

STATION 33.—Off Bermudas. 435 fathoms. Mud. April 4, 1873.

Pontocypris trigonella, G. O. Sars.
Bairdia foveolata (?), G. S. Brady.
Cythere fungoides, G. S. Brady.
bermudæ, G. S. Brady.
Xestoleberis curta, G. S. Brady.
Cytherella irregularis, n. sp.
pulchra, G. S. Brady.
Asterope, sp.

STATION 64.—Lat. 35° 35′ N., long. 50° 27′ W. 2750 fathoms. Grey ooze. June 20, 1873.

Cythere dictyon, n. sp.
acanthoderma, n. sp.
Krithe tumida, n. sp.
Xestoleberis expansa, n. sp.

STATION 70.—Lat. 38° 25′ N., long. 35° 50′ W. 1675 fathoms. Globigerina ooze. June 20, 1873.

Cythere dictyon, n. sp.
*dasyderma,*n. sp.
Krithe producta, n. sp.
Cytheropteron mucronalatum, n. sp.

STATION 73.—Lat. 38° 30′ N., long. 31° 14′ W. 1000 fathoms. Globigerina ooze. June 30, 1873.

Cythere dictyon, n. sp.
acanthoderma, n. sp.
irpex, n. sp.

STATION 75.—Off Azores. Lat. 38° 37′ N., long. 28° 30′ W. 450 fathoms. Sand. July 2, 1873.

Bairdia angulata, G. S. Brady.
victrix (?), G. S. Brady.
Cythere dictyon, n. sp.
Cytherella lata, n. sp.

STATION 76.—Lat. 38° 11′ N., long. 27° 9′ W. 900 fathoms. Bottom temperature, 4°·2 C. Globigerina ooze. July 3, 1873.

Bairdia formosa, G. S. Brady.
victrix, G. S. Brady.
Cythere dictyon, n. sp.
Krithe producta, n. sp.

STATION 78.—Lat. 37° 24′ N., long. 25° 13′ W. 1000 fathoms. Globigerina ooze. July 10, 1873.

Cythere dictyon, n. sp.
irpex, n. sp.
Cypridina gracilis, n. sp.

STATION 85.—Off Canaries. Lat. 28° 42′ N., long. 18° 6′ W. 1125 fathoms. Volcanic sand. July 19, 1873.

Cythere (?) *serratula*, n. sp.
dasyderma (?), n. sp.
Krithe producta (?), n. sp.

STATION 93 or 94.—Off St Vincent, Cape Verde. 1070–1150 fathoms. Mud. July and August 1873.

Bairdia milne-edwardsi, G. S. Brady.
acanthigera, G. S. Brady.
Cythere speyeri, G. S. Brady.
Loxoconcha africana, n. sp.
Xestoleberis variegata, n. sp.

STATION 120.—Off Pernambuco. Lat. 8° 37′ S., long. 34° 28′ W. 675 fathoms. Mud. September 9, 1873.

Macrocypris similis, n. sp.
Bythocypris reniformis, n. gen. and sp.
Bairdia formosa, G. S. Brady (variety).
victrix, G. S. Brady.
Cythere pyriformis, n. sp.
ericea, n. sp.
dictyon, n. sp.
Krithe producta, n. sp.
Cytherella lata, n. sp.

STATION 122.—Off North Brazil. 350 fathoms. Mud. September 10, 1873.

Bythocypris reniformis, n. gen. and sp.
Macrocypris tenuicauda, n. sp.
decora, G. S. Brady.
Bairdia formosa, G. S. Brady.
victrix, G. S. Brady.
Cythere dasyderma, n. sp.
dictyon, n. sp.
Krithe producta, n. sp.

STATION 135.—Off Nightingale Island, Tristan d'Acunha. 100 to 150 fathoms. Rock, shells. October 18, 1873.

Bairdia villosa, n. sp.
Cythere impluta, n. sp.
Cytherella punctata, G. S. Brady.

STATION 140.—Simon's Bay, South Africa, 15 to 20 fathoms. October 1873.

Pontocypris subreniformis, n. sp.
Macrocypris maculata, G. S. Brady.
Bairdia ovata, Bosquet.
Cythere exilis, n. sp.
flabellicostata, n. sp.
lepralioides, n. sp.
craticula, n. sp.
Loxoconcha subrhomboidea, n. sp.
Xestoleberis africana, n. sp.
Cytherura mucronata, n. sp.
clausi, n. sp.
Cytherella dromedaria, n. sp.

STATION 142.—Off Cape of Good Hope. 150 fathoms. Sand. December 18, 1873.

Cythere melobesioides, G. S. Brady.
Cythere lepralioides, n. sp.
cytheropteroides, n. sp.
Polycope orbicularis, G. O. Sars.

Off Prince Edward's Island. 50 to 150 fathoms. December 26, 1874.

Bythocypris reniformis, n. gen. and sp.
Macrocypris maculata, G. S. Brady.
Bairdia villosa, n. sp.
Cythere kerguelenensis, n. sp.
securifer, n. sp.
subrufa, n. sp.
suhmi, n. sp.
parallelogramma, n. sp.
Cythere polytrema, G. S. Brady.
Xestoleberis setigera, n. sp.
Krithe producta, n. sp.
Pseudocythere caudata, G. O. Sars.

STATION 146.—Lat. 46° 46′ S., long. 45° 31′ E. 1375 fathoms. Globigerina ooze. Bottom temperature, 1°·5 C. December 29, 1873.

Cythere dasyderma, n. sp.
acanthoderma, n. sp.
Krithe producta, n. sp.
Cythere dictyon, n. sp.
viminea, n. sp.

STATION 149.—Balfour Bay, Kerguelen Island. 20 to 50 fathoms. January 1874.

Macrocypris maculata, G. S. Brady.
tumida, n. sp.
Argillæcia eburnea, n. sp.
Aglaia obtusata, n. sp.
Bairdia villosa, n. sp.
Cythere kerguelenensis, n. sp.
subrufa, n. sp.
wyville-thomsoni, n. sp.
audei, G. S. Brady.

Xestoleberis depressa, G. O. Sars.
Cytherura obliqua, n. sp.
costellata, n. sp.
lilljeborgi, n. sp.
Cytheropteron scaphoides, n. sp.
angustatum, n. sp.
Bythocythere pumilio, n. sp.
Pseudocythere caudata, G. O. Sars.
Sclerochilus contortus (Norman).
Paradoxostoma abbreviatum, G. O. Sars.

STATION 149.—Off Christmas Harbour, Kerguelen Island. 120 fathoms. January 29, 1874.

Argillæcia eburnea, n. sp.
Macrocypris decora, G. S. Brady.
Bairdia villosa, n. sp.
victrix, G. S. Brady.
Cythere wyville-thomsoni, n. sp.
foveolata, n. sp.
Xestoleberis setigera, n. sp.
Krithe bartonensis (Jones).
Cytheropteron assimile, n. sp.
Cytheropteron fenestratum, n. sp.
Pseudocythere caudata, G. O. Sars.
Xiphichilus complanatus, n. sp.
Polycope orbicularis, G. O. Sars.
Cypridina danæ, n. sp.

STATION 149.—Royal Sound, Kerguelen Island. 28 fathoms. January 20, 1874.

Macrocypris tumida, n. sp.
maculata, G. S. Brady.
Cythere kerguelenensis, n. sp.
Xestoleberis curta, G. S. Brady.

STATION 150.—Lat. 52° 4′ S., long. 71° 22′ E. 150 fathoms. Rock. February 2, 1874.

Cythere wyville-thomsoni, n. sp.
dictyon, n. sp.
normani, G. S. Brady.
Xestoleberis depressa, G. O. Sars.

Station 151.—Off Heard Island. 75 fathoms. Mud. February 7, 1874.

Bairdia simplex, n. sp.
Cythere kerguelenensis, n. sp.
wyville-thomsoni, n. sp.
foveolata, n. sp.
Xestoleberis setigera, n. sp.
Cytheropteron assimile, n. sp.
Cytherideis lævata, n. sp.
Sclerochilus contortus (Norman).

Station 158.—Lat. 50° 1′ S., long. 123° 4′ E. Tow-net. March 7, 1874.

Halocypris atlantica, Lubbock.

Station 159.—Lat. 47° 25′ S., long. 130° 12′ E. Tow-net. March 12, 1874.

Halocypris atlantica, Lubbock.
brevirostris, Dana.

Station 160.—Lat. 42° 42′ S., long. 134° 10′ E. 2600 fathoms. Bottom temperature, 0°·2 C. Red clay. March 13, 1874.

Cytheropteron abyssorum, n. sp.

Station 161.—Off entrance to Port Philip, South Australia. 38 fathoms. Sand. April 1, 1874.

Philomedes wyville-thomsoni, n. sp.

Station 162.—Off East Moncœur Island, Bass Strait. 38 to 40 fathoms. Sand. April 2, 1874.

Pontocypris faba (?) (Reuss).
Macrocypris maculata, G. S. Brady.
Aglaia (?), *pusilla*, n. sp.
Bythocypris reniformis, n. gen. and sp.
Bairdia villosa, n. sp.
amygdaloides, G. S. Brady.
foveolata, G. S. Brady.
victrix, G. S. Brady.

Cythere canaliculata (Reuss).
kerguelenensis, n. sp.
scabrocuneata, n. sp.
obtusalata, n. sp.
rostromarginata n. sp.
Xestoleberis granulosa, n. sp.
Cytherura cryptifera, n. sp.
Cytherella cavernosa, G. S. Brady.

Port Jackson, Australia. 2 to 10 fathoms. April 20, 1874.

Pontocypris subreniformis, n. sp.
Macrocypris setigera, n. sp.
Phlyctenophora zealandica, n. gen. and sp.
Argillæcia badia, n. sp.
Bairdia minima, n. sp.
fusca, G. S. Brady.
Cythere cumulus, n. sp.
crispata, G. S. Brady.
kerguelenensis, n. sp.
goujoni, G. S. Brady.
tricristata, n. sp.
vellicata, n. sp.
demissa, G. S. Brady.
canaliculata (Reuss).
clavigera, n. sp.
Xestoleberis curta, G. S. Brady.
granulosa, n. sp.
Loxoconcha avellana, G. S. Brady.
australis, n. sp.
Cytherura curvistriata, n. sp.
Cytherella punctata (?), G. S. Brady.
cingulata, G. S. Brady.
pulchra, G. S. Brady.

STATION 164*a*.—Off Sydney. 410 fathoms. Grey ooze. June 13, 1874.

Bairdia victrix, G. S. Brady.
Cythere dictyon, n. sp.
dasyderma, n. sp.
Krithe producta, n. sp.

STATION 167.—Lat. 39° 32′ S., long. 171° 48′ E. 150 fathoms. Grey ooze. June 24, 1874.

Bairdia ovata, Bosquet.
Cythere arata, n. sp.
rastromarginata, n. sp.
scutigera, G. S. Brady.
dasyderma, n. sp.
Krithe producta, n. sp.
Cytherella punctata, G. S. Brady.
pulchra (?), G. S. Brady.

Wellington Harbour, New Zealand. Tow-net at trawl. Depth not stated.

Aglaia clavata, n. sp.
Paracypris polita (?), G. O. Sars.
Phlyctenophora zealandica, n. gen. and sp.
Macrocypris tumida, n. sp.
Cythere murrayana, n. sp.
scabrocuneata, n. sp.
Cytheropteron wellingtoniense, n. sp.
Sclerochilus contortus (Norman).
Cytherella polita, G. S. Brady.

STATION 168.—Lat. 40° 28′ S., long. 177° 43′ E. 1100 fathoms. Bottom temperature, 2°·0 C. grey ooze. July 8, 1874.

Crossophorus imperator, n. gen. and sp.

STATION 172.—Off Nukualofa, Tongatabu. 18 fathoms. Coral. July 22, 1874.

Bythocypris compressa, n. gen. and sp.
Bairdia crosskeiana, G. S. Brady.
woodwardiana, n. sp.
Cythere cancellata, G. S. Brady.
convoluta, G. S. Brady.
Xestoleberis nana, n. sp.
variegata, n. sp.
Loxoconcha avellana, G. S. Brady.
Cytherella cribrosa, n. sp.

STATION 174.—Lat. 19° 10′ S., long. 178° 10′ E. 610 fathoms. Bottom temperature, 3°·7 C. Globigerina ooze. August 3, 1874.

Krithe producta, n. sp.
Xiphichilus arcuatus, n sp.

STATION 181.—Obi to Cape York, Pacific. Tow-net. August 26, 1874.

Halocypris atlantica, Lubbock.
brevirostris, Dana.

STATION 185.—Torres' Straits. Lat. 11° 35′ S., long. 144° 3′ E. 155 fathoms. Sand. August 31, 1874.

Bairdia attenuata, n. sp.
amygdaloides, G. S. Brady.
angulata, G. S. Brady.
Cythere torresi, n. sp.
inconspicua, n. sp.
laganella, n. sp.
wyville-thomsoni (?), n. sp.
dasyderma, n. sp.
scalaris (?), n. sp.
Xestoleberis intermedia (?), G. S. Brady.
Cytheropteron angustatum, n. sp.
Bythocythere arenosa, n. sp.
orientalis (var.), G. S. Brady.
velifera, n. sp.
Polycope orbicularis, G. O. Sars.
favus, n. sp.
Cytherella truncata, G. S. Brady.
latimarginata, n. sp.
lata, n. sp.

STATION 187.—Off Booby Island. Lat. 10° 36′ S., long. 141° 55′ E. 6 to 8 fathoms.

Macrocypris orientalis, G. S. Brady.
Bairdia amygdaloides, G. S. Brady.
fortificata, n. sp.
foveolata, G. S. Brady.

Cythere reussi, G. S. Brady.
lubbockiana, n. sp.
tetrica, n. sp.
packardi, n. sp.
curvicostata, n. sp.
ovalis, n. sp.
crispata, G. S. Brady.
sabulosa, n. sp.
lauta, n. sp.
goujoni, G. S. Brady.
fungoides, G. S. Brady.
melobesioides, G. S. Brady.
cristatella, G. S. Brady.
cancellata, G. S. Brady.
Xestoleberis foveolata, n. sp.
margaritea, G. S. Brady.
curta, G. S. Brady.
Loxoconcha pumicosa, n. sp.
variolata, G. S. Brady.
sculpta, G. S. Brady.
australis, n. sp.
Cytherella semitalis, G. S. Brady.
cavernosa, G. S. Brady.
cingulata, G. S. Brady.

STATION 189.—Lat. 9° 59′ S., long. 137° 50′ E. 28 fathoms. Mud. September 11, 1874.

Bairdia foveolata, G. S. Brady.
Cythere fungoides, G. S. Brady.
euplectella, G. S. Brady.
adunca, G. S. Brady.
velivola, n. sp.
Cytherella semitalis, G. S. Brady.
cingulata, G. S. Brady.

STATION 191*a*.—Off Ki Islands. Lat. 5° 26′ S., long. 133° 19′ E. 580 fathoms. Bottom temperature, 4°·9 C. Mud. September 24, 1874.

Macrocypris, sp.
Bairdia formosa, G. S. Brady.
Cythere dasyderma, n. sp.
acanthoderma, n. sp.
adunca, G. S. Brady.
dictyon, n. sp.
radula, n. sp.
Krithe bartonensis (Jones).
Cytherideis nana, n. sp.
Cytherella punctata, G. S. Brady.
lata, n. sp.

Amboyna. 15 to 20 fathoms. October 6, 1874.

Macrocypris maculata, G. S. Brady.
Bairdia amygdaloides, G. S. Brady.
Cythere scutigera, G. S. Brady.
Cytheridea spinulosa, G. S. Brady.
Cytherella pulchra, G. S. Brady.

Zamboangan. In surface-net at anchor. October 25, 1874.

Cypridina formosa (?), Dana.

Zebu Harbour, Philippine Islands. In surface-net. January 1875.

Philomedes gibbosa, Dana.

Hong-kong Harbour. 7 fathoms. Anchor mud.

Pontocypris attenuata, G. S. Brady.
Bairdia foveolata, G. S. Brady.
Cythere crispata, G. S. Brady.
cymba, G. S. Brady.
goujoni, G. S. Brady.
cribriformis, G. S. Brady.
darwini, G. S. Brady.
Loxoconcha sinensis, G. S. Brady.
Bythocythere orientalis, G. S. Brady.
Cytherella cingulata, G. S. Brady.

Humboldt Bay, Papua. 37 fathoms. March 24, 1875.

Pontocypris attenuata, G. S. Brady.
Phlyctenophora zealandica, n. gen. and sp.
Macrocypris orientalis (?), G. S. Brady.
Bairdia amygdaloides, G. S. Brady.
Cythere papuensis, n. sp.
dictyon, n. sp.
scutigera, G. S. Brady.
Cytherella semitalis, G. S. Brady.

Nares' Harbour, Admiralty Islands. 16 fathoms. March 2, 1875.

Macrocypris decora, G. S. Brady.
Bairdia crosskeiana, G. S. Brady.
foveolata, G. S. Brady.
globulus, n. sp.
Cythere prava, Baird.
Xestoleberis tumefacta, n. sp.
Loxoconcha pumicosa, n. sp.
Cytherella semitalis, G. S. Brady.

Admiralty Islands. 16 to 25 fathoms. March 7, 1875.

Macrocypris decora, G. S. Brady.
Bairdia tuberculata, G. S. Brady.
foveolata, G. S. Brady.
globulus, n. sp.
Cythere tricristata, n. sp.
prava, Baird.
obtusalata, n. sp.
irrorata, n. sp.

Station 218.—Lat. 2° 33′ S., long. 144° 4′ E. 1070 fathoms. Bottom temperature, 2°·1 C. Globigerina ooze. March 1, 1875.

Bairdia exaltata, n. sp.
Cythere dictyon, n. sp.
dasyderma, n. sp.

Station 224.—Lat. 7° 45′ N., long. 144° 20′ E. 1850 fathoms. Bottom temperature, 1°·3 C. Globigerina ooze. March 21, 1875.

Cythere dictyon, n. sp.
Cytheropteron mucronalatum, n. sp.

STATION 231.—Tow-net. May 11, 1875.

Halocypris atlantica, Lubbock.
brevirostris, Dana.
imbricata, n. sp.

STATION 233*b*.—Inland Sea, Japan. Lat. 34° 20′ N., long. 133° 35′ E. 15 fathoms. Mud. May 26, 1875.

Cythere acupunctata, n. sp.
bicarinata, n. sp.
cymba, G. S. Brady.
quadriaculeata, n. sp.
hodgii, G. S. Brady.
darwini, G. S. Brady.
scabrocuneata, n. sp.
Krithe hyalina, n. sp.
Loxoconcha sinensis, G. S. Brady.

STATION 241.—Lat. 35° 41′ N., long. 157° 42′ E. 2300 fathoms. Bottom temperature, 1°·1 C. Red clay. June 23, 1875.

Cythere suhmi, n. sp.

STATION 241.—Lat. 35° 41′ N., long. 157° 42′ E. Tow-net. June 23, 1875.

Halocypris atlantica, Lubbock.
brevirostris, Dana.
imbricata, n. sp.

STATION 246.—Lat. 36° 10′ N., long. 178° 0′ E. 2050 fathoms. Bottom temperature, 1°·3 C. Grey ooze. July 2, 1875.

Bairdia minima, n. sp.
abyssicola, n. sp.
Cythere dasyderma, n. sp.
acanthoderma, n. sp.
circumdentata, n. sp.
dictyon, n. sp.
Cytheropteron mucronalatum, n. sp.

Off Reefs, Honolulu. 40 fathoms. July 1875.

Pontocypris faba (?) (Reuss).
Bairdia attenuata, n. sp.
amygdaloides, G. S. Brady.
crosskeiana, G. S. Brady.
expansa, n. sp.
Cythere reussi, G. S. Brady.
quadriaculeata, n. sp.
convoluta, G. S. Brady.
flos-cardui, n. sp.
rastromarginata, n. sp.
Xestoleberis curta, G. S. Brady.
Loxoconcha alata, G. S. Brady.
honoluliensis, n. sp.
anomala, n. sp.
Cytherella venusta, n. sp.

Station 276.—Lat. 13° 28′ S., long. 149° 30′ W. 2350 fathoms. Bottom temperature, 1°·0 C. Red clay. September 16, 1875.

Cythere circumdentata, n. sp.

Station 280.—Lat. 18° 40′ S., long. 149° 52′ W. 1940 fathoms. Bottom temperature, 1°·6 C. Globigerina ooze. October 4, 1875.

Cythere dictyon, n. sp.

Station 287.—Lat. 36° 32′ S., long. 132° 52′ W. Tow-net. October 19, 1875.

Halocypris atlantica, Lubbock.
brevirostris, Dana.

Station 296.—Lat. 38° 6′ S., long. 88° 2′ W. 1825 fathoms. Bottom temperature, 1°·2 C. Red clay. November 9, 1875.

Bairdia hirsuta, n. sp.
Cythere normani (?), G. S. Brady.
dasyderma, n. sp.
acanthoderma, n. sp.
dictyon, n. sp.
Krithe producta, n. sp.
Cytheropteron mucronalatum, n. sp.

420 fathoms. Sounding. October 20, 1875.

Paracypris polita (?), G. O. Sars.
Pontocypris (?), sp.
Bairdia foveolata, G. S. Brady.
Cythere lactea, G. S. Brady.
fortificata, n. sp.
Cytheridea spinulosa, G. S. Brady.

Station 300.—Lat. 33° 42′ S., long. 78° 18′ W. 1375 fathoms. Bottom temperature, 1°·6 C. Globigerina ooze. December 17, 1875.

Bairdia hirsuta, n. sp.
Cythere dictyon, n. sp.
stolonifera, n. sp.
sulcato-perforata, n. sp.
dasyderma, n. sp.
scutigera, G. S. Brady.
Xestoleberis curta, G. S. Brady.
Krithe producta, n. sp.
Cytheropteron mucronalatum, n. sp.

Station 302.—Lat. 42° 43′ S., long. 82° 11′ W. Tow-net. December 28, 1875.

Halocypris atlantica, Lubbock.
brevirostris, Dana.

Station 302.—Lat. 42° 43′ S., long. 82° 11′ W. 1450 fathoms. Bottom temperature, 1°·5 C. Globigerina ooze. December 28, 1875.

Cythere dictyon, n. sp.
acanthoderma, n. sp.
dasyderma, n. sp.
Krithe producta, n. sp.
Cytheropteron mucronalatum, n. sp.

Station 303.—Lat. 45° 31′ S., long. 78° 9′ W. Tow-net. December 30, 1875.

Halocypris atlantica, Lubbock.
brevirostris, Dana.

Station 304.—Lat. 46° 53′ S., long. 75° 11′ W. Tow-net. December 31, 1875.

Halocypris atlantica, Lubbock.

Station 305.—160 fathoms. Sounding. January 13, 1876.

Macrocypris similis, n. sp.
Bairdia angulata, G. S. Brady.
amygdaloides, G. S. Brady.
Cythere dasyderma, n. sp.
dictyon, n. sp.
scalaris, n. sp.
Krithe producta, n. sp.
Cytheropteron patagoniense, n. sp.
Cytherura cribrosa, n. sp.
Cytherella punctata, G. S. Brady.

Station 308.—Lat. 50° 10′ S., long. 74° 42′ W. 175 fathoms. Mud. January 5, 1876.

Bairdia, sp.
Cythere dictyon, n. sp.
patagoniensis, n. sp.
Krithe producta, n. sp.
Cytherella, sp.

Station 311.—Lat. 52° 50′ S., long. 73° 53′ W. 245 fathoms. Bottom temperature, 7°·7 C. Mud. January 11, 1876.

Cythere dasyderma, n. sp.
Krithe producta, n. sp.
Pseudocythere fuegiensis, n. sp.

Station 313.—Straits of Magellan, lat. 52° 20′ S., long. 68° 0′ W. 55 fathoms. Bottom temperature, 8°·8 C. Sand. January 20, 1876.

Cythere reussi, G. S. Brady.
scintillulata, n. sp.
Cytherura rudis (?), G. S. Brady.
Bythocythere exigua, n. sp.

Station 316.—Stanley Harbour, Falkland Islands. 6 fathoms. Anchor mud. February 1, 1876.

Aglaia meridionalis, n. sp.
Cythere falklandi, n. sp.
fulvotincta, n. sp.
Xestoleberis polita, G. S. Brady.
Cytherura clavata, n. sp.
Cythere impluta, n. sp.
moseleyi, n. sp.

Station 317.—Lat. 48° 37′ S., long. 55° 17′ W. 1035 fathoms. Bottom temperature, 1°·7 C. Hard ground. Tow-net at trawl. February 8, 1876.

Cythere dasyderma, n. sp.

Station 318.—Lat. 42° 32′ S., long. 56° 27′ W. Tow-net. February 11, 1876.

Halocypris atlantica, Lubbock.

Station 321.—Mouth of Rio de la Plata. 13 fathoms. Mud. February 25, 1876.

Cytherella polita, G. S. Brady.

Station 323.—Lat. 35° 39′ S., long. 50° 47′ W. 1900 fathoms. Bottom temperature, 0°·0 C. Grey mud.

Argillœcia eburnea, n. sp.
Cythere squalidentata, n. sp.
Krithe tumida, n. sp.
Xestoleberis expansa, n. sp.
Pseudocythere caudata, G. O. Sars.

Station 325.—Lat. 36° 44′ S., long. 46° 16′ W. 2650 fathoms. Tow-net at trawl. Bottom temperature, 0°·4 C. March 2, 1876.

Halocypris atlantica, Lubbock.
imbricata, n. sp.

Station 330.—Lat. 37° 45′ S., long. 33° 0′ W. March 8, 1876.

Halocypris brevirostris, Dana.

Station 332.—Lat. 37° 29′ S., long. 27° 31′ W. 2200 fathoms. Bottom temperature, 0°·4 C. Globigerina ooze. Tow-net at trawl. March 10, 1876.

Cythere dictyon, n. sp.
dasyderma, n. sp.

Station 335.—North of Tristan d'Acunha, lat. 32° 24′ S., long. 13° 5′ W. 1425 fathoms. Bottom temperature, 2°·3 C. Globigerina ooze. March 16, 1876.

Bairdia victrix, G. S. Brady.
Bythocypris elongata, n. gen. and sp.
Cythere serratula, n. sp.
Cythere dictyon, n. sp.
dasyderma, n. sp.
dorsoserrata, n. sp.
irpex, n. sp.
Krithe producta, n. sp.
Cytheropteron fenestratum, n. sp.

Station 341.—Lat. 12° 16′ S., long. 13° 44′ W. March 25, 1876.

Halocypris atlantica, Lubbock.
brevirostris, Dana.

Station 344.—Off Ascension Island. 420 fathoms. Hard ground. April 3, 1876.

Macrocypris similis, n. sp.
Cythere speyeri, G. S. Brady.
Cytherella pulchra (?), G. S. Brady.

Off Ascension Island. 7 fathoms.

Pontocypris simplex, n. sp.
Cythere audei, G. S. Brady.

Station 346.—Lat. 2° 42′ S., long. 14° 41′ W. 2350 fathoms. Bottom temperature, 0°·4 C. Globigerina ooze. April 6, 1876.

Cythere dasyderma, n. sp.

Station 348.—Lat. 3° 10′ N., long. 14° 51′ W. April 9, 1876.

Halocypris atlantica, Lubbock.

St Vincent, Cape Verde Islands. April 26, 1876.

Halocypris brevirostris, Dana.

Section PODOCOPA.

Family I. Cypridæ.

Valves mostly thin and smooth, more or less sinuated below. Anterior antennæ mostly seven-jointed, and beset with numerous setæ, which form a dense brush of greater or less length; posterior antennæ geniculated, and bent backwards, four or five-jointed, armed at the distal extremity with from three to five long, slightly curved claws, and bearing commonly on the posterior aspect of the antepenultimate joint, a bundle of setæ. Mandibles powerful, and divided at the extremity into several teeth, bearing a large four-jointed palp, the first joint of which is provided with a branchial appendage. Two pairs of jaws: the first large, and divided into four digitiform segments, the anterior segment being larger than the rest, two-jointed, and giving attachment to a large branchial plate; second pair small, simple, in the female bearing a simple sub-conical palp, in the male often pediform. Two pairs of feet: the first stout, and five-jointed, terminated by a long curved claw; the second more slender, and usually bent upwards within the valves. Postabdomen forming two long movable rami, which are sometimes rudimentary and setiform, but oftener well developed, and terminating in two strong curved claws. Eye single, or altogether wanting; rarely double. Intestinal canal forming two pouches; ovaries and testis lying immediately beneath the shell. Copulative organs of the male situated immediately in front of the postabdominal rami, and provided with testes or mucous glands of complex structure.

Paracypris, G. O. Sars.

Shell smooth, compact, elongated. Anterior antennæ seven-jointed, beset with rather short setæ; posterior stout, terminating in four strong curved claws; antepenultimate joint bearing at its base a pedicellated hyaline vesicle. Mandibles terminating in five or six long teeth, and bearing a four-jointed palp, from the basal joint of which springs a narrow branchial appendage. External lobe or palp of the first pair of maxillæ linear, not much broader than the rest. Second pair of maxillæ provided with a branchial appendage, the palp elongated, conical, and inarticulate. Last pair of feet similar to the first in form and size; both pairs five-jointed, and terminating in a long curved claw, the last pair armed also with a short seta, which is directed upwards. Postabdominal rami large, armed at the extremity with two strong curved claws, and a short slender seta; the posterior margin also bears two long setæ; one eye.

Paracypris polita, G. O. Sars.

Paracypris polita, G. O. Sars, Oversigt af Norges marine Ostracoder, p. 12; Brady, Monograph of Recent British Ostracoda, Trans. Lin. Soc., vol. xxvi. p. 378, pl. xxvii. figs. 1–4, and pl. xxxviii. fig. 2.

A few specimens of *Paracypris polita* were found amongst mud, brought up by the anchor in Vigo Bay; others, very doubtfully referable to the same species, occurred in the proceeds of the tow-net at trawl, from Wellington Harbour, New Zealand, and in a sounding from a depth of 420 fathoms, October 20, 1875.

All these examples, however, are so imperfect and ill-developed that to describe or figure them would be quite useless. The species is known hitherto only as inhabiting the seas of Northern Europe.

Phlyctenophora,[1] n. gen.

Carapace (Pl. III. fig. 1, *a*) elongated, not higher in front than behind; shell smooth, and usually more or less ornamented with dark-coloured blotches or striæ. Anterior antennæ (fig. 1, *e*) seven-jointed, beset with moderately long and slender setæ; posterior (fig. 1, *f*) four-jointed, stout, ending in four strong curved claws; second joint bearing a stalked hyaline vesicle, and a brush of short setæ. Mandible, strongly toothed at the apex (fig. 1, *g*) bearing a four-jointed palp, which is destitute of a branchial appendage (?). First pair of maxillæ divided into four linear setiferous segments (fig. 1, *h*), and having at the base a branchial plate bearing six setæ; second pair (fig. 1, *i*) also bearing a branchial appendage, and a small conical palp. First pair of feet five-jointed, terminating in a long slender curved claw (fig. 1, *j*); second pair (fig. 1, *k*) four-jointed (?), flexuous, provided with a movable hinge between the second and third joints; terminal claw long, reflexed against the limb. Postabdominal rami (fig. 1, *l*) well developed, bearing two strong terminal claws. Spermatic gland of the male (fig. 1, *m*) cylindrical, beset with a spiral of delicate setose filaments.

This seems to be sufficiently distinguished from the preceding genus by the absence of a branchial appendage to the mandible palp, and by the flexuous second foot, while from *Macrocypris* it differs, not only in the characters of the mandibles and maxillæ, but in having well-developed postabdominal rami; also in the structure of the spermatic glands.

The genera *Paracypris* and *Phlyctenophora*, both in external appearance, and in the structure of the various parts of the animal, are more nearly allied to the fresh water Cypridæ than are any other marine genera. Many forms probably yet remain to be discovered, which will more completely bridge over the gap between these and the Cytheridæ, and the classification of some of the species described in this monograph, and known only by their shells, must be looked upon as merely provisional. In this category

[1] Φλύκταινα, a blotch; φέρω, I carry.

we must include most of those here referred to the genera *Macrocypris*, *Argillœcia*, and *Pontocypris*.

Phlyctenophora zealandica, n. sp. (Pl. III. fig. 1, *a–m*).

Carapace elongated, compressed; seen from the side, subsiliquose; greatest height situated in the middle, and equal to less than half the length; anterior extremity well rounded, posterior narrowed, and ending in a subacute angle near the ventral surface; dorsal margin well arched, and continued in an unbroken curve to the infero-posteal angle, ventral margin slightly sinuated in the middle; seen from above, the outline is ovate, widest in the middle, and tapering only slightly to the broadly-rounded extremities; width and height about equal; end view subcircular, rather narrowed and angular below. Shell-surface smooth, whitish, marked with a few irregular strigæ of a blackish hue, and on the ventral surface with a broad longitudinal and transversely striated squamous band. Length, 1-26th of an inch (·98 mm.).

Several specimens of this species were taken in the tow-net at trawl in Wellington Harbour, New Zealand; at Port Jackson, Australia, in a depth of 2 to 10 fathoms; and at Humboldt Bay, Papua, in 37 fathoms.

[Pl. III. fig. 1, *a–m*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front, *e* anterior antenna, *f* posterior antenna, *g* mandible, *h* first maxilla, *i* second maxilla, *j* first foot, *k* second foot, *l* postabdominal ramus, *m* spermatic gland of male. The figures of the shell magnified 50 diameters.]

Aglaia, G. S. Brady.

Aglaia, Brady, Les Fonds de la Mer, tom. i., 1867.
Aglaia, Brady, Crosskey, and Robertson, Post-Tertiary Entomostraca, 1874.

Shell smooth and polished, of about equal height before and behind, compressed, subcylindrical. Anterior antennæ seven-jointed, beset with short stout setæ; posterior robust, and bearing at the apex of each joint several strong curved setæ; furnished also with a very small hyaline vesicle, and on the penultimate joint with a lash of very short setæ. Mandibles slender, divided at the extremity into about five blunt teeth, and furnished with a large, narrow, branchial palp. First pair of jaws divided into four elongated segments, and bearing a distinct branchial appendage; second pair also provided with a branchial lamina, and with a simple conical setiferous palp. First pair of feet long, five-jointed, with a long terminal claw; second pair flexuous, four-jointed, last joint armed with three setæ, one of which is very long, and finely pectinate on its inner margin. Postabdominal rami moderately robust, bearing two curved terminal claws, one seta on the anterior, and two on the posterior margin. Testis disposed round the body of the animal; mucous gland of the male elongated, and composed of seven series of whorled filaments.

This genus comes very near to the preceding one, *Phlyctenophora*, but the animal is altogether stouter in build, the limbs shorter, the setose armature of the antennæ much shorter and more robust, and the mandible provided with a branchial lamina; as regards the shell the chief distinction is in the want of angulation of the posterior extremity. The anatomy of the genus was worked out from one or two dried specimens sent to me by M. le Marquis de Folin, and, as regards the main points at any rate, the description given above may be relied upon as being accurate; but as all the Challenger specimens referable to the genus are mere empty shells, I am not able from this source to verifiy, or add anything to the first description, nor even to do more than guess at the genus to which these shells ought to be assigned.

1. *Aglaia* (?) *pusilla*, n. sp. (Pl. XXX. fig. 6, *a–d*).

Carapace compressed, oblong; seen from the side subreniform, rather higher in front than behind, height rather less than half the length; extremities obliquely rounded; dorsal margin very gently arched, ventral sinuated in the middle; seen from above ovate, tapering, and acuminate in front, narrowly rounded behind, width somewhat less than the height; end view subcircular. Surface of the shell perfectly smooth. Length, 1-50th of an inch (·5 mm.).

Dredged off East Moncœur Island, Bass Straits, in 38 to 40 fathoms. Sandy bottom. Station 162.

[Pl. XXX. fig. 6, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

2. *Aglaia clavata*, n. sp. (Pl. VI. fig. 4, *a–d*).

Shell elongated, reniform; seen from the side rather lower in front than behind, height greatest in the middle, and equal to less than half the length, extremities well rounded, dorsal margin gently arched, ventral slightly sinuated in the middle; seen from above, the outline is subclavate, widest behind the middle, tapering very gradually towards the front, and scarcely at all behind, anterior extremity very obtusely pointed, posterior broadly rounded; width and height nearly equal; end view circular; shell-surface perfectly smooth. Length, 1-45th of an inch (·54 mm.).

A few specimens from tow-net at trawl, Wellington Harbour, New Zealand.

[Pl. VI. fig. 4, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

3. *Aglaia* (?) *meridionalis*, n. sp. (Pl. XXX. fig. 7, *a–d*).

Shell compressed, oblong; seen from the side sub-ovate, height equal to more than one-third of the length, extremities rounded and nearly equal in height, the posterior rather oblique; dorsal margin gently arched, highest in the middle, ventral straight;

seen from above, compressed, subulate, widest in the middle, and tapering evenly to the extremities, which are acuminate, width equal to about one-third of the length; end view subcircular, the right valve greatly overlapping the left. Surface of the shell perfectly smooth; length 1-37th of an inch (·68 mm.).

Found in a haul of anchor-mud, from a depth of 6 fathoms, in Stanley Harbour, Falkland Islands. Station 316.

The very great inequality of the two valves of this and the following species may possibly indicate a distinct generic rank, but without the means of examining anatomical details, the point must for the present be left undecided. The larger valve, in this case, is the right; in *Bairdia*, where a like inequality exists, the left valve is the large one.

[Pl. XXX. fig. 7, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

4. *Aglaia* (?) *obtusata*, n. sp. (Pl. XXX. fig. 8, *a–d*).

Shell tumid, subovate, right valve much larger than the left; seen from the side, subreniform, slightly depressed in front; extremities well rounded, the posterior much wider than the anterior; dorsal margin moderately arched, highest in the middle, ventral nearly straight, height equal to half the length; outline as seen from above, ovate, acuminate in front, broadly rounded behind, greatest width equal to the height, and situated in the middle, whence the margins converge quickly towards the front, but scarcely at all backwards; end view subcircular, sides unequal. Surface quite smooth. Length, 1-45th of an inch (·54 mm.).

Dredged in Balfour Bay, Kerguelen Island, in a depth of 20 to 50 fathoms. Station 149.

[Pl. XXX. fig. 8, *a–d*. *a* Shell seen from the left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

Pontocypris, G. O. Sars.

Pontocypris, G. O. Sars, Oversigt af Norges marine Ostrac., 1865.

Shell thin and fragile, higher in front than behind. From the first joint of the seven-jointed anterior antennæ spring two short setæ, one seta from each of the four following joints, four from the sixth, and four from the seventh, those of the last joint being much the longest; last joint of the posterior antenna bearing four long terminal claws; to the side of the second joint is attached a pedicellated vesicle, and to its apex a brush of about five setæ, the longest of which do not much overreach the apices of the terminal claws. Mandibles slender, divided into several curved teeth, and bearing near the apex a long ciliated seta; palp robust, the basal joint large, and bearing a branchial appendage, last joint short and spinous. External segment of the first pair of maxillæ very large, the rest very short and setiferous, and provided with a branchial plate. Second pair of maxillæ without a branchial plate; palp large and subpediform, three-jointed, last joint in the female, armed with two long slightly curved claws. First pair of feet five-jointed, terminal claw very long; second pair flexuous, four-jointed, last joint short, armed at the extremity with several stout setæ, the margin of one of which is pectinated. Postabdominal rami well developed, with three long marginal setæ; at the apex two curved claws and one slender seta; also one long seta at the base, near the orifice of the intestinal canal. According to G. O. Sars, the ovaries are contained between the valves forming a loop posteriorly, while the testes extend round the whole circumference of the valves.

The palp of the second maxilla is here much more fully developed than in the two genera already described; and the armature of the second pair of feet affords another good distinctive character. The animals, though quite able to swim, are far from active in their habits,—in captivity at any rate being content chiefly to crawl on the bottom,—and, judging from structure, one would suppose that the habits of the genera *Phlyctenophora* and *Aglaia* must be pretty much the same. *Paracypris*, on the other hand, is restricted entirely to a crawling life, by the absence of swimming setæ on its lower antennæ. The specimens of *Pontocypris*, brought home by the Challenger, are remarkably few, and those few present no very distinctive shell characters; possibly they may be immature examples. The reason of this paucity of specimens I believe to be that the genus is essentially one belonging to shallow water, and no doubt littoral dredgings in the warm seas of the tropical and sub-tropical zones would bring to light numerous new species. Some few species from the Mediterranean and the Island of Mauritius I have already had the opportunity of describing.[1] In the open sea, and especially in shallow sheltered inlets, round the British Islands, in depths of from 5 to 20, or 30 fathoms, the two typical species, *Pontocypris mytiloides*, Norman, and *Pontocypris trigonella*, Sars, are often very abundant.

1. *Pontocypris trigonella*, G. O. Sars (Pl. XV. fig. 4, *a–d*).

Pontocypris trigonella, Sars, Oversigt af Norges marine Ostracoder, p. 16, 1865.
Pontocypris trigonella, Brady, Monograph of Recent Brit. Ostrac., p. 387, pl. xxv. figs. 31–34, and pl. xxviii. fig. 3.
Pontocypris trigonella, Brady, Crosskey, and Robertson, Monog. Post-Tertiary Entom., p. 137, pl. xvi. figs. 26–28.

Carapace compressed, oblong; seen from the side subtriangular, greatest height situated in the middle, and equal to half the length, anterior extremity moderately broad and well-rounded, posterior rounded, but much narrower; dorsal margin boldly arched, highest in the middle, ventral very gently sinuated in the middle; seen from

[1] Ann. and Mag. Nat. Hist., 1868 and 1869.

above regularly ovate, widest near, or a little in front of, the middle, and tapering equally toward both ends; extremities acuminate, width equal to one-third of the length; end view ovate. Surface of the shell smooth and polished, white or cream-coloured, and bearing often a few minute impressed puncta. Length, 1-50th of an inch (·5 mm.).

Found in a dredging from off Bermudas (Station 33), 435 fathoms; mud. These specimens, though considerably smaller than those met with in Europe, present no other important difference. I suppose, therefore, that the conditions of a tropical sea are not so favourable to the species as those of temperate regions. Possibly the same observation may hold good if applied to the whole genus. *Pontocypris trigonella* is a common species in Northern Europe, and has been noticed also in dredgings from the Mediterranean and Cape Verde. It occurs not unfrequently in the Post-Tertiary deposits of Scotland.

[Pl. XV. fig. 4, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. All magnified 60 diameters.]

2. *Pontocypris simplex*, n. sp. (Pl. I. fig. 5, *a–d*).

Carapace compressed, elongated; seen from the side, subreniform, higher in front than behind; greatest height situated in the middle, and equal to half the length; anterior extremity broadly and obliquely rounded, posterior rounded but considerably narrowed; dorsal margin boldly arched, highest near the middle; ventral sinuated in front of the middle; seen from above the outline is ovate, widest a little in front of the middle; extremities subacuminate, width equal to somewhat more than one-third of the length; end view ovate, rather compressed towards the dorsal margin; surface of the valves quite smooth. Length, 1-38th of an inch (·66 mm.).

Dredged in a depth of 7 fathoms off Ascension Island.

[Pl. I. fig. 5, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

3. *Pontocypris faba* (?), Reuss (Pl. I. fig. 4, *a–d*).

Bairdia faba, Reuss, Ein Beitrag zur genaueren Kenntniss der Kreidegebilde Meklenburgs, Zeitsch. d. deutsch. Geol. Ges., 1855, p. 278, pl. x. fig. 2.
Pontocypris faba, Brady, Ostracoda of the Antwerp Crag, Trans. Zool. Soc., 1878, p. 382, pl. lxiii. fig. 6, *a–e*.

Carapace of the female rather tumid; seen from the side subtriangular, highest in front of the middle, the height being equal to more than half the length; anterior extremity very broadly rounded, posterior much attenuated and almost acuminate; dorsal margin very boldly arched, highest in front of the middle, sloping with a steep curve backwards, and more gently towards the front; ventral rather deeply sinuated in the middle; seen from above, the shape is ovate, rather more than twice as long as broad, widest in front of the middle, and acuminate at the extremities; end view broadly ovate. Surface of the shell perfectly smooth. Length, 1-30th of an inch (·85 mm.).

The foregoing description applies to the female carapace, which I suppose to be represented by the figures *a–c*, the form figured at *d* being probably the male of the same species. Forms found in the Antwerp Crag differing from each other in almost precisely the same way, and agreeing very closely with those here described, I have, through the kindness of M. Ernest Vanden Broeck, already had the opportunity of describing; the Challenger specimens are, however, somewhat larger. The following dredgings yielded specimens which I refer to this species: males, off East Moncœur Island, Bass Strait (Station 162), 38 to 40 fathoms, sand; females, off Reefs, Honolulu, 40 fathoms.

[Pl. I. fig. 4, *a–d*. *a* Shell of female seen from left side, *b* from below, *c* from front, *d* male seen from left side. All magnified 40 diameters.]

4. *Pontocypris attenuata*, G. S. Brady (Pl. XV. fig. 2, *a–d*).

> *Pontocypris attenuata*, Brady, Ann. and Mag. Nat. Hist., ser. 4, vol. ii. 1868, p. 179, pl. iv. figs. 11–14.

Carapace compressed, elongated, siliquose; seen from the side subtriangular, much higher in front than behind, height scarcely equal to half the length; anterior extremity broadly rounded, posterior attenuated, and tapering to a narrowly-rounded point; dorsal margin elevated, and subangular in front of the middle, thence sloping gently towards the front, steeply and almost in a straight line backwards; ventral margin deeply sinuated in front of the middle; seen from above, the outline is compressed, lanceolate, widest in front of the middle, extremities acuminate, greatest width equal to about one-third of the length; end view ovate; surface of the shell quite smooth. Length, 1-43d of an inch (·57 mm.).

Found in anchor-mud, from a depth of 7 fathoms, in Hong-kong Harbour and in Humboldt Bay, Papua, 37 fathoms. The type-specimens were from Mauritius.

[Pl. XV. fig. 2, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. All magnified 60 diameters.]

5. *Pontocypris* (?) *subreniformis*, n. sp. (Pl. XV. fig. 6, *a–d*).

Carapace, as seen from the side, subreniform, highest in the middle, height equal to somewhat more than half the length; anterior extremity rounded, somewhat depressed, posterior broad, rather flattened, rounded off above and below; dorsal margin very boldly arched, almost gibbous in the middle where it is highest; ventral margin, very slightly sinuated; seen from above the outline is evenly ovate, widest in the middle, extremities rounded off, the anterior much the narrower of the two, greatest width equal to more than one-third of the length; end view broadly ovate, widest toward the ventral margin; surface of the shell smooth. Length, 1-43d of an inch (·57 mm.).

Dredged in Simon's Bay, South Africa, 15 to 20 fathoms (Station 140); Port Jackson, Australia, 2 to 10 fathoms. The anterior depression of this species suggests doubt as to the propriety of its genuine location as a *Pontocypris*, but I do not know of any genus, except perhaps *Bythocypris*, to which it could with propriety be referred, its anatomical characters being quite unknown.

[Pl. XV. fig. 6, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. All magnified 60 diameters.]

Argillœcia, G. O. Sars.

Argillœcia, Sars, Oversigt af Norges marine Ostracoder, 1865.
Argillœcia, Brady, Crosskey, and Robertson, Post-Tertiary Entomostraca, 1874.

Valves equal, smooth, elongated, moderately robust, scarcely higher in front than behind, more or less angulated at the junction of the posterior and ventral margins. Anterior antennæ (Pl. IV. fig. 5) robust, five-jointed, first joint large and stout, the rest beset on the lower margins with strong spines, and on the upper margins, especially in the male, with numerous long setæ; posterior antennæ (Pl. IV. fig. 6) short and thick, otherwise as in *Pontocypris;* the setæ of the antepenultimate joint in the female short, in the male very long, and reaching much beyond the terminal claws. Mandibles (fig. 7) almost as in *Pontocypris*, the palp, however, having only three or four setæ ("one," Sars) in place of a branchial plate. Palp of the second pair of jaws indistinctly three-jointed (fig. 9) bearing several terminal setæ ("ending in a single claw," Sars). First pair of feet (fig. 10) strong, ending in two nearly equal claws; second pair unlike the first, and almost like those of *Pontocypris;* last joint very short, and bearing three setæ, of which one is very long and curved. Postabdominal rami short, attenuated towards the apices, terminal claws very small. Eye wanting.

The anatomical details of *Argillœcia eburnea*, as shown in Pl. IV., do not in all respects coincide with Sars' generic description; the antennal setæ of *Argillœcia eburnea* are much longer and more slender than ought to be the case, the branchial setæ of the mandible-palp are more numerous, and the second pair of maxillæ seem to be somewhat different in structure; yet, notwithstanding these divergences, I prefer, for the present at least, to place this species in the already established genus, rather than to create a new one on what might perhaps prove to be insufficient grounds. The genus, though widely distributed, does not seem to contain a large number of species, and these, like most of the *Cypridæ*, present so few peculiarities of external form that their identification is a difficult matter in the case of fossil species and of recent empty shells. The subacute infero-posteal angle, and the overlap of the right valve in the centre of the ventral surface, are the only tangible distinctive marks, so far as the shell is concerned.

1. *Argillæcia eburnea*, n. sp. (Pl. IV. figs. 1–15).

Shell oblong, compressed, subreniform, height less than half the length; seen from the side the anterior extremity is obliquely rounded; posterior produced, and subacute at the ventral angle; dorsal margin boldly arched, highest in the middle, sloping, with a gentle curve forwards, and steeply backwards, as far as the ventral angle; ventral margin rather deeply sinuated in the middle; seen from above, compressed ovate, widest near the middle, acuminate in front, rounded behind, width equal to the height; end view nearly circular. Surface of the shell perfectly smooth. Length, 1-32d of an inch (·77 mm.).

Argillæcia eburnea, occurred plentifully in two dredgings from Kerguelen Island,—Balfour Bay, 20 to 50 fathoms, and off Christmas Harbour, 120 fathoms; also in lat. 35° 39′ S., long. 50° 47′ W., 1900 fathoms (Station 323).

[Pl. IV. figs. 1–15. Fig. 1, shell of male seen from left side; fig. 2, from above; fig. 3, from below; fig. 4, from front; fig. 5, anterior antenna; fig. 6, posterior antenna; fig. 7, mandible and palp; fig. 8, first maxilla; fig. 9, second maxilla (male); fig. 10, first foot; fig. 11, second foot (male); fig. 12, second foot (female); fig. 13, abdomen and postabdominal ramus; fig. 14, copulative organs of male; fig. 15, muscle spots. The figures of the shell magnified 50 diameters.]

2. *Argillæcia badia*, n. sp. (Pl. VI. fig. 3, *a-d*).

Shell minute, compressed, ovate; seen from the side, oblong, subovate, higher in front than behind, greatest height situated in the middle, and equal to half the length; anterior extremity broadly rounded, posterior depressed, obliquely rounded; dorsal margin moderately arched, ventral almost straight; seen from above, ovate, acuminate in front, rounded behind, greatest width in the middle, and equal to rather more than one-third of the length; end view subcircular. Surface of the shell perfectly smooth. Length, 1-62d of an inch (·4 mm.).

Dredged at Port Jackson, Australia, in 2 to 10 fathoms.

[Pl. VI. fig. 3, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front, magnified 60 diameters.]

Macrocypris, G. S. Brady.

Macrocypris, Brady, Monog. Recent Brit. Ostrac., 1868.
Bairdia (in part), G. O. Sars, Oversigt af Norges marin. Ostr., 1865.

Carapace elongated, attenuated at the extremities; valves unequal, the right larger than the left, and overlapping dorsally; hinge-line flexuous. Surface of the shell smooth, polished, and destitute of hairs. Antennæ short and robust; the anterior seven-jointed, tapering to the apex, bearing numerous short setæ; posterior five-jointed.

last two joints very short; terminal claws elongated; second joint bearing a bundle of short biarticulate setæ. Mandibles large, dilated, and armed with six or seven strong teeth; palp elongated, four-jointed, and provided with a branchial appendage. The first pair of jaws have an unusually small, subovate branchial plate, and the external segment is narrow, and not larger than the rest; second pair destitute of a branchial appendage; palp in the female, large and subpediform, four-jointed, the last joint armed with three claws; in the male, very robust and subcheliform. First pair of feet much elongated, five-jointed, last joint armed with one or two long curved claws; second pair very different, covered entirely by the shell, five-jointed, terminal claw very long and recurved. Postabdominal rami rudimentary, forming two small simple appendages attached to the posterior part of the abdomen. No eye. Male smaller than the female; copulative organs large; spermatic glands long and narrow, the lateral filaments apparently not arranged in a verticellate manner.

The type of this genus, *Macrocypris minna*, was included by G. O. Sars under *Bairdia*, he having had no opportunity of investigating the anatomy of the animal. The shell, however, differs distinctly from that of *Bairdia* in having the *right* valve instead of the left the larger; while as to the structure of the contained animal, the presence in *Macrocypris* of two pairs of jaws, the flexuous second foot, and the rudimentary postabdominal rami, besides other differences, are amply sufficient to separate the one genus from the other.

1. *Macrocypris tenuicauda*, n. sp. (Pl. II. fig. 1, *a–f*, and Pl. III. fig. 2, *a*, *b*).

Carapace elongated, siliquose; seen from the side subtriangular, highest in the middle, narrowly rounded in front, much attenuated, and subacuminate behind; dorsal margin strongly arched, and sloping steeply from the middle to each extremity, ventral slightly sinuated in front; height equal to rather more than one-third of the length; seen from above the outline is broadly ovate, widest near the middle, and tapering evenly to the extremities, which are acuminate; width and height nearly equal; the end view is subcircular, but somewhat angulated above, and keeled below; the left valve (Pl. II. fig. 1, *e*) is much narrower than the right (fig. 1, *f*), and has its dorsal arch truncated. Shell perfectly smooth, dense in structure, whitish. Length, 1-16th of an inch (1·55 mm.).

This species seems to be not very widely distributed; the only dredgings in which I have met with it being those from off Culebra Island, West Indies, 390 fathoms, mud (Station 24); and off North Brazil, 350 fathoms, mud (Station 122). In both of these it occurred abundantly, though the specimens were for the most part separated valves. From some of the more perfect specimens I have been able to satisfy myself as to the structure of the contained animal, and this, together with the characters of the shell, is sufficient to identify the genus to which it belongs.

[Pl. II. fig. 1, *a–f*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front, *e* left valve *f* right valve; all magnified 40 diameters. Plate III. fig. 2, *a–b*. *a* Second maxilla of male, *b* second foot.]

2. *Macrocypris canariensis*, n. sp. (Pl. II. fig. 3, *a–d*).

Carapace, as seen from the side, elongated, arcuate, highest in the middle, the dorsal margin forming one continuous arch as far as the extremities, both of which are subacute; ventral margin nearly straight; height equal to one-third of the length; seen from above, the outline is elongate-ovate, more than thrice as long as broad, widest in the middle, and tapering gradually to the extremities, both of which are acuminate. Surface of the shell quite smooth. Length, 1-12th of an inch (2·1 mm.).

Only one example of this species has been noticed. It occurred in a dredging from a depth of 620 fathoms, off the Canary Islands, on a bottom of sandy mud and shells (Station 8).

[Pl. II. fig. 3, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 30 diameters.]

3. *Macrocypris similis*, n. sp. (Pl. II. fig. 2, *a–d*).

Carapace, as seen from the side, elongated, siliquose, highest in the middle, height not equal to one-half of the length; anterior extremity broadly rounded, posterior acuminate at the ventral angle; dorsal margin strongly arched, sloping gently towards the front, and with a steep curve to the ventral angle; ventral margin sinuous, incurved in the middle; seen from above, ovate, widest in the middle, nearly thrice as long as broad; extremities acute; end view subcircular, width less than the height. Shell-surface smooth and polished. Length, 1-12th of an inch (2·1 mm.).

Habitat.—Off Pernambuco, lat. 8° 37′ S., long. 34° 28′ W., 675 fathoms, mud (Station 120). From a sounding in a depth of 160 fathoms off the coast of Patagonia, and off Ascension Island, 420 fathoms.

This is perplexingly like in its general characters to the next described species, *Macrocypris orientalis;* but it is at least twice as large, and somewhat more compressed.

[Pl. II. fig. 2, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 30 diameters.]

4. *Macrocypris orientalis*, G. S. Brady (Pl. II. fig. 4, *a–d*).

Macrocypris orientalis, Brady, Les Fonds de la Mer, tom. i., p. 61, pl. vii. figs. 1–3.
(?) *Cytherina acuminata*, Alth., Reuss in Haidinger's Abhandl., 1850, vol. iv. p. 49, tab. vi. fig. 7, *a–c*, and fig. 8.

Except in its much smaller size, and in being more robust, there are no characters in this species to separate it from *Macrocypris similis*. Its length is 1-27th of an inch (·9 mm.).

The figures of *Cytherina acuminata*, given by Reuss (*loc. cit.*), though somewhat more slender, are very near to the present species in general character. Indeed, had Reuss's drawings referred to a recent species, there need have been no hesitation in saying that our shells belonged to the same, but as *Cytherina acuminata* is a chalk-marl species, and is stated to be only ·7 mm. in length, it seems best to regard its identity as, at any rate, not proven for the present. The Challenger specimens are from near Booby Island, lat. 10° 36′ S., long. 141° 55′ E., 6 to 8 fathoms (Station 187), and (?) from Humboldt Bay, Papua, 37 fathoms. The type specimens, described in Les Fonds de la Mer, are from Batavia and other stations in the Malay Archipelago.

[Pl. II. fig. 4, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

5. *Macrocypris setigera*, n. sp. (Pl. I. fig. 1, *a–d*).

Carapace, as seen from the side, elongated, subtriangular, highest in the middle, height less than half the length; extremities rounded, the anterior the broader of the two; dorsal margin boldly arched, high in the middle, ventral nearly straight; seen from above, ovate, nearly thrice as long as broad, widest in the middle, and only slightly tapering towards the very broadly rounded extremities; end view nearly circular. Shell smooth, bearing a few small scattered setæ towards the extremities. Length, 1-20th of an inch.

Found only in a dredging made at Port Jackson, in a depth of 2 to 10 fathoms. The specimens being only empty shells, I have no means of verifying the generic reference, so that the position here assigned to the species must be understood as purely provisional.

[Pl. I. fig. 1, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 40 diameters.]

6. *Macrocypris tumida*, n. sp. (Pl. VI. fig. 2, *a–d*).

Shell oblong, tumid, subovate; seen laterally the anterior extremity is broadly rounded, the posterior obliquely rounded, produced and obscurely angular below; dorsal margin boldly and evenly arched, highest in the middle; ventral straight; height equal to half the length; seen from above the outline is broadly ovate, widest in the middle, and tapering very slightly towards the extremities, which are broadly rounded; the anterior slightly mucronate, width equal to the height; end view nearly circular. Shell-surface smooth. Length, 1-16th of an inch (1·55 mm.).

A very fine and well-marked species, found in a dredging from a depth of 28 fathoms, in Royal Sound, Kerguelen Island (Station 149), and from Wellington Harbour, New Zealand, in tow-net at trawl.

[Pl. VI. fig. 2, *a-d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 30 diameters.]

7. *Macrocypris decora*, G. S. Brady (Pl. I. fig. 3, *a–d*, and Pl. VI. fig. 8, *a*, *b*).

Cytherideis decora, Brady, Trans. Zool. Soc., 1865, vol. v. p. 366, pl. lvii. fig. 13, *a–c*.
Paracypris hieroglyphica, Brady, Les Fonds de la Mer, tom. i., 1868, p. 62, pl. vii. figs. 7, 8.

Carapace, as seen from the side, elongated, flexuous, siliquose, highest in the middle; anterior extremity rather obliquely rounded, posterior attenuated, and very slightly rounded off, almost acuminate; dorsal margin boldly arched, somewhat flattened in the middle, sloping with a slight sinuosity towards the front, more steeply, and almost in a right line, backwards; ventral margin deeply sinuated in the middle; seen from above the outline is ovate, widest in the middle, and tapering to the extremities which are equally pointed, width and height almost equal; end view subcircular. Surface of the shell smooth, polished, and marked, in fresh living specimens, with two or more waved transverse bands of black (Pl. VI. fig. 8). Length, 1-22d of an inch (1·1 mm.).

A widely-distributed species in the Southern Hemisphere. Among the Challenger dredgings it occurred as follows:—Off Culebra Island, West Indies, 390 fathoms, mud (Station 24); off North Brazil, 350 fathoms, mud (Station 122); off Christmas Harbour, Kerguelen Island, 120 fathoms (Station 149); Nares' Harbour, Admiralty Islands, 16 fathoms. The type specimens were from Australia, and those more lately described under the name of *Paracypris hieroglyphica*, from Batavia.

Between this and the following species, *Macrocypris maculata*, the distinction is not very clear, the more regularly arcuate dorsal curve of the latter, together with its more evenly rounded extremities, when viewed from the side, seem to be the best diagnostic marks; but it is quite possible that further examination may show the two forms to belong to the males and females of one and the same species. The figures in Pl. VI. are given merely to show the coloured markings which occur in characteristic specimens.

[Pl. I. fig. 3, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Pl. VI. fig. 8, *a*, *b*. *a* Carapace seen from right side, *b* from above. Magnified 40 diameters.]

8. *Macrocypris maculata*, G. S. Brady (Pl. I. fig. 2, *a–d*).

Cytherideis maculata, Brady, Trans. Zool. Soc., 1865, vol. v. p. 367, pl. lvii. fig. 12, *a–b*.

Carapace, seen from the side, elongated, subreniform, highest in the middle, extremities rounded, and nearly equal in width, dorsal margin boldly arched, sloping about equally to either end; ventral margin sinuated in front of the middle, height scarcely equal to half the length; seen from above ovate, nearly thrice as long as broad, widest in the middle, and tapering evenly to each extremity; end view broadly ovate, keeled below. Shell smooth and polished. Length, 1-16th of an inch (1·55 mm.).

Macrocypris maculata was found in dredgings from the following localities:—Simon's

Bay, 15 to 20 fathoms (Station 140); Balfour Bay, Kerguelen Island, 20 to 50 fathoms (Station 149); Royal Sound, Kerguelen Island, 28 fathoms; off Prince Edward's Island, 50 to 150 fathoms; off East Moncœur Island, Bass' Strait, 38 to 40 fathoms (Station 162); and off Amboyna, 15 to 20 fathoms. The type specimens were from "Australia, the West Indies, and Turk's Island."

[Pl. I. fig. 2, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 30 diameters.]

Bythocypris, n. gen.

Shell thin and fragile, smooth, reniform or subreniform; left valve much larger than the right, which it overlaps both on the dorsal and ventral margins. Antennæ short and stout; anterior pair (Pl. V. fig. 1, *f*) six-jointed, the first two joints very large, the remainder small and bearing numerous long setæ; posterior pair (fig. 1, *g*) five-jointed, having no "hyaline vesicle," the second and fifth joints about twice as long as the rest, scarcely at all tapered toward the apex, and terminating in about six stout curved setæ, one of which is much stouter than the others; mandibles (fig. 1, *h*) armed with numerous strong serrated apical teeth, and bearing a well-developed, four-jointed, and setiferous palp, the first joint of which bears a rudimentary branchial appendage consisting of a single stout seta. One pair of jaws only (?), consisting of four setiferous digits (fig. 1, *i*) and a large branchial appendage, which is divided into two portions, the upper portion ovate and bearing ten setæ, the lower narrow, biarticulate, and provided with five slender setæ. Two pairs (?) of feet, the first (fig. 1, *j*) bearing a single curved terminal claw and about three short marginal setæ, the second (fig. 1, *k*) rudimentary, consisting of a single small joint with two stout setæ. Post-abdominal rami (fig. 1, *l*) of moderate size, curved, and armed at the apex with one long and one short curved seta.

Of this genus I have seen no perfect specimens, the description above given having been drawn up from the examination of a number of mutilated individuals. Most of the dredged specimens consisted of single detached valves; and the few which were perfect so far as the shell is concerned contained in no case more than very imperfect remains of the animal. Drawings of the various parts are given in Plate I., and from these it will be seen that the species cannot be assigned to any hitherto described genus, those with which it has most affinity, however, being *Cypris* and *Bairdia*. From *Cypris* it is distinctly separated by the unequal valves, the absence of a tuft of swimming setæ on the second pair of antennæ, and by the quite rudimentary character of the branchial appendage of the mandible-palp; from *Bairdia*, to which, however, it approaches very closely, by the rudimentary branchial appendage of the mandible (which in *Bairdia* (Pl. I. fig. 2, *c*) consists of a distinct trisetose joint); and by differences in the characters of the maxillary branchial apparatus and of the post-abdominal rami. From all other genera of

Cypridæ—except, perhaps, *Potamocypris*, the animal of which is as yet imperfectly known—the characters of the shell afford amply sufficient distinction. The anatomical points which want still further elucidation are, chiefly, the presence or absence of a second maxilla,—(though, considering its close affinity with *Bairdia*, the absence of this organ may perhaps be safely assumed),—the number and characters of the feet, and the real nature of the rudimentary organ here called the second foot.

1. *Bythocypris reniformis*, n. sp. (Pl. V. fig. 1, *a–l*).

Carapace reniform; seen laterally, the greatest height situated in the middle, and equal to more than half the length; extremities rounded, the anterior broader than the posterior, ventral margin sinuated in the middle, dorsal boldly and evenly arched; seen from above, the outline is narrowly ovate, about thrice as long as broad and widest in the middle, tapering evenly to the extremities, of which the anterior is pointed, the posterior narrowly rounded; end view ovate, the width equal to about two-thirds of the height. The left valve is more rounded in contour, and is also much more strongly arched dorsally than the right valve, the hinge margins overlapping along almost its entire length; its lower margin also forms a curved flange, which overlaps the right valve in the middle of the ventral aspect. The shell is smooth, thin, and homogeneous in structure, but marked with irregularly scattered translucent spots; muscle spots arranged irregularly near the centre of the valves. Length, 1-20th of an inch (1·3 mm.).

A considerable number of detached valves, together with a few entire specimens, of the shell of this species were found in dredgings from 390 fathoms, off Culebra Island, West Indies, mud (Station 24); off North Brazil, in 675 fathoms and 350 fathoms, mud (Stations 120 and 122); off Prince Edward's Island, in 50 to 150 fathoms; and off East Moncœur Island, Bass' Straits, in 38 to 40 fathoms, sand.

[Pl. V. fig. 1, *a–l*. *a* Carapace, magnified 40 diameters, seen from left side, *b* from right side, *c* from above, *d* from below, *e* from front, *f* anterior antenna, *g* posterior antenna, *h* mandible with palp, *i* maxilla with palp, *j* first foot, *k* second foot (?), *l* abdominal ramus.]

2. *Bythocypris* (?) *compressa*, n. sp. (Pl. XXXV. fig. 5, *a–d*).

Carapace compressed, elongated, subreniform, greatest height situated in the middle, and equal to half the length. Seen laterally the anterior extremity is broad, obliquely rounded, and somewhat produced at its lower end, the posterior much narrower and evenly rounded; dorsal margin well arched, ventral gently sinuated; seen from above, the outline is compressed, ovate, widest in the middle, and tapering evenly to the extremities, which are not very acute; width equal to about one-third of the length. The end view is subovate, rounded above, and rather suddenly narrowed below the middle. Shell smooth and structureless. Length, 1-33d of an inch (·77 mm.).

One specimen only of this species was found in material dredged in 18 fathoms off Tongatabu, South Pacific (Station 172). From *Bythocypris reniformis* it is separated by the broad, very oblique, and downwardly produced anterior margin, as well as by a generally more elongated contour.

[Pl. XXXV. fig. 5, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. All magnified 50 diameters.]

3. *Bythocypris elongata*, n. sp. (Pl. VI. fig. 1, *a–c*).

Carapace compressed, elongated; seen from the side, subreniform, highest in the middle, height equal to about half the length; anterior extremity rounded off, posterior somewhat produced, narrowed, scarcely rounded; dorsal margin forming a flattened arch, which slopes much more abruptly behind than in front; ventral very slightly sinuated in the middle; seen from above the outline is elongate-ovate, widest in the middle, and having subacuminate extremities. The valves are unequal, the right being somewhat lower and more angular in outline than the left. Surface of the shell quite smooth. Length, 1-22d of an inch (1·1 mm.).

Only a few separated valves of this species have been noticed. It is impossible to refer them even provisionally to any known species, and their true generic position is also doubtful. In general appearance they seem to come nearer to *Bythocypris* than to any other genus. The specimens described were found in a dredging from a depth of 1425 fathoms, north of Tristan d'Acunha, lat. 32° 24′ S., long. 13° 5′ W. (Station 335).

Bairdia, M'Coy.

Bairdia, M'Coy, Carb. Limest. Foss. Ireland, 1844.

Valves unequal in size, the left much the larger of the two, and overlapping the right on the dorsal, and in the middle of the ventral surface; the right valve (Pl. VIII. fig. 1, *e*) is narrow, elongated, and angular; its anterior margin often rather produced at the lower extremity; dorsal margin flattened in the middle, and sloping steeply toward each end; the posterior extremity produced into a more or less prominent beak; and the ventral margin more or less sinuated; the left valve (fig. 1, *f*) is much less angular in outline, dorsal margin much elevated, and very strongly arched; ventral convex; anterior extremity broadly rounded, posterior narrower, but not beaked. The shape of the shell is variable, — reniform, subtriangular or subrhomboidal; hinge simple, and without teeth; shell-surface smooth, hirsute or slightly punctate. Muscle-spots not far from the centre of the valves, and arranged usually in a rosette. Eyes absent. Antennæ usually robust; the anterior pair six to eight-jointed (Pl. V. fig. 2, *a*), first two joints large, the rest short, and finally joined together, "but forming with a second joint, a movable hinge" (Sars), and bearing numerous long, apical setæ; posterior antennæ five or six-jointed, the first joint bearing at its base a bisetose tubercle, fourth and fifth joints elongated and slender, last joint very short, and terminating in two or three curved claws (fig. 2, *b*); mandibes (fig. 2, *c*) large, bearing six or seven strong curved teeth at the dilated extremity; palp robust, four-jointed, and provided with a trisetose branchial appendage, which is attached to the basal joint. One pair of jaws only (fig. 2, *d*), divided into three or four narrow subequal and setiferous branches, and having a large branchial plate, which is divided into two parts by a distinct constriction, the basal portion bearing six, the upper dilated and ovate portion about twenty-four, long ciliated filaments. Three pairs of feet, all of similar structure, directed forwards and protuding from the shell, four-jointed, and terminating in a long claw, the first pair having attached to its basal joint a large ovate, branchial lamina, which, like that of the maxilla, is divided into two portions, and fringed with numerous plumose filaments (fig. 2, *e*). Postabdominal rami (Pl. III. fig. 3, *e*, and Pl. V. fig. 2, *g*) well developed, and of moderate length, bearing several lateral setæ, and two long, curved apical claws, the larger of which is (at any rate, sometimes) pectinated towards the apex. Copulative organs of the male (Pl. III. fig. 3, *a*) complex in structure, and not unlike those of many *Cytheridæ;* no spermatic glands have been noticed. The animal crawls slowly about amongst the mud.

This is a widely dispersed genus, attaining, apparently, its greatest development in the tropical and southern seas, in dredgings from which regions the number of specimens of *Bairdiæ* not unfrequently exceeds that of all the other *Ostracoda* together; the individuals, however, though numerous, are usually found to belong in each gathering to one, or at most two, predominant species.

The anatomy of the genus has been pretty well made out by G. O. Sars,[1] from an examination of the European species, *Bairdia complanata*, Brady. The structure of this animal agrees in all essential respects with that of *Bairdia villosa*, a new species of which several perfect examples occurred in the Challenger dredgings from Kerguelen Island, and which I have been able to dissect and figure with tolerable completeness. The most important generic characters,—apart from the form of the shell, the peculiarities of which have long been recognised,—reside in the absence of the second maxilla, the very small trisetose branchial appendage of the mandible, and the presence of a branchial appendage to the first foot, of which, unlike the typical *Cypridæ,* there are three pairs. G. O. Sars has, with his usual accuracy and acuteness, pointed out that this genus constitutes a very interesting link between the two families *Cypridæ* and *Cytheridæ,* agreeing with the first-named family in its perfectly developed postabdominal rami, and with the last in having three pairs of legs, the first of which, however, answers to the second maxilla of the typical *Cypridæ,* and has attached to its base a well-developed

[1] Undersögelser over Hardangerfjordens Fauna, I. Crustacea, af G. O. Sars (Videnskabs.—Selskabets Forhandlinger, p. 246, 1871).

branchial plate. The genera *Pontocypris* and *Macrocypris* also show intermediate characters in the structure of the second pair of maxillæ.

Of the twenty-three species of *Bairdia* noticed in this monograph, one only, *Bairdia villosa,* was taken alive. All the rest are represented merely by dead shells. In this condition it will be seen that the task of specific identification becomes very difficult, the only available characters being those of the shell, which in this genus does not show any very marked specific differences of surface-ornament; the shape and proportions of the shell thus become the only available diagnostic marks, and it is very probable that the further investigation of larger numbers of specimens, and above all, of living animals, may very much modify our view as to the validity of some of the characters here adopted as specific marks, but which may prove to be dependent upon sex or stages of growth. It need scarcely be said that many of the fossil forms described by authors under the generic name *Bairdia,* must of necessity be transferred to other genera, and the same observation holds good as regards *Cythere, Cytheridea, Cypridina,* and other names in use by palæontologists before our anatomical knowledge of the group had been much elaborated. But as important anatomical differences are constantly coincident with well-marked shell characters,[1] it is possible in most cases to refer even fossil species to their proper generic position, the difficulty being, indeed, no greater than constantly occurs with recent dredged specimens, in which the animal contents of the shell have entirely disappeared.

1. *Bairdia fusca,* G. S. Brady (Pl. VII. fig. 2, *a–d*).

Bairdia fusca, Brady, Trans. Zool. Soc. London, 1865, vol. v. p. 364, pl. lvii. fig. 9, *a–d.*

Carapace as seen from the side subtriangular, greatest height situated in the middle, and equal to about two-thirds of the length; extremities rounded, but more broadly in front than behind; ventral margin nearly straight; dorsal very boldly arched; seen from above, the outline is compressed, ovate, subacuminate behind, and rather more obtusely pointed in front; greatest width in the middle, scarcely equal to half the length; end view ovate, height much exceeding the width. Shell-surface smooth (slightly hairy when recent), and covered with closely set minute punctations. Length, 1-25th of an inch (1 mm.).

A few specimens of *Bairdia fusca* occurred in a dredging made in very shallow water (2 to 10 fathoms) at Port Jackson, Australia. The species was described by myself in 1865, from Australian specimens, which agree entirely with those brought home by the Challenger, except that these last, being only dead shells, are pale in colour and have lost all their hairs.

[1] So far as British Post-Tertiary species are concerned, these characters have been tabulated in Messrs Brady, Crosskey, and Robertson's Monograph of the Post-Tertiary Entomostraca, issued by the Palæontographical Society.

[Pl. VII. fig. 2, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. All magnified 30 diameters.]

2. *Bairdia villosa*, n. sp. (Pl. III. fig. 3, *a*, *b*, Pl. V. fig. 2, *a–g*, and Pl. VIII. fig. 4, *a–f*).

Carapace, as seen laterally, subtriangular, highest in the middle, height equal to two-thirds of the length; extremities well rounded and not at all beaked; dorsal margin excessively arched, very high and subangular in the middle; ventral almost straight; seen from above, regularly ovate with subacute and nearly equal extremities, twice as long as broad; end view broadly ovate. The shell is finely punctate, and densely clothed with coarse brown hairs, many of which, especially towards the hinder extremity, are very long; colour, deep brown. Length, 1-18th of an inch (1·4 mm.).

The antennæ are more slender than is usual in this genus (Pl. V. fig. 2, *a*, *b*); the anterior pair seven-jointed, the posterior six-jointed (?). The terminal claws of the post-abdominal rami (fig. 2, *g*) are two, one of them very long, and bearing towards the apex a long seta and a number of short cilia, arranged in a pectinate manner along its concave side; the other claw, about half as long, and destitute of marginal setæ; the inner margin of the ramus bears near its distal end, five long setæ. In other respects the animal exhibits the ordinary characters of the genus.

The following is the list of dredgings in which *Bairdia villosa* has been found:—off Nightingale Island (Tristan d'Acunha), 100 to 150 fathoms (Station 135); Balfour Bay, Kerguelen Island, 20 to 50 fathoms (Station 149); off Christmas Harbour, Kerguelen Island, 120 fathoms; off Prince Edward's Island, 50 to 150 fathoms; off East Moncœur Island, Bass' Strait, 38 to 40 fathoms (Station 162).

The characters of the species are sufficiently well marked; it is less compressed, larger and much more hirsute than *Bairdia fusca*, and much less tumid than the following species, *Bairdia hirsuta*. In the Balfour Bay dredging there were a considerable number of specimens, but not so many in those from other localities.

[Pl. III. fig. 3, *a*, *b*. *a* Copulative organs and postabdominal rami of the male, *b* labrum. Pl. V. fig. 2, *a–g*. *a* Anterior antenna, *b* posterior antenna, *c* mandible, *d* maxilla, *e* first foot with branchial plate attached, *f* second foot, *g* postabdominal ramus. Pl. VIII. fig. 4, *a–f*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front, *e* right valve, *f* left valve; the figures of the shell magnified 30 diameters.]

3. *Bairdia hirsuta*, n. sp. (Pl. VIII. fig. 3, *a–d*).

In general appearance very much like the preceding species, but more tumid, more compressed at the extremities, and slightly beaked behind; seen from the side, the dorsal margin is not so strongly arched as in *Bairdia villosa*, the ventral margin is convex, and both extremities are slightly produced; height equal to two-thirds of the length; seen from above, the outline is broadly ovate, with suddenly tapering and produced mucronate extremities, twice as long as broad; end view very broadly ovate, the greatest width being below the middle, and almost equalling the height. Shell brown and densely hairy. Length, 1-16th of an inch (1·55 mm.).

Dredged in lat. 38° 6′ S., long. 88° 2′ W., bottom of red clay, 1825 fathoms (Station 296); and in lat. 33° 42′ S., long. 78° 18′ W., 1375 fathoms, among globigerina ooze (Station 300).

[Pl. VIII. figs. 3, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 30 diameters.]

4. *Bairdia simplex*, n. sp. (Pl. VII. fig. 1, *a–d*).

Carapace, as seen from the side, oblong, subovate, nearly twice as long as high, extremities rather narrow, evenly rounded; dorsal margin arched, ventral straight or slightly convex; the outline, as seen from above, is compressed, ovate, about twice as long as broad, widest in the middle, extremities subacuminate; end view broadly ovate, widest in the middle, width equal to two-thirds of the height. Shell-surface smooth, with a few scattered hairs. Length, 1-20th of an inch (1·3 mm.).

One or two specimens of this species were found in a dredging (Station 151) made off Heard Island, in 75 fathoms, on a muddy bottom. Were it not for its much more elongated contour and larger size, it might have been referred to *Bairdia villosa*, to which in other respects it bears a very close resemblance.

[Pl. VII. fig. 1, *a–d*. *a* Carapace seen from the left side, *b* from above, *c* from below, *d* from front. Magnified 30 diameters.]

5. *Bairdia exaltata*, n. sp. (Pl. IX. fig. 2, *a–d*).

Carapace, as seen from the side, subovate, highest in the middle; height equal to more than two-thirds of the length; extremities evenly, and very broadly rounded, dorsal margin excessively arched, ventral slightly convex; seen from above the outline is ovate, with compressed, though rather obtuse extremities, more than twice as long as broad, the greatest width being in the middle; end view ovate, much attenuated towards the dorsal edge, widest in the middle, the greatest width equal to two-thirds of the height. Shell-surface perfectly smooth, and polished. Length, 1-18th of an inch (·1·4 mm.).

One or two specimens only of this fine and very distinct species were collected in a dredging from lat. 2° 33′ S., long. 144° 4′ E., 1070 fathoms. Bottom of globigerina ooze (Station 218).

[Pl. IX. fig. 2, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 40 diameters.]

6. *Bairdia formosa*, G. S. Brady (Pl. X. fig. 1, *a–e*).

Bairdia formosa, Brady, Ann. and Mag. Nat. Hist., 1868, ser. 4, vol. ii. p. 221, pl. xiv. figs. 5–7.

Carapace as seen from the side subtriangular, all the angles broadly rounded off, height greatest in the middle, and equal to three-fourths of the length; the dorsal margin is excessively arched, and somewhat gibbous in the middle, the ventral straight or rather convex; anterior extremity broadly rounded, posterior narrower, slightly produced below the middle; seen from above, the outline is very broadly ovate, the greatest width being situated in the middle, and equal to more than half the length; extremities obtuse, submucronate; the end view is broadly ovate, the height considerably greater than the width. In well-developed adult specimens the surface is slightly punctate, and is beset with numerous slight tubercular or papilliform eminences, the left valve bearing also at its infero-posteal angle a series of five or six spines; the right valve is fringed along its anterior margin with a considerable number—twelve or more—of small blunt teeth; young specimens have the shell quite smooth and destitute of marginal teeth. Length, 1-16th of an inch (1·55 mm.).

Numerous specimens, chiefly detached valves, of this handsome species occurred in dredgings from lat. 38° 11′ N., long. 27° 9′ W., 900 fathoms, on a bottom of globigerina ooze (Station 76); from lat. 8° 37′ S., long. 34° 28′ W., 675 fathoms, muddy bottom (Station 120); from a depth of 350 fathoms off North Brazil, lat. 9° 5′ S., long. 34° 49′ W. (Station 122); and (one or two doubtful examples) from lat. 5° 26′ S., long. 133° 19′ E., 580 fathoms (Station 191*a*).

The Mediterranean specimens from which *Bairdia formosa* was originally described, differ not inconsiderably from those now under notice, being rather more elongated, more distinctly beaked behind, sharper and more constant in their spinous armature, and in the pitting of the shell surface. But notwithstanding this, the general aspect is so similar that I think it quite reasonable to look upon the specimens from these various localities as specifically identical. At any rate it would not be easy to point out good characters for specific distinction.

[Pl. X. fig. 1, *a–e*. *a* Carapace seen from left side, *b* from right side, *c* from above, *d* from below, *e* from front. Magnified 40 diameters.]

7. *Bairdia abyssicola*, n. sp. (Pl. VII. fig. 4, *a–c*).

Left valve, seen laterally, subreniform, highest in the middle; height equal to about two-thirds of the length; anterior extremity broadly rounded, posterior somewhat produced and narrowed, dorsal margin boldly arched, ventral nearly straight. The right valve is narrower, more produced behind, and has the dorsal margin sinuated near the front. Seen from above, the outline is regularly ovate. Surface of the shell quite smooth. Length, 1-16th of an inch (1·55 mm.).

The two valves figured in Pl. VII. are the only examples of this species. In the same dredging, from a depth of 2050 fathoms (Station 246) were also found some specimens of the next described species *Bairdia minima*, and it is not unlikely that one species may prove to be only a fully-developed stage of the other. This, however, cannot be decided without comparison with a larger series of specimens in various stages of growth.

[Pl. VII. fig. 4, *a–c*. *a* Left valve seen laterally, *b* right valve seen laterally, *c* the same seen from above. Magnified 30 diameters.]

8. *Bairdia minima*, n. sp. (Pl. VII. fig. 6, *a–g*).

Shell, seen laterally, oblong, subovate or subtriangular, somewhat gibbous, greatest height situated near the middle, and equal to nearly two-thirds of the length; extremities rounded, anterior broad, posterior somewhat angular and narrower; dorsal margin strongly arched and slightly angular or gibbous at its highest point, ventral nearly straight; seen from above, the outline is broadly and regularly ovate, widest in the middle, and tapering evenly to the extremities which are pointed; the width and height of the shell are equal; end view very broadly ovate or subcircular. [The specimen shown in figures *e–g* differs only in being somewhat more compressed laterally, and may, perhaps, belong to a male, figures *a–d* representing probably the female.] Shell perfectly smooth. Length, 1-35th of an inch (·75 mm.).

Habitat.—Port Jackson, Australia, 6 fathoms, and from a depth of 2050 fathoms, lat. 36° 10′ N., long. 178° 0′ E. Station 246.

The characters of this species are not very well marked, and it may fairly be doubted whether it be not only a young stage of some larger animal, perhaps of *Bairdia abyssicola*.

[Pl. VII. fig. 6, *a–g*. *a–d* specimens from Station 246. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. *e–g* specimens from Port Jackson; *e* seen from left side, *f* from below, *g* from front. All magnified 50 diameters.]

9. *Bairdia ovata* (?), Bosquet (Pl. VII. fig. 3, *a–d*).

Bairdia ovata, Bosquet, Crustacés fossiles du Limbourg, 1853, p. 63, pl. v. fig. 6, *a–d*.
Bairdia ovata, Brady, Trans. Zool. Soc. Lond., 1865, vol. v. p. 364, pl. lvii. fig 7, *a–c*.

Valves ovate, broadly and evenly rounded in front, more or less produced at the infero-posteal angle. The left valve is almost perfectly egg-shaped, very broad in front, the margins sweeping in one continuous curve, with a very bold dorsal, and a slight ventral arch to the posterior angle, which is subacute. The right valve is, as usual, narrower, distinctly beaked behind, and has the dorsal and ventral margins slightly sinuous; outline as seen from above, regularly ovate. Shell-surface quite smooth. Length, 1-22d of an inch (1·1 mm.).

Habitat.—Simon's Bay, South Africa, 15 to 20 fathoms (Station 140). Lat. 39° 32′ S., long. 171° 48′ E., 150 fathoms. Grey ooze (Station 167).

Though approaching very closely to the species described by M. Bosquet, under the name *ovata,* this somewhat differs from the figures given by that author, in being somewhat higher in proportion to its length, and more acute at the posterior angle. Still the resemblance is sufficiently close to justify, at any rate, a provisional reference to that species. I have not yet seen a specimen retaining both valves in apposition.

[Pl. VII. fig. 3, *a–d.* *a* Left valve seen from side, *b* from above, *c* right valve seen from side, *d* from above. Mangnified 40 diameters.]

10. *Bairdia globulus,* n. sp. (Pl. IX. fig. 1, *a–d*).

Carapace excessively tumid; as seen from the side, subcircular, the circumference forming one continuous curve, except behind, where the upper and lower borders unite, and form an acute angle; the anterior extremity is very broadly rounded, and bears a fringing row of several short closely-set teeth; the dorsal margin is very boldly and evenly arched, the ventral margin also considerably arched; height equal to three-fourths of the length; seen from above, the outline is broadly ovate, widest in the middle, and tapering equally to the extremities which are subacuminate, width equal to two-thirds of the length; end view ovate, tumid, height not much greater than the width. Surface of the shell smooth, marked by a few distant small impressed puncta. Length, 1-20th of an inch (1·3 mm.).

Two or three specimens only of this interesting and well-marked species were found amongst the proceeds of dredgings made near the Admiralty Islands, in a depth of 16 to 25 fathoms.

[Pl. IX. fig. 1, *a–d.* *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 40 diameters.]

11. *Bairdia amygdaloides,* G. S. Brady (Pl. IX. fig. 5, *a–f,* Pl. X. fig. 2, *a–c*).

Bairdia amygdaloides, Brady, Trans. Zool. Soc. Lond., 1865, vol. v. p. 364, pl. lvii. fig. 6, *a–c.*
Bairdia de wattrei, Brady, Les Fonds de la Mer, p. 199, pl. xxvii. figs. 17, 18.

Carapace, as seen from the side, subtriangular, greatest width situated in the middle, and equal to two-thirds of the length; anterior extremity broad and obliquely rounded, posterior narrowed to a subacute angle; dorsal margin boldly arched and somewhat gibbous in the middle, sloping almost in a right line toward the front, and with a steep curve backwards; ventral more or less convex; seen from above ovate, with slightly rounded extremities, width in the middle equal to half the length; end view broadly ovate, height one-third greater than the width. Surface of the shell smooth, often finely punctate. Length, 1-20th of an inch (1·3 mm.).

Habitat.—Off East Moncœur Island, Bass' Strait, 38 to 40 fathoms (Station 162);

Port Jackson, Australia, 2 to 10 fathoms; Torres' Straits, lat. 11° 35′ S., long. 144° 3′ E., 155 fathoms (Station 185); off Booby Island, lat. 10° 36′ S., long. 141° 55′ E., 6 to 8 fathoms (Station 187); Humboldt Bay, Papua, 37 fathoms; off reefs, Honolulu, 40 fathoms; sounding in lat. 47° 48′ S., long. 74° 48′ W., 160 fathoms (near Station 305).

The somewhat more tumid form of the species figured in Pl. X., I once thought to be specifically distinct, and on that account figured it separately. There seems, however, to be no sufficient ground for this separation.

[Pl. IX. fig. 5, *a–f*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front, *e* right valve, *f* left valve. Pl. X. fig. 2, *a–c*. *a* Carapace seen from left side, *b* from above, *c* from front. Magnified 40 diameters.]

12. *Bairdia foveolata*, G. S. Brady (Plate VIII. fig. 1, *a–f*, and fig. 2, *a–f*).

Bairdia foveolata, Brady, Les Fonds de la Mer, tom. i. p. 56, pl. vii. figs. 4–6.

Shell tumid; seen from the side subtriangular, highest in the middle; height equal to about two-thirds of the length; anterior extremity broad, obliquely rounded, and obscurely angulated in the middle; posterior narrowed and produced into a short obtuse beak; dorsal margin very strongly, ventral slightly arched; seen from above, the outline is lozenge-shaped, widest in the middle, and with obtusely rounded extremities, width equal to at least half the length; end view subcircular, height not much greater than the width. Surface of the shell smooth, usually more or less beset with small impressed puncta. Length, 1-22d of an inch (1·1 mm.).

Habitat.—Off Bermudas, 435 fathoms, mud (Station 33); off St Vincent, Cape Verde, 1070 to 1150 fathoms, mud (Stations 93 and 94); off East Moncœur Island, Bass' Strait, 38 to 40 fathoms, sand (Station 162); off Booby Island, 6 to 8 fathoms (Station 187); lat. 9° 59′ S., long. 137° 50′ E., 28 fathoms, mud (Station 189); Hong-kong Harbour, 7 fathoms; Admiralty Islands, 16 to 25 fathoms; sounding, 420 fathoms, October 20, 1875.

This is one of the more abundant forms of *Bairdia*, especially in the Southern Seas, and it seems to be subject to a great deal of variation, both in form and surface-ornament. Two varieties are figured in Pl. VIII., and the specimens from which the species was first described (Les Fonds de la Mer, tom. i.) differed from both of these in being more or less spinous on the anterior and posterior margins. This approaches, perhaps, as nearly as any recent form, to the typical *Bairdia subdeltoidea*, Münster, but the differences are too great to allow of its identification with that species. It is, indeed, very probable that several species are comprised under the specific name *subdeltoidea*, as applied by various palæontologists, the figures of that species given in the works of Messrs Bosquet, Jones, Speyer, Reuss, and Egger, presenting important points of difference among themselves.

[Pl. VIII. figs. 1 and 2, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front, *e* right valve, *f* left valve. Fig. 1 magnified 40, fig 2, 30 diameters.]

13. *Bairdia milne-edwardsi*, G. S. Brady (Pl. X. fig. 4, *a–g*).

Bairdia milne-edwardsi, Brady, Les Fonds de la Mer, tom. i. p. 139, pl. xvii. figs. 3, 4.

Carapace, as seen from the side, subtriangular, height equal to two-thirds of the length; anterior extremity slightly rounded, ending suddenly in an obtuse angle above; posterior produced into a median conical beak; dorsal margin strongly arched, gibbous, sloping with a steep curve to either end, sinuated in front, ventral margin slightly convex; seen from above the outline is lozenge-shaped, twice as long as broad, with a distinct lateral sinuation before and behind the middle, extremities obtuse, mucronate; end view broadly ovate, height one-third more than the width. Surface of the shell densely punctate with small circular impressions. Length, 1-25th of an inch (1 mm.).

The only dredging in which I have seen specimens at all certainly referable to this species is one from a depth of 1070 to 1150 fathoms, on a muddy bottom, off St Vincent, Cape Verde.

The types described in Les Fonds de la Mer, were also got at St Vincent. Some of the shells, which I have referred, with not a little hesitation, to *Bairdia foveolata*, make a very close approach to the present species: that figured in fig. 4 *a–c*, where, though the lateral outline is very different, the sinuous dorsal aspect is exactly the same, is an instance of a debateable form; judging from the regularly arcuate dorsal margin, the dentated anterior, and the very slightly produced posterior extremity, one would have placed it without hesitation apart from *Bairdia milne-edwardsi*, but the other aspects of the shell leave one in doubt about the matter. I have seen only one specimen, I think, of this questionable form: figures *d–g* must be looked upon as representing the typical form of the species.

[Pl. X. fig. 4, *a–g*. *a* Carapace (variety ?) seen from left side, *b* from below, *c* from front, *d* (typical form) seen from left side, *e* from above, *f* from below, *g* from front. Magnified 40 diameters.]

14. *Bairdia victrix*, G. S. Brady (Pl. X. fig. 5, *a–d*).

Bairdia victrix, Brady, Les Fonds de la Mer, tom. i. p. 152, pl. xviii. figs. 17, 18.

Carapace tumid, gibbous; seen from the side subtriangular, height equal to rather more than two-thirds of the length; anterior extremity rounded, posterior obliquely truncate and produced into a prominent obtuse beak; dorsal margin very boldly arched, ventral more or less convex, and often irregularly sinuous towards the posterior extremity; the margins of the right valve are often beset at the two extremities with numerous short, obtuse teeth; seen from above the outline is broadly ovate, more than twice as long as broad, widest in the middle; anterior extremity subacuminate, posterior broadly mucronate; end view ovate, widest below, height almost one-third greater than the width. Surface of the shell smooth, sometimes sparingly punctate, and (especially towards the hinder end) bearing a few scattered, rigid hairs. Length, 1-15th of an inch (1·6 mm.).

Habitat.—Off Culebra Island, West Indies, 390 fathoms, mud (Station 24); lat. 38° 11′ N., long. 27° 9′ W., 900 fathoms, globigerina ooze (Station 76); off Azores, lat. 38° 37′ N., long. 28° 30′ W., 450 fathoms, sand (Station 75); off North Brazil, 350 to 675 fathoms, mud (Stations 120 and 122); off Christmas Harbour, Kerguelen Islands, 120 fathoms (Station 149); off Sydney, Australia, 410 fathoms, grey ooze, Station 164*a* (?); north of Tristan d'Acunha, lat. 32° 24′ S., long. 13° 5′ W., 1425 fathoms, Station 335 (?).

This fine species seems to be commonly distributed in the South-Western Atlantic, and perhaps over even a larger area of the Southern Hemisphere, inhabiting chiefly water of a considerable depth. The two stations, 164*a* and 335, must be considered as doubtful, the specimens from the former place being not very well characterised, and only provisionally referred to this species, while from Tristan d'Acunha there is only one valve, which probably, but by no means certainly, belongs to *Bairdia victrix.* The species was first described from examples brought from Colon-Aspinwall, and I have also seen specimens taken at Cuba.

[Pl. X. fig. 5, *a–d.* *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 40 diameters.]

15. *Bairdia woodwardiana*, n. sp. (Pl. XI. fig. 1, *a–e*).

Carapace elongated, tumid, height equal to half the length; seen from the side, subrhomboidal; anterior extremity oblique, slightly rounded, ending above in an obtuse angle; posterior attenuated and produced into a tapering acute or subacute beak; dorsal margin forming a rather flattened arch, and sinuated towards each extremity, ventral nearly straight; seen from above, the outline is regularly ovate, about twice as long as broad, hinder end more tapering and acute than the front; end view subtriangular, widest below; height and width equal. Shell-surface smooth, more or less ornamented with minute circular punctures. Length, 1-25th of an inch (1 mm.).

Found only in one dredging—off Nukualofa, Tongatabu, 18 fathoms, coral (Station 178). About half a dozen specimens were picked out of this dredging.

Seen laterally the resemblance is very close between this species and *Bairdia crosskeiana*, but in all other aspects the two are entirely different, so that, though both species occurred in the Tongatabu dredging, it is scarcely likely that the differences are those merely of sex or growth.

The species is dedicated to my friend Dr H. Woodward, F.R.S. of the British

Museum, a naturalist to whose long continued and conscientious labours all students of the Crustacea are deeply indebted.

[Pl. XI. fig. 1, *a–e*. *a* Carapace seen from left side, *b* from right side, *c* from above, *d* from below, *e* from front. Magnified 50 diameters.]

16. *Bairdia crosskeiana*, G. S. Brady (Pl. IX. fig. 3, *a–c*).

Bairdia crosskeiana, Brady, Trans. Zool. Soc. Lond., 1865, vol. v. p. 366, pl. lvii. fig. 10, *a–d*.

Carapace elongated, compressed, greatest height equal to about half the length, and situated rather in front of the middle; seen laterally the outline is subpyriform, wider in front than behind; anterior extremity obliquely rounded and angulated at its junction with the dorsal margin; posterior gradually tapering, subacute, and more or less squamously dentated below; dorsal margin moderately arched, slightly sinuated in front; ventral margin nearly straight seen from above, the outline is spear-shaped, more than twice as long as broad, widest near the front, tapering abruptly and with a slight sinuosity forwards, very gradually and with a gentle curve backwards; the anterior extremity is somewhat obtusely rounded, the posterior subacute; end view ovate, narrowed above, broad below, height considerably exceeding the width. Surface of the shell smooth, marked with closely-set minute punctations. Length, 1-25th of an inch (1 mm.).

Found in the Tongatabu dredging, along with the preceding species; at Nares' Harbour, Admiralty Islands, in a depth of 16 fathoms; and off reefs at Honolulu, in 40 fathoms.

The southern form as shown by the Challenger dredgings differs from the types taken in the Mediterranean only in being somewhat more slender. My first specimens were found in sponge-sand from the Levant, but since then I have had dredged specimens from other parts of the Mediterranean.

[Pl. IX. fig. 3, *a–c*. *a* Carapace seen from left side, *b* from below, *c* from front. Magnified 40 diameters.]

17. *Bairdia expansa*, n. sp. (Pl. XI. fig. 2, *a–e*).

Carapace oblong, tumid; seen from the side, subrhomboidal; anterior extremity obliquely subtruncate, scarcely at all rounded; posterior much narrower, oblique, somewhat squamous, and divided into a few flattened tooth-like processes; dorsal margin evenly arched, ventral straight; height equal to more than half the length; the dorsal view is broadly ovate, not twice as long as broad, widest in the middle, tapering evenly to the extremities, which are mucronate; end view subtriangular, width slightly exceeding the height; shell-surface perfectly smooth. Length, 1-33d of an inch (·77 mm.).

One specimen only, from a depth of 40 fathoms, off Honolulu, in company with *Bairdia crosskeiana*, *attenuata* and *amygdaloides*. Apparently quite distinct from any other, but requiring further investigation with the help of a larger series of specimens.

[Pl. XI. fig. 2, *a–e*. *a* Carapace seen from left side, *b* from right side, *c* from above, *d* from below, *e* from front. Magnified 50 diameters.]

18. *Bairdia attenuata*, n. sp. (Pl. XI. fig. 3, *a–e*).

Carapace compressed, seen from the side, subtriangular; height equal to more than half the length; anterior extremity oblique, rounded off below, but obtusely angular above; posterior extremity narrowed and produced into a tapering beak; dorsal margin boldly arched in the middle, sinuated towards each extremity, ventral slightly convex; dorsal outline compressed, lozenge-shaped, twice and a half as long as broad, widest in the middle, extremities acuminate; end view ovate, tapering towards the dorsum; width equal to two-thirds of the height; surface of the shell marked with small and closely-set, circular, impressed punctures. Length, 1-30th of an inch (·85 mm.).

Found only in a dredging from Torres Straits, lat. 11° 35′ S., long. 144° 3′ E., 155 fathoms, sand (Station 185); and off the reefs at Honolulu, in a depth of 40 fathoms.

The compressed form, taken together with the other characters, abundantly distinguishes this from all other known species.

[Pl. XI. fig. 3, *a–e*. *a* Carapace seen from left side, *b* from right side, *c* from above, *d* from below, *e* from front. Magnified 50 diameters.]

19. *Bairdia fortificata*, n. sp. (Pl. XI. fig. 4, *a*, *b*).

Valves as seen from the side, oblong, subquadrate; height equal to somewhat more than half the length; extremities broad, rather oblique, moderately rounded, and fringed each with nine or ten short, blunt teeth; dorsal margin gently arched; ventral nearly straight; outline, as seen from above, ovate, widest in the middle; surface of the shell sculptured with numerous closely-set subrotund excavations of moderate size. Length, 1-23d of an inch (1·1 mm.).

Only one specimen of this species, the valves of which, unfortunately, separated before it could be drawn, was found in a dredging made, in a depth of 6 to 8 fathoms, off Booby Island, lat. 10° 36′ S., long. 141° 55′ E. (Station 187).

[Pl. XI. fig. 4, *a*, *b*. *a* Left valve seen laterally, *b* the same from above. Magnified 50 diameters.]

20. *Bairdia angulata*, G. S. Brady (Pl. XI. fig. 5, *a–d*).

Bairdia angulata, Brady, Les Fonds de la Mer, tom. i. p. 199, pl. xxvii. figs. 11, 12.

Carapace oblong, compressed; seen from the side, subreniform, scarcely twice as long as high; extremities well and evenly rounded; the anterior bearing about the middle a few (four or five) short broad teeth; the posterior armed *below* the middle with six or eight nearly similar teeth; dorsal margin very slightly arched; ventral straight, except that near the front at its junction with the anterior border it is produced downwards into a conspicuous angular prominence; seen from above, the outline is about thrice as long as broad, compressed, with parallel sides and tapering acuminate extremities; end view ovate, compressed, width scarcely equal to half the length (in the plate, fig. 5, *d*, the ventral margin is, by an error of the artist, placed uppermost); surface of the shell smooth, or finely punctate. Length, 1-28th of an inch (·9 mm.).

Dredged off the Azores; lat. 38° 37′ N., long. 28° 30′ W., 450 fathoms, sand (Station 75); Torres Straits, lat. 11° 35′ S., long. 144° 3′ E., 155 fathoms, sand (Station 185); and in a sounding from 160 fathoms (Station 305).

A very distinct and well marked species, described first from specimens taken at Halt Bay in the Straits of Magellan. Only one or two specimens were found in each of the dredgings mentioned above. The specific name *angulosa* has been already used for a so-called member of this genus by Egger (Ostrac. der Miocän.-Schicht. bei Ortenburg), but as the form to which Egger applied the name is in all probability a *Cytheridea*—at any rate not a true *Bairdia*—there can be no impropriety in allowing the name *angulata* to stand.

[Pl. XI. fig. 5, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

21. *Bairdia tuberculata*, G. S. Brady (Pl. X. fig. 3, *a–d*).

Bairdia rhomboidea, Brady, Les Fonds de la Mer, tom. i. p. 162, pl. xix. figs. 14, 15.

Carapace oblong, tumid; seen from the side, subrhomboidal; height equal to half the length, and nearly the same throughout; extremities obliquely rounded and fringed irregularly with small blunt teeth; dorsal margin very slightly arched; ventral straight or a little sinuated; seen from above, the outline is ovate, scarcely twice as long as broad; with rather irregular margins and rounded extremities; end view depressed, height less than the width; shell-surface rather rough, with small closely-set tubercular prominences. Length, 1-33d of an inch (·77 mm.).

This species was found only in a dredging from 16 to 25 fathoms, off the Admiralty Islands.

The specific name *rhomboidea* being preoccupied (Kirkby, Ann. and Mag. Nat. Hist., 1858), I have substituted that of *tuberculata*. The types from which the species was first described, and which agree exactly with those found in the Challenger dredging, were got at Mauritius.

[Pl. X. fig 3, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 40 diameters.]

22. *Bairdia acanthigera*, G. S. Brady (Pl. IX. fig. 4, *a–c*).

Bairdia acanthigera, Brady, Trans. Lin. Soc., 1868, vol. xxvi. p. 390, pl. xxvii. figs. 18–21.

Carapace oblong, tumid; seen from the side, subreniform, twice as long as broad; anterior extremity rounded (usually dentate), posterior narrowed, and fringed with a few small teeth; dorsal margin gently arched, ventral slightly sinuated in the middle; seen from above, ovate, twice as long as broad, with nearly parallel sides, and abruptly tapered, rather obtuse extremities; end view broad, subovate, widest below the middle, height and width nearly equal. Shell-surface nearly smooth, marked with numerous small circular punctures, and towards the hinder extremity slightly hirsute. Length, 1-30th of an inch (·85 mm.).

This species occurred in a dredging from a depth of 1070 to 1150 fathoms off St Vincent, Cape Verde, muddy bottom (Stations 93 and 94). Except from a few stations in the English Channel, whence the type specimens were derived, I do not know of the occurrence of *Bairdia acanthigera* elsewhere. The specimen from which the artist has drawn his figures appears to have been without the usual row of teeth on the anterior margin; these teeth, however, constantly exist on adult specimens as far as my observation goes.

[Pl. IX. fig. 4, *a–c*. *a* Carapace seen from left side, *b* from below, *c* from front. Magnified 40 diameters.]

Family II. Cytheridæ.

Shell mostly hard and compact, calcareous; surface generally more or less rough and uneven, occasionally quite smooth. Hinge margins mostly toothed; antennæ not adapted for swimming, the anterior composed of from five to seven joints, and armed with various setæ or spines; posterior four-or five-jointed, last joint the smallest, and armed with one to three curved claws, second joint destitute of the brush of setæ, which mostly exists in the Cypridæ; first joint giving origin, at its apex, to a long biarticulate tubular seta, which extends downwards in front of the antenna, about as far as the last joint, and is connected above by an efferent tube, with a gland situated in the body of the animal. Mandible very similar to that of the Cypridæ. One pair of jaws, composed of four segments, with a branchial plate. Three pairs of feet directed forwards, very much alike in shape, but increasing in length from before backwards; all of them adapted for creeping, and terminating in a single strong curved claw. The first foot corresponds with the palp of the second maxilla in the Cypridæ, the cutting segments being represented by two small setiferous appendages, arising from a common base. Postabdomen rudimentary, and almost obsolete, forming two small lobes or setæ. Eyes mostly separate, sometimes confluent, more rarely altogether wanting. Ovaries and testes not extending between the valves. Male copulative organs very large and complex in structure. Mucus gland wanting.

This family, which includes by far the greater number of the marine Ostracoda, differs chiefly from the Cypridæ in the structure of the posterior antennæ and mandible-palp, and in having three instead of two pairs of feet, the appendage forming the second pair of jaws in the Cypridæ assuming the shape of an ambulatory foot in the Cytheridæ. They do not swim, but the posterior antenna is armed with a curved tubular seta, connected with what appears to be a poison gland, situated near the base of the limb. The limbs, both in this family, and in the Cypridæ, are often strengthened on their anterior and posterior surfaces, with dense chitinous plates, which give firm points of attachment to the powerful muscles of the interior of the limb.

Cythere, Müller.

Cythere, Müller, Entomostraca, 1785.

Valves unequal, mostly oblong-ovate, subreniform, or quadrate; surface variously ornamented, smooth, punctate, foveolate, strongly rugose, spinous or tuberculated, usually having a distinct polished tubercle over the anterior hinge-joint. Hinge formed on the right valve by two terminal teeth, on the left by one anterior tooth, and a posterior fossa, between which there is frequently a ridge which is received into a corresponding furrow of the opposite valve; the teeth are in some few cases crenulated, and on the left valve are sometimes altogether absent. Antennæ robust; anterior five- or six-jointed, armed on the anterior margin with three long curved spines, mostly one on the third and two on the fourth joint; posterior four-jointed, the last joint short and stout; mandibular palp three- or four-jointed, bearing in place of a branchial appendage a turf of two to five setæ. Eyes one or two. Structure of the shell usually very dense.

The genus *Cythere*, as above defined, includes probably nearly as many species, recent and fossil, as all the remaining genera put together, the number assigned to it in this monograph being 83 out of a total of 221. But though in its present form excessively unwieldy, it seems impossible, without a more perfect knowledge than we yet possess of the variations of anatomical structure in the several species, either to form useful sub-genera, or to separate from the main group any true generic types. I have no doubt, however, that further investigation will before long enable us to do this. Meantime it is sufficient to note that the external shell characters are quite insufficient for the purpose, and that such divisions as have already been proposed, on this basis, are at the best very vague, and can only be looked upon as a mere temporary expedient for the sake of convenience.

1. *Cythere scintillulata*, n. sp. (Pl. XIV. fig. 3, *a–d*).

Shell oblong, compressed, subreniform, rather lower in front than behind; seen from the side, the extremities are well rounded, the posterior rather the wider of the two; dorsal margin moderately arched, highest in the middle, sloping steeply in front, ventral sinuated in the middle; height equal to nearly half the length; seen from above the outline is regularly ovate, greatest width situated in the middle, and equal to rather less than the height; extremities subacuminate, and nearly equal; end view subcircular. Surface of the shell covered with minute, closely-set impressed puncta, and on the ventral aspect marked with delicate longitudinal grooves. Length, 1-43d of an inch (·57 mm.).

A few specimens of this elegant species were dredged in the Straits of Magellan, lat. 52° 21′ S., long. 68° 0′ W., depth 55 fathoms (Station 313).

I refer it, not without hesitation, to the genus *Cythere*, the general configuration of the shell having much in common with the Cypridæ, but as in many other cases noted in this memoir, the want of opportunity of examining the animal structure leaves the real affinity of the species open to doubt.

[Pl. XIV. fig. 3, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. All magnified 60 diameters.]

2. *Cythere* (?) *laganella*, n. sp. (Pl. XVI. fig. 7, *a–d*).

Shell oblong, subreniform, compressed; the extremities as seen from the side are boldly rounded, and nearly equal; dorsal margin moderately arched, ventral slightly sinuated; the height, which is greatest in the middle, equal to more than half the length; seen from above, the outline is much compressed and widest in the middle, regularly ovate, sharply-pointed in front, rather more obtuse behind; width equal to about one-third of the length; end view ovate, much higher than broad. Shell-surface perfectly smooth. Length, 1-58th of an inch (·44 mm.).

Dredged in Torres Straits, lat. 11° 35′ S., long. 144° 3′ E., 165 fathoms (Station 185).

[Pl. XVI. fig. 7, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

3. *Cythere tenera*, G. S. Brady (Pl. XII. fig. 3, *a–f*).

Cythere tenera, Brady, Monog. Recent Brit. Ostr., 1868, p. 399, pl. xxviii. figs. 29–32.
Cythere tenera, Brady, Crosskey, and Robertson, Monog. Post-Tertiary Entom., 1874, p. 145, pl. xiii. figs. 6, 7.

Carapace of the female oblong, compressed; seen from the side, subquadrangular, rather higher in front than behind, height equal to half the length; anterior extremity rounded, posterior subtruncate, only slightly rounded, and smaller than the anterior; dorsal margin sloping almost in a right line from before backwards; ventral nearly straight, seen from above, compressed, subovate, widest near the middle, sides nearly parallel in the middle, and converging rather suddenly towards the extremities, which are obtusely pointed, width equal to rather more than one-third of the length; end view ovate, widest below the middle; the shell of the male (fig. 3, *e, f*) is narrower, and, seen laterally, is more tapered towards the hinder end. Shell-surface quite smooth. Length, 1-55th of an inch (·46 mm.).

The only specimens of this species brought home by the Challenger were found in anchor-mud from Vigo Bay; they are ill-grown, and do not exhibit the delicate, punctured, and papillose ornament which is usually found in British specimens; the headquarters of the species appears to be the North Sea, though I have examples also from the Mediterranean and the Bay of Biscay. It occurs, too, though very sparingly, as a Post-Tertiary fossil in Wales, Scotland, and Norway.

[Pl. XII. fig. 3, *a–f*. *a* Carapace of female seen from left side, *b* from above, *c* from below, *d* from front, *e* male seen from left side, *f* from below. All magnified 60 diameters.]

4. *Cythere vellicata*, n. sp. (Pl. XII. fig. 2, *a–d*).

Carapace elongated, compressed, seen from the side, subreniform, height scarcely equal to half the length, and nearly the same before and behind; anterior extremity well rounded, posterior obliquely truncated, and looking upwards; dorsal margin very slightly arched, highest in the middle, and sloping almost imperceptibly to each extremity, ventral deeply sinuated in the middle, and inclined rather abruptly upwards behind; seen from above, the outline is nearly cuneiform, very narrow, widest at the posterior extremity, the width being equal to one-third of the length; sides nearly parallel for the greater part of their course, but converging in front of the middle, and ending in an obtuse anterior extremity; at the hinder end the lateral margins terminate abruptly in a right angle, the extremity being truncated, and having a large central mucronate process; end view subovate, widest in the middle. Surface of the shell smooth, and somewhat undulated. Length, 1-58th of an inch (·44 mm.).

A small but very distinctly characterised species not unlike *Cythere castanea* in lateral outline, but abundantly separated from it by the wedge-shaped dorsal outline, and the want of punctured surface ornament.

Dredged at Port Jackson, Australia, in a depth of 2 to 10 fathoms.

[Pl. XII. fig. 2, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 80 diameters.]

5. *Cythere moseleyi*, n. sp. (Pl. XII. fig. 5, *a–f*).

Carapace of the female, as seen from the side, oblong, subquadrangular, somewhat higher in front than behind, height equal to half the length; anterior extremity well rounded, posterior narrower, and obliquely truncated, with very slightly rounded angles; dorsal margin slightly arched, and sloping gently from before backwards, ventral slightly sinuated in front, and trending upwards behind the middle; seen dorsally, the outline is subovate, with nearly parallel sides, converging rather abruptly towards the extremities, which are nearly equal and obtusely pointed; width less than the height; end view subquadrate, with a well-marked ventral keel. The surface of the shell is marked irregularly with small rounded depressions, and also round the margins with sinuous grooves, which on the ventral aspect are disposed in regular longitudinal lines; the hinge-line along the dorsal valvular commissure is slightly depressed, and there is likewise a similar, though short depression on the ventral surface near the middle of the two contact margins. The shell of the male (fig. 5, *e–f*) is altogether more slender, and more tapered towards the hinder extremity. Length, 1-43d of an inch (·57 mm.).

Found only in anchor-mud, from a depth of 6 fathoms, in Stanley Harbour, Falkland Islands. (Station 316.)

This species I have much pleasure in naming after Mr H. N. Moseley, F.R.S., whose admirable researches on the structure of Corals, and in other departments of Natural History, especially in connection with the voyage of the Challenger, are too well known to need recital here. *Cythere moseleyi*, in lateral view, and in style of sculpture, resembles rather closely *Cythere pellucida*, Baird, to which species I was at first disposed to refer it, but the posterior ventral angle in the latter species is rounded away entirely, and the other aspects of the shell are also very much less angular than in *Cythere moseleyi*. The male exhibits at the posterior angle some approach to the *pellucida* character, and is altogether much more slender than the female, a condition which is found to exist in most, if not all, members of the genus *Cythere*, and which is shown in four of the species figured in Pl. XII.—*Cythere tenera*, *moseleyi*, *falklandi*, and *demissa*.

[Pl. XII. fig. 5, *a–f*. *a* Shell of female seen from left side, *b* from above, *c* from below, *d* from front, *e* male seen from left side, *f* from below. All magnified 60 diameters.]

6. *Cythere falklandi*, n. sp. (Pl. XII. fig. 6, *a–f*).

Carapace of the *female* rather tumid; seen from the side, subquadrangular, higher in front than behind, height equal to half the length; anterior extremity well rounded; posterior truncated, rounded off below, and excavated above the middle; dorsal margin slightly arched, highest in the middle; ventral nearly straight; seen from above, the outline is ovate, twice as long as broad, widest behind the middle, acuminate in front, narrowed and truncated behind, lateral margins curved and somewhat sinuous; end view broadly ovate, width and height nearly equal, ventral border keeled. Surface of the shell marked out into polygonal areolæ, which are either slightly depressed or excavated into distinct pits. Length, 1-45th of an inch (·53 mm.).

Found only in anchor-mud, from Stanley Harbour, Falkland Islands, depth 6 fathoms (Station 316). It is perhaps doubtful whether figures *e* and *f* really belong to the same species as *a–d*.

[Pl. XII. fig. 6, *a–f*. *a* Shell of female seen from left side, *b* from above, *c* from below, *d* from front, *e* male seen from left side, *f* from below. All magnified 60 diameters.]

7. *Cythere demissa*, G. S. Brady (Pl. XII. fig. 1, *a–j*).

Cythere demissa, Brady, Ann. and Mag. Nat. Hist., 1868, ser. 4, vol. ii. p. 180, pl. xii. figs. 1, 2.

Shell seen laterally, oblong, subovate or subreniform, not much higher in front than behind, height equal to about half the length; anterior extremity somewhat obliquely rounded, posterior only poorly rounded, subtruncate; dorsal margin highest in front of the middle, where it is slightly gibbous, thence sloping steeply to the front, and with a slight curve backwards; ventral margin sinuated in the middle; seen from above, the outline is ovate, with wide, obtuse, or subtruncate extremities, and nearly parallel sides, width considerably less than half the length, the whole posterior extremity and the hinder parts of the lateral margins present a succession of deep notches or crenations, and the anterior extremity is either abruptly truncated or rounded, and broken into tooth-like crentations; end view subcircular, with a tendency to hexagonal form. Shell-surface thickly beset with subrotund or angular excavations, which, on the ventral surface, coalesce so as to form well-marked grooves and ridges. Length, 1-58th of an inch (·43 mm.).

Several specimens, varying a good deal in minor details, but agreeing in general character, and, I think, all belonging really to one species, which may fairly be identified with *Cythere demissa*, were found in a dredging made at Port Jackson, in a depth of 2 to 10 fathoms (Station 163). The most distinct of these forms are represented in Pl. XII., fig. 1, *e* and *f*, being probably the male. The tapering and strongly sculptured form shown in figures *g–j*, may perhaps be looked upon as the fully-developed adult female, of which figures *a–d* show an earlier stage.

[Pl. XII. fig. 1, *a–j*. *a* Shell of female seen from left side, *b* from above, *c* from below, *d* from front, *e* male seen from left side, *f* from above, *g* adult female seen from left side, *h* from above, *i* from below, *j* from front. All magnified 80 diameters.]

8. *Cythere ovalis*, n. sp. (Pl. XIV. fig. 4, *a–d*).

Shell oblong, rather tumid; seen from the side, elongated, subreniform, height equal to about half the length, and nearly the same throughout; extremities well rounded; the anterior fringed with a regular series of small teeth, about twelve in number, posterior having a smaller number of similar teeth at the longer angle; dorsal margin very slightly arched, sloping gently from before backwards, ventral nearly straight; seen from above, the outline is regularly ovate, widest behind the middle; extremities subacuminate, sides gently curved, converging gradually towards the front, and more suddenly towards the hinder end, width equal to the height; end view subcircular, produced in the median line both above and below; surface of the valves marked throughout with large, closely-set, angular fossæ. Length, 1-40th of an inch (·66 mm.).

Dredged off Booby Island, lat. 10° 36′ S., long. 141° 55′ E., 6 to 8 fathoms. The nearest known ally of this species is probably the familiar *Cythere tuberculata*, Sars, an abundant North Sea species. The southern form is, however, much more regularly ovate in contour, has fewer surface rugosities, while, in lateral view, it has its extremities more evenly rounded, and is destitute of any marked angular elevation in the situation of the anterior hinge-joint.

[Pl. XIV. fig. 4, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

9. *Cythere fulvotincta*, n. sp. (Pl. XIV. fig. 5, *a–d*).

Shell compressed, oblong; seen from the side, subreniform, scarcely higher in front than behind, height equal to somewhat more than half the length; anterior extremity boldly rounded, posterior subtruncate, scarcely rounded; dorsal margin gently arched, obscurely angulated behind, ventral slightly sinuated in the middle; seen from above, club-shaped, widest near the hinder end, the width equal to considerably less than half the length; anterior extremity broad, produced in the middle, posterior obtusely rounded; lateral margins protuberant near the hinder extremity, from which point they converge suddenly backwards, and with a gradual sinuous curve towards the front; end view broadly ovate, sides convex below, and sinuated above the middle, base broad, apex narrowed and truncate. Shell-surface marked with irregularly angular, excavated areolæ; anterior hinge-tubercle distinct. Length, 1-45th of an inch (·53 mm.).

Found in anchor-mud from a depth of 6 fathoms, Stanley Harbour, Falkland Islands.

[Pl. XIV. fig. 5, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

10. *Cythere torresi*, n. sp. (Pl. XIX. fig. 8, *a–c*).

Valves, seen from the side, subelliptical, rather higher behind than in front, height equal to more than half the length; anterior extremity rounded, and produced into four squamous, tooth-like processes; posterior wider, squamous, and bearing at the lower angle four distinct spines; the dorsal margin forms a flattened arch; the ventral is straight or only slightly sinuated; seen from above, the valves are tumid, and strongly convex in the middle, sloping to either extremity with a hollow curve; extremities produced and obtuse; the end view shows a projecting median keel, both above and below, and has two distinct lateral dorsal prominences. The central portion of the valves is much elevated, and is limited by a squamous encircling ridge, and the surface is closely set with rounded excavations. Length, 1-70th of an inch (·38 mm.).

One valve only found in a dredging from Torres Straits, 155 fathoms (Station 185).

[Pl. XIX. fig. 8, *a–c*. *a* Left valve seen from side, *b* from above, *c* from front. Magnified 100 diameters.]

11. *Cythere acupunctata*, n. sp. (Pl. XIV. fig. 1, *a–h*).

Shell elongated, compressed; seen from the side, subreniform, higher in front than behind, height equal to about half the length; anterior extremity broad and fully rounded, posterior narrow, subtruncate, scarcely rounded, produced and somewhat angular below the middle; dorsal margin sloping gently, and almost in a straight line from before backwards, curved in front, but forming a distinct angle behind; ventral gently sinuated in the middle; seen from above, compressed, regularly ovate, nearly thrice as long as broad, widest towards the posterior extremity, sides converging very gradually, and with a gentle curve towards the anterior extremity, which is subacuminate, posterior extremity broadly rounded; end view very broadly oval. Surface of the shell thickly covered with small, impressed, circular puncta, and at the anterior extremity produced into a not very prominent bordering flange. Length, 1-42d of an inch (·6 mm.).

This species was dredged in the Inland Sea, Japan, on a muddy bottom, 15 fathoms deep. It is very nearly allied to *Cythere fuscata*, Brady, a European species, and might perhaps, without much impropriety, have been identified with it; the Japanese shells are, however, more elongated, more nearly reniform, and seen from above are not so acutely tapered in front.

[Pl. XIV. fig. 1, *a–h*. *a* Carapace of adult seen from left side, *b* from above, *c* from below, *d* from front; figures *a–h* represent the same views of the young shell. All magnified 60 diameters.]

12. *Cythere lubbockiana*, n. sp. (Pl. XIV. fig. 6, *a–d*).

Shell, seen from the side, elongated, curved, scarcely higher in front than behind, height equal to nearly half the length; anterior extremity obliquely rounded, posterior subtruncate, only very slightly rounded, divided below the middle into four or five broad, blunt teeth; dorsal margin gently curved, sloping from before backwards, and ending in an obtuse angle, ventral slightly sinuated; seen from above, compressed, subhexagonal, more than twice as long as broad, with parallel sides, which converge very abruptly and at an obtuse angle behind, but much more gradually in front; anterior extremity obtusely rounded, posterior acuminate, end view subcircular. Surface of the shell marked with rather vaguely-defined, roundish irregular excavations. Length, 1-40th of an inch (·65 mm.).

Several specimens found in the Booby Island dredging, depth 6 to 8 fathoms, lat. 10° 36′ S., long. 141° 55′ E.

This seems to occupy an intermediate position between *Cythere oblonga*, Brady, and

Cythere finmarchica, Sars, and might perhaps, without much impropriety, be considered as a variety of the former species; the dorsal outline, however, is in *Cythere lubbockiana* much more angular, the sides being almost rectilinear, and I have not observed any trace of the tubercle which is so marked a characteristic of *Cythere oblonga*, as well as of *Cythere finmarchica*. *Cythere oblonga* is also a considerably larger species, having a length of 1-29th of an inch.

[Pl. XIV. fig. 6, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

13. *Cythere exilis*, n. sp. (Pl. XVI. fig. 5, *a–h*).

Shell of the female, seen from the side, oblong, subquadrangular, greatest height situated near the anterior extremity, and equal to half the length; anterior margin boldly rounded, sometimes fringed below the middle with a series of minute teeth, posterior much produced, narrowly rounded; dorsal margin almost straight, ending in an obtuse angle behind, ventral deeply and very abruptly sinuated in the middle, slightly notched behind the middle, then gently curving upwards at the hinder end; seen from above, compressed, subovate, width considerably less than half the length, extremities nearly equal, obtusely rounded, sides subparallel, and slightly sinuated in the middle, converging very gradually towards the extremities; end view irregular, slightly higher than broad, ventral margin broad, convex and emarginate in the middle, dorsal strongly arched. The surface of the valves is undulated, marked with irregular longitudinal ribs, and with numerous large angular excavations, the margins of the valves forming, especially at the two extremities, a stout encircling fillet. The shell of the male (figures *e–h*) is exactly similar, except in being narrower and more elongated. Length, 1-34th of an inch (·75 mm.).

The only dredging in which *Cythere exilis* was detected is from Simon's Bay, South Africa. Depth, 15 to 20 fathoms. (Station 140.)

[Pl. XVI. fig. 5, *a–h*. *a* Shell of female seen from left side, *b* from above, *c* from below, *d* from front; figures *e–h* refer to similar views of the male shell. All magnified 50 diameters.]

14. *Cythere murrayana*, n. sp. (Pl. XVI. fig. 4, *a–h*).

Carapace of the female, as seen from the side, oblong, subquadrangular, scarcely higher in front than behind, height equal to half the length, anterior extremity rounded, posterior narrower, subtruncated and rather angular, the lower angle rounded off; dorsal margin nearly straight, but, towards the hinder end, suddenly depressed and excavated, ventral margin sinuated in the middle, and turned upwards behind; seen from above, the outline is subovate, width nearly equal to the height, sides slightly curved and nearly parallel, extremities obtusely rounded; end view subhexagonal, with obtusely-rounded angles. Surface marked with numerous closely-set, small angular excavations. Length, 1-62d of an inch (·41 mm.).

In a gathering taken in the "tow-net at trawl" in Wellington Harbour, New Zealand, a good series of specimens belonging to this species were obtained. Though small, its characters are well marked; the shell represented in fig. 4, *e–h*, probably belongs to the male. The species is named after Mr John Murray, one of the several able naturalists attached to the Challenger Expedition.

[Pl. XVI. fig. 4, *a–h*. *a* Shell of female seen from left side, *b* from above, *c* from below, *d* from front, *e* male seen from left side, *f* from above, *g* from below, *h* from front. All magnified 60 diameters.]

15. *Cythere bicarinata*, n. sp. (Pl. XVI. fig. 6, *a–d*).

Shell compressed, oblong; seen from the side, subtrapezodial, greatest height near the middle, and equal to at least half the length; extremities rounded, the anterior the broader of the two, dorsal margin straight in the middle, sloping steeply and abruptly towards each end, ventral straight in the middle, and gently curved upwards at the ends; seen from above, the outline is compressed, ovate, nearly thrice as long as broad, sides nearly parallel, converging only slightly towards the extremities, which are equal, broad, subtruncated, and prominent in the middle; end view subtriangular, height considerably greater than the width, with convex sides, obtuse apex, and narrow flattened base; sides of the valves marked with distant, small impressed puncta, ventral surface having a sinuous longitudinal keel on each side of the median line, these being continued round almost the whole circumference of the shell in the form of an encircling flange. Length, 1-55th of an inch (·46 mm.).

Found only in a dredging from the Inland Sea of Japan. Depth, 15 fathoms. (Station 233*b*.)

[Pl. XVI. fig. 6, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

16. *Cythere inconspicua*, n. sp. (Pl. XIII. fig. 1, *a–d*).

Carapace oblong, short and stout; seen from the side subquadrangular, higher in front than behind, greatest height equal to at least half the length; anterior extremity broad and well rounded, sometimes slightly toothed below the middle, posterior narrower, truncated, and scarcely at all rounded off; dorsal margin sloping almost in a right line from the front, but behind the middle descending with a rather steeper curve, ventral sinuated near the middle; seen from above, the outline is irregular, the extremities being broadly truncated; greatest width situated behind the middle, whence the lateral margins converge slightly towards the front and abruptly towards the hinder end, this part of the outline being broken by a large almost rectangular projection of the hinder portion of the valves; the dorsal surface is elevated along the hinge-line into a prominent ridge; the ventral surface keeled in a similar manner, and having the valve-margins expanded so as to form a flattened flange anteriorly; end view triangular, the angles rounded off, the lateral margins arched, and the ventral margin bisinuate; surface of the shell sculptured throughout with subrotund excavations of moderate size and rather closely set; the valves gradually elevated behind the middle so as to form a rather prominent alæform protuberance. Length, 1-62d of an inch (·41 mm.).

A well marked but small species, distinguished by the broadly truncated extremities and the alæform lateral elevations of the valves. It was noticed only in a dredging from Torres Straits, depth 155 fathoms, sand. (Station 185.)

[Pl. XIII. fig. 1, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

17. *Cythere cumulus*, n. sp. (Pl. XIII. fig. 2, *a–d*).

Shell oblong, tumid; seen from the side, subquadrangular, not much higher in front than behind, height equal to a little more than half the length; anterior extremity well rounded; posterior rounded and narrow; dorsal margin straight; ventral straight throughout the greater part of its course, but turned abruptly upwards at an obtuse angle at the posterior extremity; seen from above the outline is boat-shaped, tapering abruptly in front, scarcely at all behind, sides nearly straight and parallel; anterior extremity obtusely pointed, posterior broad and rounded off, but having a small mucronate projection in the middle, width equal to the height; the end view is in the form of a high arch with a slightly convex base, the sides being nearly straight below the middle. Surface of the shell thickly covered with deep angular excavations. Length, 1-50th of an inch (·5 mm.).

The only dredging in which *Cythere cumulus* occurred is that from Port Jackson, 2 to 10 fathoms.

[Pl. XIII. fig. 2, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

18. *Cythere flos-cardui*, n. sp. (Pl. XIII. fig. 3, *a–h*).

Carapace of the female, as seen from the side, subquadrangular, higher in front than behind, the greatest height situated near the anterior extremity and equal to nearly two-thirds of the length; anterior extremity broad and obliquely rounded, posterior narrower, oblique, scarcely rounded, looking slightly upwards; dorsal margin slightly arched, sloping gently backwards, and terminating in a distinct angle, ventral nearly straight, bent upwards at the posterior extremity; seen from above, ovate, with subparallel sides, twice as long as broad; anterior extremity narrow, rounded off, and mucronate in the middle; posterior more abruptly rounded, almost truncated, and having also a mucronate process in the middle; end view broadly ovate, wide at the base, and only slightly tapered toward the dorsal margin. Surface of the shell beset with small angular fossæ, which have a concentric arrangement, and on the ventral surface form groves with separating ridges. Specimens which I take to be the male of this species (figures *e–h*) are rather different in shape, the infero-posteal angle being more decidedly rounded off, and the posterior extremity, when viewed from above, being expanded so as to give a distinct sinuation to the lateral margins, the whole outline thus getting a pretty close resemblance to that of a thistle-blossom; the sculpturing of the surface is also much coarser than in the female. Length, 1-55th of an inch (·46 mm.).

Several specimens of this *Cythere* occurred in a dredging from a depth of 40 fathoms, off the reefs at Honolulu. (Station 246.)

[Pl. XIII. fig. 3, *a–h*. *a* Shell of female (?) seen from left side, *b* from above, *c* from below, *d* from front, *e* shell of male (?) seen from left side, *f* from above, *g* from below, *h* from front. All magnified 60 diameters.]

19. *Cythere crispata*, G. S. Brady (Pl. XIV. fig. 8, *a–d*).

Cythere cicatricosa, G. O. Sars (1865), Oversigt af Norges marine Ostracoder, p. 33.

Cythere badia (in part), Brady (1868), Monog. Recent Brit. Ostrac., p. 399 (not figures). (Not *C. badia*, Norman.)

Cythere badia, Brady (1868), Les Fonds de la Mer, tom. i. p. 89.

Cythere crispata, Brady (1868), Ann. and Mag. Nat. Hist., ser. 4, vol. ii. p. 221, pl. xiv. figs. 14, 15.

Cythere cicatricosa, Brady and Robertson (1869), Ann. and Mag. Nat. Hist., ser. 4, vol. iii. p. 369, pl. xix. figs. 13, 14.

Cythere crispata, Brady, Crosskey, and Robertson (1874), Post-Tertiary Entomostraca, p. 146, pl. xii. figs. 52, 53, and pl. xiii. figs. 12, 13.

Shell, seen from the side, subquadrangular, rather higher in front than behind; height equal to at least half the length; anterior extremity obliquely rounded, posterior narrower, truncated, and only very slightly rounded; dorsal margin sloping from before backwards and gently curved, ventral slightly sinuated in the middle; seen from above, the outline is compressed and irregularly subhexagonal, the greatest width less than half the length; extremities truncated, the anterior being much narrower than the posterior, sides nearly parallel, but gently converging from a point in front of the middle to the anterior extremity, and, near the hinder end, slightly emarginate; end view hexagonal and nearly equilateral. Shell-surface sculptured all over with closely-set angular excavations of irregular form and size. Length, 1-50th of an inch (·5 mm.).

Cythere crispata was observed in dredgings from Port Jackson, 2 to 10 fathoms; from Booby Island, 6 to 8 fathoms, (Station 187); and in anchor-mud brought up from a depth of 7 fathoms in Hong Kong Harbour. It is a widely-distributed species; shells not specifically separable from it having been met with in the British seas, in those of Norway, and in the Mediterranean (?). As a Post-Tertiary fossil it has been found in Scotland, Ireland, and Norway. The specimens from these various localities differ, doubtless, in minor details both of form and surface sculpture, but not so much as to preclude grouping them under one specific name. The two following species, *Cythere cancellata* and *Cythere canaliculata*, approach it very closely, but the former may be distinguished by its ovate dorsal and more rounded or reniform lateral outline, the latter by the more flexuous lateral outline, broad dorsal surface, and regular disposition of the very large central excavations of the shell.

[Pl. XIV. fig. 8, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

20. *Cythere cancellata*, G. S. Brady (Pl. XIV. fig 9, *a–e*).

Cythere cancellata, Brady, Les Fonds de la Mer, tom. i. (1868), p. 62, pl. vii. figs. 9–11.

Shell oblong, rather tumid; seen from the side, subreniform, scarcely higher in front than behind, height equal to about half the length; anterior extremity obliquely rounded, and divided below the middle into several short blunt teeth; posterior also well rounded, and sometimes delicately toothed below the middle; dorsal margin very gently arched and slightly sinuous, ventral nearly straight; seen from above, ovate, with obtusely pointed and nearly equal extremities; sides somewhat sinuous, width equal to half the length; end view irregular, boldly arched above, sides converging downwards towards a narrowed ventral line. Surface of the shell marked (as in *Cythere crispata*) with closely-set angular excavations, and, in old specimens (figures *d*, *e*), with sinuous, obliquely transverse ribs. Length, 1-35th of an inch (·75 mm.).

Dredged off Mukuolofa, Tongatabu, 18 fathoms, coral (Station 172); and off Booby Island, 6 to 8 fathoms (Station 187). The type specimens were from Java.

[Pl. XIV. figs. 9, *a–e*. *a* Shell seen from left side, *b* from above, *c* from front, *d* right valve of adult seen laterally, *e* the same from above. Magnified 50 diameters.]

21. *Cythere canaliculata* (Reuss), (Pl. XIV. fig. 7 *a–d*).

Cypridina canaliculata, Reuss, Haidinger's Abhand. (1850), Bd. iii. p. 76, tab. ix. fig. 12.
Cythere canaliculata, Egger (1858), Ostrak. der Miocän.-Schicht., Bd. v. p. 33, t. v. figs. 10, 11.
Cythere canaliculata, Brady, Trans. Zool. Soc. (1865), vol. v. p. 373, pl. lix. fig. 4, *a–f*.

Carapace oblong, rather tumid; seen from the side, subsigmoid, highest in the middle, the height being equal to at least half the length; anterior extremity well rounded, posterior oblique, rounded off with a full curve below, and forming a distinct angle with the dorsal margin above; dorsal margin boldly arched, forming in front a continuous curve with the anterior margin, slightly sinuated behind, and joining the posterior extremity at an acute angle; ventral margin deeply sinuated in the middle, and curving upwards with a bold sweep behind; seen from above, the outline is boat-shaped, obtusely pointed in front, broad and truncated behind; the sides sinuous, curved, and falling slightly inwards at an obtuse angle near the posterior extremity; width and height nearly equal; end view broadly ovate, widest above, the sides converging towards the ventral margin, which is narrow and keel-shaped. The central portion of each valve is excavated so as to form a large subrotund pit, above which, towards the dorsal margin, is a series of four or five similar, but not quite so large, excavations; these are separated from each other by rounded ridges, and round about this group of large fossæ are disposed several much smaller hollows; the dorsal surface is very broad, has a deep longitudinal furrow along the greater part of the hinge-line, and shows conspicuously the transverse ribbing which separates the lateral fossæ. Length, 1-58th of an inch (·43 mm.).

The specimens described by me in the Zoological Transactions were from Hobson's Bay, Australia; but those figured by Reuss and Egger were fossils from the European Tertiary formations. The Challenger specimens are from off East Moncœur Island, Bass Strait, 38 to 40 fathoms (Station 162); and from Port Jackson, Australia, 2 to 10 fathoms.

[Pl. XIV. fig. 7, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

22. *Cythere reussi*, G. S. Brady (Pl. XIV. fig. 2, *a–d*).

Cythere reussi, Brady, Les Fonds de la Mer, tom. i. p. 153, pl. xviii. figs. 9, 10.

Shell, seen from the side, oblong, subquadrate; greatest height situated near the anterior extremity, and equal to half the length; anterior extremity broad, obliquely rounded, posterior narrower, rounded off above, somewhat angular below, and having below the middle one or two short stout teeth; dorsal margin nearly straight, sloping gently from before backwards, ventral slightly sinuated in the middle; seen from above, the outline is compressed, ovate, more than twice as long as broad, and having the greatest width near the middle; lateral margins gently curved; extremities bimucronate; the anterior wide and truncated; the posterior narrower, and deeply notched between the two terminal teeth; end view broadly ovate, almost circular, keeled on the ventral margin. The valves are throughout sculptured with numerous closely-set, irregularly-shaped fossæ of small size; the tubercles over the anterior hinge-joint are conspicuous, and the junction of the valves on the dorsal surface is marked by a deep longitudinal groove. Length, 1-50th of an inch (·5 mm.).

The localities in which *Cythere reussi* was dredged are the following:—Off Booby Island, lat. 10° 36′ S., long. 141° 55′ E., 6 to 8 fathoms (Station 187); off the reefs, Honolulu, 40 fathoms; and Straits of Magellan, 55 fathoms (Station 313). The type-specimens were from Colon-Aspinwall, and differ somewhat from those here described, in being of more robust build and more strongly spinous.

[Pl. XIV. fig. 2, *a-d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. All magnified 60 diameters.]

23. *Cythere fortificata*, n. sp. (Pl. XXI. fig. 1, *a–d*).

Carapace compressed, oblong; seen from the side, quadrangular, not much higher in front than behind, height equal to one-half the length; anterior extremity rounded and fringed with a row of short, blunt teeth, posterior obliquely truncated, rounded off and fringed with a few short, almost obsolete teeth, below the middle; dorsal margin sloping greatly from the anterior extremity where it forms a gibbous elevation, slightly curved behind the middle, and ending in a somewhat rounded angle; ventral almost straight; seen from above, the outline is compressed, oblong, more than twice as long as broad, widest in the middle, the sides gently convex and tapering evenly to the extremities which are produced, obtuse and subtruncated; end view broadly ovate; the valves are smooth, and encircled, except on the ventral margin, by a flattened flange of no great width. Length, 1-47th of an inch (·53 mm.).

The only material which yielded this species was a sounding from a depth of 420 fathoms, in the Mid Pacific, about 38° S. latitude.

[Pl. XXI. fig. 1, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. All magnified 60 diameters.]

24. *Cythere foveolata*, n. sp. (Pl. XIII. fig. 5, *a–h*).

Carapace of the female tumid; seen from the side subrhomboidal, greatest height situated in the middle and equal to more than half the length; extremities obliquely rounded; dorsal margin flattened in the middle, and sloping steeply to either extremity, ventral sinuated in front and turned upwards at the back; the shape as seen from above is broadly ovate, scarcely twice as long as broad, with acutely pointed extremities and very convex sides; greatest width in the middle, whence the sides converge evenly towards each extremity; the posterior curve, however, broken by two small angular projections; end view cordate, the apex corresponding with the dorsal, base with the ventral, margin. Shell-surface marked all over with deep, closely-set, angular cavities; hinge-tubercles prominent. The outline of the male (figures *e–h*) is more compressed and very much more angular. Length, 1-45th of an inch (·53 mm.).

Several specimens occurred in dredgings from off Christmas Harbour, Kerguelen Island, 120 fathoms (Station 149); and off Heard Island, 75 fathoms (Station 151). The general form of this species is very familiar; many might be named which approach it rather closely, but no described species seems to be absolutely identical with it. The nearest, perhaps, are *Cythere borealis*, Brady,—an Arctic form,—and *Cythere œdichilus*, Brady, a fossil of the Antwerp Crag.

[Pl. XIII. fig. 5, *a–h*. *a* Carapace of female seen from side, *b* from above, *c* from below, *d* from front; figures *e–h* represent similar views of the male shell. All magnified 60 diameters.]

25. *Cythere securifer*, n. sp. (Pl. XIII. fig. 4, *a–h*).

Shell of the female, seen from the side, nearly rhomboidal, highest in the middle, scarcely higher in front than behind, height equal to two-thirds of the length; anterior extremity obliquely rounded, posterior subtruncated, produced and obscurely angular in the middle; dorsal margin gently arched, ending behind in an obtuse angle, ventral slightly sinuated both in front and behind, and prominent in the middle; seen from above, boat-shaped, twice as long as broad, broadest a little behind the middle, sides gently curved, extremities truncated, with strong mucronate projections in the middle line, the anterior narrower than the posterior; end view quadrilateral, all the sides slightly convex. Surface of the shell coarsely sculptured with deep angular excavations. The shell of the male, besides being more slender than that of the female, has the ventral margin of each valve produced downwards, near the middle, so as to form a conspicuous triangular or hatchet-shaped protuberance, that of the left valve being commonly larger than on the right; the ventral margins in the female are also produced, but not in so marked a manner. Length, 1-50th of an inch (·5 mm.).

A good series of this remarkable *Cythere* was obtained off Prince Edward's Island, in a depth of 50 to 150 fathoms. (Near Station 145.)

[Pl. XIII. fig. 4, *a–h*. *a* Shell of female seen from left side, *b* from above, *c* from below, *d* from front; figures *e–h* represent similar views of the male shell. All magnified 60 diameters.]

26. *Cythere impluta*, n. sp. (Pl. XVI. fig. 3, *a–d*, and Pl. XXVI. fig. 6, *a–d*).

Shell, seen from the side, subovate or subquadrangular, higher in front than behind; anterior extremity wide and obliquely rounded, posterior narrow, subtruncated or rounded, sometimes produced below the middle, and dentated; dorsal margin gibbous over the anterior hinge, thence sloping steeply backwards, and ending either in an obtuse angle or a rounded curve, ventral margin convex; greatest height situated at the anterior hinge, and equal to more than half the length; seen from above, regularly ovate, widest near the middle, more than twice as long as broad, sides gently convex, or slightly sinuated in the middle, and converging evenly to the extremities which are equal and subacuminate; end view subtriangular, higher than broad, sides convex, angles rounded off. The sides of the valves are marked with irregularly scattered subrotund excavations of variable size; just within the ventral margin there is an elevated ridge, and occasionally one or more indistinct longitudinal ribs on the middle of the valves which are also slightly undulated transversely; the hinge-line on the dorsal aspect of the shell is distinctly depressed in the middle. Length, 1-37th of an inch (·74 mm.).

Dredged off Nightingale Island, Tristan d'Acunha, in 100 to 150 fathoms (Station 135); also in anchor-mud, from a depth of 6 fathoms, Stanley Harbour, Falkland Islands (Station 316).

The somewhat different forms figured in Plates XVI. and XXVI. I at first supposed to belong to distinct species, but my impression now is that they cannot properly be separated. The forms shown in Pl. XVI. occurred in the Falkland Islands only; that in Pl. XXVI. in both localities.

[Pl. XXVI. fig. 6, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters. Pl. XVI. fig. 3, *a–d*, represent similar views of one of the Falkland Island forms. Magnified 60 diameters.]

27. *Cythere* (?) *serratula*, n. sp. (Pl. XLIII. fig. 7, *a–d*).

Valves compressed, oblong; seen from the side subreniform, rather higher in front than behind, height equal to half the length; extremities boldly rounded, anterior smooth, posterior bordered with a series of very small distant spines; dorsal margin nearly straight, ventral deeply sinuated in the middle; seen from above the valves are compressed, ovate, and slightly sinuated in the middle of the lateral margin. Shell smooth, or very partially and indistinctly marked with small circular impressed puncta. Length, 1-23d of an inch (1·1 mm.).

Cythere serratula occurred in three dredgings, but in each case only a very few separated valves were found; it might, perhaps, more properly have been placed amongst the *Cypridæ*, but its real affinity must, with the scanty material at present available, be merely conjectural:—Off Culebra Island, West Indies, 390 fathoms (Station 24); off Canaries, 1125 fathoms (Station 85); and north of Tristan d'Acunha, 1425 fathoms (Station 335).

[Pl. XLIII. fig. *a–d*. *a*, *c*, Right valves (? young and old) seen from side; *b*, *d*, the same seen from below. Magnified 40 diameters.]

28. *Cythere pyriformis*, n. sp. (Pl. XV. fig. 3, *a–d*).

Valves seen from the side, much higher in front than behind, all the margins perfectly smooth; anterior extremity broadly rounded, posterior also rounded, but much narrower; dorsal margin boldly arched, highest in front of the middle, and sloping steeply backwards, ventral margin nearly straight, greatest height equal to considerably more than half the length; seen from above, the outline forms a regular curve with a slight sinuation towards either end, extremities equal and subacute. Surface of the shell smooth, slightly undulated, and marked round the extremities and on the ventral margin with numerous radiating hair-like lines. Length, 1-28th of an inch (·9 mm.).

A few valves only belonging to this species were found in a dredging from off Pernambuco (Station 120), lat. 8° 37′ S., long. 34° 28′ W., depth, 675 fathoms. From these scanty materials it is impossible to describe the species fully, but there can be little doubt of its distinctness from any recorded form. The valve shown at fig. 3, *d*, may perhaps be taken to belong to the young of the same.

[Pl. XV. fig. 3, *a–d*. *a* Left valve seen from side, *b* from above, *c* from front, *d* right valve of a younger specimen. All magnified 50 diameters.]

29. *Cythere cytheropteroides*, n. sp. (Pl. XV. fig. 5, *a–d*).

Valves seen from the side, subovate, much higher in front than behind; the greatest height equal to more than half the length; anterior extremity broad, rounded, its lower half armed with a series of broad, short, and blunt teeth, about twelve in number; posterior extremity produced, narrowed, and in some cases bearing two or three teeth, of similar character to those of the anterior border; dorsal margin gibbous in front, thence sloping with a gentle curve to the hinder extremity, ventral slightly convex, sinuated in front of the middle, seen from above, the outline appears to be subovate, widest behind the middle, and with very thick, heavy extremities. The surface of the shell is smooth, but bears a prominent rounded crest near the ventral margin. Length, 1-32d of an inch (·77 mm.).

As with the preceding species, I am able only imperfectly to describe this shell. Detached valves only were found, and very few of them; these occurred in a dredging from off the Cape of Good Hope, 150 fathoms (Station 142).

[Pl. XV. fig. 5, *a–d*. *a* Left valve seen from side, *b* from above, *c* from front, *d* right valve seen from side. All magnified 50 diameters.]

30. *Cythere kerguelenensis*, n. sp. (Pl. IV. figs. 16–18, and Pl. XX. fig. 1, *a–f*).

Carapace of the female, seen from the side, subreniform, higher in front than behind, greatest height situated in the middle, and equal to nearly two-thirds of the length; left valve much larger than the right; anterior extremity well rounded; posterior produced below the middle, and forming an angular squamous beak, which is often bordered with a few small, blunt teeth; dorsal margin evenly and boldly arched, highest in the middle, ventral sinuated in the middle; seen from above, oblong, ovate, widest in the middle, and tapering evenly to the extremities which are equal and sharply acuminate; width scarcely equal to half the length; end view broadly ovate, broad below, and tapering to the apex which is acute, sides very convex, base strongly keeled in the middle. Surface of the valves profusely marked with rounded, impressed puncta; hinge-tubercles conspicuous; margins produced, especially at the two ends of the shell, so as to form a squamous encircling fillet, which in front and behind is marked by small marginal teeth and numerous transverse hair-like lines; along the contact margins of the valves, both on the dorsal and ventral surface, is a distinct angular depression. Length, 1-25th of an inch (·1 mm.).

Dredged plentifully in Balfour Bay, 20 to 50 fathoms, and Royal Sound, Kerguelen Island, 28 fathoms; off Prince Edward's Island, 50 to 150 fathoms; off East Moncœur Island, Bass' Strait, 38 to 40 fathoms; and Port Jackson, Australia, 2 to 10 fathoms. Seen on the dorsal surface, this species bears a close resemblance to the common British *Cythere albomaculata*, Baird, but the shell is much more coarsely sculptured, while the spinous margins, and very broadly reniform lateral outline are constant distinctive characters.

[Pl. XX. fig. 1, *a–f*. *a* Carapace of female seen from left side, *b* from above, *c* from below, *d* from front, *e* male seen from left side, *f* from above. All magnified 40 diameters.]

31. *Cythere speyeri*, G. S. Brady (Pl. XX. fig. 2, *a–f*).

Cythere speyeri, Brady, Ann. and Mag. Nat. Hist., 1868, ser. 4, vol. ii. p. 222, pl. xv. figs. 8–11.
Cythere speyeri, Les Fonds de la Mer, tom. i. p. 99, pl. xii. figs. 8–10.

Shell of the female excessively tumid; seen from the side, broadly ovate, with a prominent posterior beak, greatest height in the middle, and equal to two-thirds of the length, anterior extremity fully rounded, and forming a continuous curve with the dorsal margin, which is boldly arched; posterior extremity produced below the middle into a prominent angular beak; ventral margin moderately convex; seen from above, broadly ovate, not twice as long as broad, widest behind the middle, lateral margins extremely convex, converging gently towards the front, and more abruptly backwards, anterior extremity subacuminate, posterior obtuse; end view broad, ovate, widest below the middle, pointed at the apex, sides very convex; left valve larger than the right. Surface of the shell marked throughout with large circular impressed puncta, hinge-tubercles conspicuous; no very marked encircling fillet. Length, 1-28th of an inch (·9 mm.).

Dredged off St Vincent, Cape Verde, in a depth of 1070 to 1150 fathoms (Station 93), and off Ascension Island, 420 fathoms (Station 344). The type specimens which differ in nothing from those here described, except in the frequent presence of a spine at the infero-posteal angle, were found in a dredging from Tenedos; and I have other specimens from Colon and New Providence, and St Vincent, Cape Verde. The species altogether is very like an excessively tumid *Cythere convexa*, Baird. The distinct inequality of size of the right and left valves, in this and the preceding species, is an interesting peculiarity, and may, perhaps, coincide with other more important structural characters, which, however, I have not been fortunate enough to discover.

[Pl. XX. fig. 2, *a–f*. *a* Shell of female, seen from left side, *b* from above, *c* from below, *d* from front, *e* male, seen from side, *f* from above. All magnified 40 diameters.]

32. *Cythere sabulosa*, n. sp. (Pl. XIX. fig. 1, *a–h*).

Shell very tumid; its greatest height situated near the front, and equal to two-thirds of the length; the anterior extremity, seen from the side, is broad and very obliquely rounded, the posterior narrowed, slightly produced below the middle, and sloping steeply above; the dorsal margin is slightly gibbous in front, over the large and conspicuous hinge-tubercle, and thence slopes with a gentle curve backwards; ventral margin straight, or slightly convex, and somewhat jagged or crenulated near the posterior extremity; seen from above, the outline is very broadly ovate, widest near the middle, the lateral margins forming a bold curve from one extremity to the other; the anterior extremity is obtusely pointed, the posterior broader and slightly produced; end view equilaterally triangular, the sides convex, apex emarginate. The surface of the shell is thickly covered with angular depressions, the intervals between which are in many cases rough, or almost spinous; a wide longitudinal area in the middle of the dorsal and ventral surfaces is, however, smooth, and free from sculptured ornament; the hinge-line is deeply depressed. Length, 1-45th of an inch (·53 mm.).

The specimen shown in figures *e–f* is somewhat different in shape, and may perhaps belong to the male; while figures *g–h* have a less gritty surface, and show a peculiar crenulation of the ventral margin; a somewhat similar crenulation is visible on the upper posterior angle in *a* and *e*, though not on the ventral margin. I do not imagine that these variations, though interesting, are of any importance, except as showing a variable development of the subspinous ornament of the shell.

Cythere sabulosa occurred in moderate abundance in the dredging from Station 187, off Booby Island, depth 6 to 8 fathoms.

[Pl. XIX. fig. 1, *a–h*. *a* Shell of female seen from left side, *b* from above, *c* from below, *d* from front, *e* shell of male (?) seen from left side, *f* from above, *g* smooth variety, shell seen from left side, *h* from above. All magnified 60 diameters.]

33. *Cythere cymba*, G. S. Brady (Pl. XX. fig. 5, *a–f*).

Cythere cymba, Brady, Les Fonds de la Mer, tom. i. p. 157, pl. xvi. figs. 5–7.

Shell of the female, seen from the side, higher in front than behind, greatest height situated a little in front of the middle, and equal to two-thirds of the length; anterior extremity broad, fully rounded, and often finely denticulated from the front of the ventral to the commencement of the dorsal margin; posterior truncated, angular, produced below the middle, the lower half bearing several short blunt spines; dorsal margin well arched, ending posteriorly in an abrupt angle; ventral margin moderately convex; end view elongated, rhomboidal, twice as long as broad, widest in the middle, whence the margins converge abruptly at an angle towards either extremity; extremities equal, bimucronate; end view triangular, with rounded angles, and slightly convex sides. The valves are ornamented with numerous large, roundish, or angular excavations; the hinge-tubercles are prominent and polished; there is a sharply-defined ridge or crest running at a little distance within, and parallel to, the ventral border, continuing round the posterior and dorsal margins, and gradually becoming lost near the anterior extremity; another as distinctly marked ridge runs close along the ventral margin; these ridges are most distinctly seen on the ventral aspect of the shell, and the intervals are ornamented with angular sculpture. Length, 1-28th of an inch (·9 mm.).

Found in anchor-mud from 7 fathoms in Hong Kong Harbour; also in a dredging from the Inland Sea, Japan, lat. 34° 20′ N., long. 133° 35′ E.; 15 fathoms. The type specimens also were from Hong Kong.

[Pl. XX. fig. 5, *a-f*. *a* Shell of female seen from left side, *b* from above, *c* from below, *d* from front, *e* male from left side, *f* from above. All magnified 40 diameters.]

34. *Cythere subrufa*, n. sp. (Pl. XX. fig. 3, *a–f*).

Carapace, seen from the side, oblong, subquadrangular, higher in front than behind, height equal to rather more than half the length; anterior extremity well-rounded, posterior truncated, scarcely rounded, fringed below the middle with several short blunt spines of irregular size, inferior angle rounded off; dorsal margin gibbous over the hinge tubercle, thence sloping backwards with a gentle curve, and sinuated just in front of the hinder extremity which forms a somewhat produced angle; ventral margin straight; seen from above, ovate, twice as long as broad, the greatest width situated in the middle, sides evenly and continuously curved throughout; extremities acuminate, a slight constriction in front of the hinder one; end view ovate, broad below and tapering above, height greater than the width. The surface of the valves is marked with a reticulated pattern, enclosing angular, finely punctated areolæ, the hinge-tubercles are polished and prominent, and the anterior and posterior extremities produced so as to form flange-like borders which are marked with transverse hair-like lines. Length, 1-33d of an inch (·77 mm.).

A good series of this species was obtained in Balfour Bay, Kerguelen Island, from a depth of 20 to 50 fathoms (Station 149); also off Prince Edward's Island, 50 to 150 fathoms.

[Pl. XX. fig. 3, *a–f*. *a* Shell of female seen from left side, *b* from above, *c* from below, *d* from front, *e* male seen from left side, *f* from front. Magnified 40 diameters.]

35. *Cythere wyville-thomsoni*, n. sp. (Pl. XX. fig. 4, *a–f*).

Shell of the female, seen from the side, oblong, quadrangular, highest over the anterior hinge-joint, the height being equal to more than half the length; anterior extremity boldly rounded, fringed from above the middle with a series of small and regular serratures; posterior truncated, produced below the middle, and bearing four or five short, very stout and blunt spines; dorsal margin elevated over the anterior hinge, thence sloping steeply, and with two or three abrupt sinuations, backwards to the posterior extremity, where it is sharply angulated; ventral margin straight; seen from above, the outline is very irregularly hastate, fully twice as long as broad, the lateral margins deeply indented in the middle, converging gently in front and abruptly behind, and forming at each extremity a wide truncated prominence, the hinder one cut up into a number of blunt spines; end view irregularly triangular; the margins of the valves, as in the preceding species, are much expanded, and marked by transverse lines; the hinge-tubercles are large and prominent, the central portion of the valves has a large round elevated tubercle, while within the ventral and, less distinctly, also near the dorsal margin runs a sharply-cut longitudinal ridge, these ridges being especially conspicuous on the dorsal and ventral aspects of the shell; the general surface of the valves, including the lateral tubercle, is thickly sculptured with angular excavations. Length, 1-28th of an inch (·9 mm.).

A fine series of this very well marked species was obtained in the dredgings from Balfour Bay and Christmas Harbour, Kerguelen Island (Station 149). It occurred also in those from lat. 52° 4′ S., long. 71° 22′ E., 150 fathoms (Station 150); off Heard Island, 75 fathoms (Station 151); Torres Straits (?), lat. 11° 35′ S., long. 144° 3′ E., 155 fathoms (Station 185).

Pl. XX. fig. 4, *a–f*. *a* Shell of female seen from left side, *b* from above, *c* from below, *d* from front, *e* male seen from left side, *f* from above. All magnified 40 diameters.]

36. *Cythere parallelogramma*, n. sp. (Pl. XV. fig. 1, *a–e*).

Carapace, seen from the side, oblong, quadrangular, nearly equal in height throughout, the height being less than one-half the length; anterior extremity obliquely rounded, and sometimes obscurely dentated below the middle; lower half of the posterior margin slightly rounded and minutely dentated, upper half obliquely truncated (in the right deeply excavated); dorsal margin almost straight, terminating behind in a produced angle, ventral straight; seen from above, the outline is oblong, ovate, with irregularly sinuated sides. The surface of the valves is marked throughout with coarse, irregularly shaped excavations; within the anterior and ventral borders runs a more or less distinct elevated ridge, and just in front of the middle of each valve is a large, rounded tubercular elevation, the markings of which are smaller than those on other parts of the shell. Length, 1-30th of an inch (·85 mm.).

Dredged off Prince Edward's Island, 50 to 150 fathoms, near Station 145.

[Pl. XV. fig. 1, *a–e*. *a* Left valve of male seen from side, *b* from above, *c* right valve of male from side, *d* the same from above, *e* right valve of female seen from side. All magnified 50 diameters.]

37. *Cythere rastromarginata*, n. sp. (Pl. XVI. fig. 1, *a–d* and fig. 2, *a–d*).

Shell compressed, oblong; seen from the side, quadrangular, a little higher in front than behind, greatest height situated over the anterior hinge, and equal to half the length; anterior extremity boldly rounded and fringed throughout with a series of short, blunt, and subequal teeth; posterior truncated, rounded, and produced at the ventral angle, where it is armed with a row of six or eight strong, spine-like teeth; dorsal margin sloping with a sinuous curve backwards, and ending in an obtuse angle both before and behind, ventral nearly straight; seen from above, the outline is much compressed, thrice as long as broad, with nearly parallel sides, and broadly truncated equal extremities, the sides converging only very slightly towards the ends; end view irregularly ovate, height much greater than the width. Surface of the shell sculptured with polygonal fossæ, arranged in a somewhat radiate manner round a subcentral circular tubercle; the ventral surface forms two flattened, but only slightly extended lateral alæ, which are marked with very large excavated fossæ. Length, 1-37th of an inch (·8 mm.).

Males (fig. 1), dredged off reefs, Honolulu, 40 fathoms; off East Moncœur Island, Bass Straits, in 38 to 40 fathoms (Station 162). Females (fig. 2), in lat. 39° 32′ S., long. 171° 48′ E., 150 fathoms (Station 167).

The form figured in Pl. XVI. fig. 2, *a–d*, which I at first thought to belong to a distinct species, I now believe to be, in all probability, only the female of that shown in fig. 1, *a–d*. The general characters of the two forms are altogether similar, the chief difference being found in the large lateral expansions of fig. 2; its rather more attenuated extremities and less pronounced style of surface-sculpture, but these are all characters which are well known to be often of only sexual importance. Had the two forms occurred in the same dredging, I should not have hesitated at all to assign them to the two sexes of the same species.

[Pl. XVI. fig. 1, *a–d*, and fig. 2, *a–d*. 1*a* Shell of male (?) seen from left side, 1*b* from above, 1*c* from below, 1*d* from front. 2*a* Shell of female (?) seen from left side, 2*b* the same seen from above, 2*c* from below, 2*d* from the front. Magnified 60 diameters.]

38. *Cythere audei*, G. S. Brady (Pl. XV. fig. 7, *a–h*).

Cythere audei, Brady, Les Fonds de la Mer, tom. i. p. 162, pl. xix. figs. 12, 13.
Cythere rectangularis, Brady, Les Fonds de la Mer, tom. i. p. 153, pl. xviii. figs. 13, 14.

Shell, seen from the side, oblong, quadrangular, highest in front, the height being equal to more than half the length; anterior extremity obliquely rounded, posterior truncated, produced below the middle into a beak-like or irregularly squamous process; dorsal margin highest over the hinge-tubercle, thence sloping with a sinuous curve backwards, and ending in a well-marked angle, ventral margin nearly straight; seen from above, the outline is oblong and subhexagonal, with parallel sides, which converge gently towards the front, abruptly and almost at a right angle behind; anterior extremity wide, subtruncated, and having a small central mucro, posterior produced in the middle into a broad protuberance; end view vaulted, dorsal margin arched, ventral broad and only slightly convex. Surface of the valves marked with small, shallow pittings, which are rather irregularly disposed and obscurely rounded. Length, 1-50th of an inch (·5 mm.).

Found in a dredging from a depth of 7 fathoms off Ascension Island; the single valve shown in figures *e–h* is from Balfour Bay, Kerguelen Island, but it may well be doubted whether it really belongs to this species. The type specimens were from Mauritius and Colon-Aspinwall.

[Pl. XV. fig. 7, *a–h*. *a* Shell of Ascension Island specimen seen from left side, *b* from above, *c* from below, *d* from front; figures *e–h* exhibit similar views of a right valve from Balfour Bay. Magnified 60 diameters.]

39. *Cythere curvicostata*, n. sp. (Pl. XII. fig. 4, *a–d*).

Carapace compressed oblong; seen from the side, subclavate, rather higher in front than behind, greatest height not so much as half the length; anterior extremity well rounded and bordered with a regular row of small teeth, which extend a short distance along the ventral margin; posterior subtruncated, slightly produced below the middle, the produced portion divided into teeth similar to those of the anterior extremity; dorsal margin highest in front, and falling by two abrupt but shallow steps towards the posterior extremity; ventral margin straight. The lateral surfaces of the shell exhibit two or three sinuous longitudinal ribs extending nearly the whole length of the valves, and towards the margins some irregularly-disposed smaller ribs; the interspaces are occupied by small fossæ closely set and arranged in longitudinal rows; seen from above, the outline is oblong, thrice as long as broad, nearly equal in width throughout, the sides parallel, the extremities broad and subtruncate; end view subquadrangular, height greater than the width. Length, 1-45th of an inch (·53 mm.).

One or two specimens only in a dredging from near Booby Island, in a depth of 6 to 8 fathoms. In style of surface ornament as well as in general shape the species is not very unlike the British *Cythere emaciata*, but a critical examination shows numerous important differences. Yet the peculiar disposition of the rib-work and associated fossæ, the finely-dentated margins and fan-like posterior expansions of the valve-margins suggest either a community of descent, or (which is scarcely likely) exposure to conditions which have at length resulted in similar peculiarities of structure. The same observation applies with equal force to several of the ribbed species which come next to be described.

[Pl. XII. fig. 4, *a–d*. *a* Shell seen from left side, *b* from below, *c* from above, *d* from front. All magnified 60 diameters.]

40. *Cythere lauta*, n. sp. (Pl. XXI. fig. 4, *a–d*).

Shell, seen from the side, oblong, subquadrate, the greatest height being situated over the anterior hinge-joint, and equalling at least half the length; anterior extremity well rounded and crenulated, posterior truncated and irregularly notched, lower angle rounded off; dorsal margin sinking rather abruptly behind the anterior hinge, thence sloping gently with an irregularly notched line to the hinder end where it is abruptly angular, ventral margin slightly sinuated; seen from above, the outline is clavate, nearly thrice as long as broad, the sides parallel, suddenly converging in front of the middle, then running again directly forwards and forming a broad truncated anterior extremity; the posterior extremity forms a short truncated and notched prominence rather broader than that of the anterior; end view irregularly quadrangular, the dorsal and ventral margins convex, sides concave. The margins of the shell are produced and form a thick, flattened, and dentated flange, this being most fully developed at the two extremities, and much expanded on the ventral surface; the remaining central portion of the valve forms a somewhat elliptical area, and is marked off more or less perfectly by elevated ridges; there is also an oblique longitudinal ridge occupying the posterior half of the middle line, the rest of the surface being marked by angular excavations. Length, 1-52d of an inch (·49 mm.).

Found only in the Booby Island dredging, from lat. 10° 36′ S., long. 141° 55′ E., 6 to 8 fathoms. (Station 187.)

[Pl. XXI. fig. 4, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

41. *Cythere stimpsoni*, G. S. Brady (Pl. XXI. fig. 6, *a–h*).

Cythere stimpsoni, Brady, Les Fonds de la Mer, tom. i. p. 78, pl. x. figs. 7, 8, and Ann. and Mag. Nat. Hist., ser. 4, 1869, vol. iii. p. 48, pl. vii. figs. 9–12.

Carapace of the female, seen from the side, oblong, subclavate, higher in front than behind, greatest height situated over the anterior hinge, and equal to half the length; anterior extremity broadly rounded, bordered with numerous more or less strongly developed spines, posterior much narrower, somewhat angular in the middle, toothed below the middle; dorsal margin gibbous over the anterior hinge, thence sloping with a gentle curve backward; ventral margin nearly straight; seen from above, the outline forms a narrow parallelogram with two nearly equally broad, produced extremities, width equal to less than half the length; the end view forms an irregular pentagon. Surface of the valves coarsely excavated with large, closely-set and irregular fossæ, and having three conspicuous curved ribs, the largest of which runs lengthwise nearly in the middle of the valve, another rather shorter and near the ventral margin, and a third close to the dorsal margin; these, in the full-grown shell, all end abruptly behind in angular prominences, and are lost in front on the surface of the shell; the ribbing and spinous armature are much more fully developed in the male (fig. *e*). Length, 1-33d of an inch (·77 mm.).

This is a characteristic Mediterranean species, and the only specimens brought home by the Challenger, so far as I have seen, are from anchor-mud, brought up from a depth of 11 fathoms in Vigo Bay.

[Pl. XXI. fig. 6, *a–h*. *a* Carapace of female seen from left side, *b* from above, *c* from below, *d* from front, *e* male seen from left side; *f, g, h* show young forms of the shell. All magnified 45 diameters.]

42. *Cythere quadriaculeata*, n. sp. (Pl. XXII. fig. 2, *a–d*, and Pl. XXV. fig. 4, *a–d*).

Shell, seen from the side, irregularly quadrate, much higher in front than behind, the greatest height equal to two-thirds of the length; anterior extremity well rounded, oblique, posterior narrowed, truncated, and emarginate, dorsal margin sloping steeply from the front, and suddenly excavated just in front of the angulated posterior extremity; ventral margin nearly straight, but up-curved behind the middle; seen from above, the outline is oblong, subhastate, fully twice as long as broad, widest behind the middle, the sides slightly converging forwards from two spinous projections near the posterior extremity; behind these projections they converge more abruptly to the middle line; the posterior extremity is subacute, the anterior more obtuse; end view angular, five or six sided, lateral margins parallel, ending above and below in sharp projecting processes. Surface of the shell marked with closely-set subrotund excavations, and having on each lateral aspect two strongly-marked longitudinal ridges, each of which terminates much behind the middle of the valve in a sharp spine. Length, 1-50th of an inch (·5 mm.).

Dredged in the Inland Sea, Japan, 15 fathoms (Station 233*b*), and off the reefs at Honolulu in 40 fathoms.

This is in general character very like *Cythere polytrema*, but it is not so coarsely sculptured, and is devoid of the marginal spines belonging to that species. The ribs in *Cythere polytrema* are straighter, longer, and more strongly developed, but do not end posteriorly in the conspicuous spines which are characteristic of *Cythere quadriaculeata*. The dorsal and ventral aspects are very different in the two species.

[Pl. XXII. fig. 2, *a–d*. *a* Shell (Honolulu) seen from left side, *b* from above, *c* from below, *d* from front. Magnified 80 diameters. Pl. XXV. fig. 4, *a–d*. *a* Shell (Japan) seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

43. *Cythere polytrema*, G. S. Brady (Pl. XXI. fig. 5, *a–h*).

Cythere polytrema, Brady, Trans. Zool. Soc., 1878, vol. x. p. 393, pl. lxvi. fig. 1, *a–d*.

Shell of the female, seen from the side, subquadrangular, highest in front, the height over the hinge-joint considerably exceeding half the length; anterior extremity broad, well rounded, and bearing a series of from six to ten stout, blunt spines; posterior truncated, angular, and bordered irregularly with spines like those of the anterior margin; dorsal margin sloping backwards with a somewhat sinuous curve, but in the male often much cut up and indented; ventral margin more or less sinuous and spinous at the hinder end; the dorsal aspect is not unlike that of *Cythere stimpsoni*, except that the lateral margins, instead of being straight, are convex; end view also like *Cythere stimpsoni*, but showing the projections of the ribs more strongly; the surface of the shell is roughly excavated as in *Cythere stimpsoni*, and the lateral aspect of the valves shows two very strong and almost straight longitudinal ribs, which terminate abruptly both in front and behind without reaching the extremities of the shell. Length, 1-33d of an inch (·77 mm.).

A few detached valves brought by the Challenger from off Prince Edward's Island in the Southern Ocean are in no respect distinguishable from the fossil specimens described by me in a *Monograph of the Fossil Ostracoda of the Antwerp Crag*, under the name *Cythere polytrema*. It is extremely interesting to note the occurrence, alive in this distant region, of so well marked a European fossil. The forms figured at *d* and *e* are, I think, undoubtedly the right and left valves of the male, while *f*, *g*, and *h* represent most likely immature conditions of the shell.

[Pl. XXI. fig. 5, *a–h*. *a* Left valve of female seen from the side, *b* from above, *c* from front, *d* left valve of male, *e* right valve of male; *f*, *g*, *h* immature forms of the shell. All magnified 45 diameters.]

44. *Cythere scalaris*, n. sp. (Pl. XXI. fig. 8, *a–c*).

Valves, seen from the side, much higher in front than behind, greatest height equal to considerably more than half the length; anterior extremity broad and rounded, armed with numerous long and stout spines which are directed somewhat downwards; posterior extremity narrowed, angular, and irregularly spinous; dorsal margin sloping steeply backwards in a succession of very sharply angular steps; ventral irregularly sinuous, and bending upwards at the hinder end; dorsal aspect ovate, with very irregularly indented and spinous margins. Surface of the shell bearing one or more much contorted longitudinal ribs, and covered, like the foregoing, with closely-set, large, polygonal excavations. Length, 1-30th of an inch (·85 mm.).

Only a few valves of *Cythere scalaris* were noticed in a dredging from Torres Straits, lat. 11° 26′ S., long. 140° 3′ E., 155 fathoms (Station 185), and in a sounding from 100 fathoms (Station 305).

[Pl. XXI. fig. 8, *a–c*. *a* Left valve (young), *b* right valve (adult) seen from side, *c* the same from above. All magnified 50 diameters.]

45. *Cythere packardi*, n. sp. (Pl. XIX. fig. 2, *a–d*).

Shell, seen from the side, oblong, rather higher in front than behind, anterior extremity obliquely rounded, posterior rounded off above, produced below the middle; dorsal margin sloping backwards from the front, almost in a right line, inferior sinuated about the middle; greatest height equal to more than half the length; seen from above, the outline is oblong, with nearly parallel sides and broad truncated extremities; the lateral margins are slightly sinuated in the middle, and converge somewhat suddenly towards the extremities; width equal to half the length; the end view is irregularly ovate, height considerably greater than the width. Surface of the shell honeycombed with rather large angular cavities, and having also several sinuous ridges, the most conspicuous of which runs parallel with the ventral margin, and makes an upward turn a little in front of the posterior margin. Length, 1-52d of an inch (·48 mm.).

This species, which occurred only in a dredging from Station 187, off Booby Island, I have pleasure in naming after Dr A. Packard of Cambridge, U.S., a naturalist well known for his valuable contributions to the knowledge of many branches of invertebrate zoology.

[Pl. XIX. fig. 2, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

46. *Cythere flabellicostata*, n. sp. (Pl. XIII. fig. 6, *a–h*).

Shell of the female, seen from the side, quadrangular, highest in front, height equal to more than half the length; anterior extremity broad and obliquely rounded, posterior truncated, produced below the middle and slightly emarginate above; dorsal margin gibbous in front, thence sloping with a slight convexity backwards, and ending in a sharp angle; ventral margin nearly straight; seen from above, ovate, with nearly equal, broadly truncated extremities; width equal to about half the length; the sides are gently curved, converging gradually towards the front and more suddenly behind; end view ovate, with irregular convex margins, broad at the base, and slightly tapered to the apex. The surface of the valves is marked throughout with large, irregularly-shaped, angular cavities, separated from each other by sharply-cut ridges, which on the hinder half assume a radiating or fan-like arrangement. The shell of the male (figures *e–h*) presents the usual elongated, compressed, and angular form. Length, 1-50th of an inch (·5 mm.).

Dredged in Simon's Bay, South Africa, in a depth of 15 to 20 fathoms (Station 140).

[Pl. XIII. fig. 6, *a–h*. *a* Shell of female seen from left side, *b* from above, *c* from below, *d* from front. Figures *e–h* show similar views of the male. All magnified 60 diameters.]

47. *Cythere craticula*, n. sp. (Pl. XXI. fig. 7, *a–d*).

Shell larger and much more tumid than that of *Cythere flabellicostata*, but, seen laterally, of almost exactly the same shape; seen from above, the shape approaches that of a very irregular elongated octagon, about twice as long as broad; the sides are nearly parallel and slightly sinuated, converging gently towards the front and much more abruptly behind, each extremity forming a wide truncated prominence, the anterior, however, much the wider of the two; the posterior is emarginate, the anterior bimucronate; end view very irregularly quadrate; height and width about equal, the lateral margins having a very large and conspicuous median protuberance. The lateral surfaces of the valves are marked by two or three flexures and very prominent longitudinal ribs, which again are connected by several similar transverse ribs, forming a very open network, the interspaces of which are excavated into numerous smaller cavities; on the ventral surface the longitudinal ribs are more numerous and closely set; the anterior margin of the shell has a few small blunt spines, the posterior two or three of rather larger size. Length, 1-38th of an inch (·66 mm.).

Dredged in Simon's Bay, South Africa, in a depth of 15 to 20 fathoms (Station 140).

[Pl. XXI. fig. 7, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. All magnified 60 diameters.]

48. *Cythere stolonifera*, n. sp. (Pl. XXI. fig. 3, *a–d*).

Shell compressed, elongated; seen from the side, oblong, subovate, with a much-produced infero-posteal angle, rather higher in front than behind, height equal to about one-half of the length; anterior extremity well rounded, and forming a continuous curve with both dorsal and ventral margins, posterior obliquely truncated, much produced below the middle, where it is also minutely dentate; dorsal margin gently arched and somewhat sinuous, ventral almost straight; seen from above, the outline is compressed, ovate, widest behind the middle, and having both extremities projected as rectangularly truncate processes, the anterior much the larger of the two; width considerably less than half the length; the end view is in the form of a narrow irregular octagon, its sides more or less denticulated or spinous. The sides of the valves are ornamented with several flexuous ribs, two or three of which run lengthwise, the rest obliquely or in various directions; the margins, especially the anterior and ventral, are produced into a well-marked, flattened, or concave encircling rim. Length, 1-42d of an inch (·6 mm.).

Dredged in Simon's Bay, South Africa, 15 to 20 fathoms (Station 140).

[Pl. XXI. fig. 3, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

49. *Cythere bermudæ*, G. S. Brady (Pl. XXI. fig. 2, *a–d*).

Cythere serrulata, Brady, Les Fonds de la Mer (1868), tom. i. p. 153, pl. xviii. figs. 11, 12.

Shell, seen from the side, somewhat siliquose, much higher in front than behind, the greatest height situated over the anterior hinge, and equal to at least half the length; anterior extremity broad and obliquely rounded; posterior truncated, narrow, irregularly emarginate and angulated about the middle; dorsal margin sloping backwards with a steep curve, and terminating in a produced angle; ventral nearly straight, angulated at the hinder end; seen from above, the outline is that of a narrow parallelogram with two broad produced extremities, the sides converging gently in front and almost at a right angle behind; width equal to rather more than one-third of the length; end view sub-pentagonal. Surface of the valves marked with three prominent longitudinal ribs, the interspaces excavated into large irregular pits. Length, 1-50th of an inch (·5 mm.).

Specimens which seem fairly referable to this species, differing a little, however, in shape as well as in the absence of serratures on the extremities of the valves, were dredged in a depth of 435 fathoms off Bermudas (Station 33). The type specimens were from Colon-Aspinwall, but the specific name originally applied to them (*serrulata*) having been already used by M. Bosquet is here abandoned in favour of *bermudæ*.

[Pl. XXI. fig. 2, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

50. *Cythere cristatella*, n. sp. (Pl. XIX. fig. 6, *a–d*).

Shell, seen laterally, oblong, quadrangular, higher in front than behind, the greatest height being equal to at least half the length; anterior extremity moderately rounded and slightly jagged; posterior truncated, produced in the middle and angulated both above and below; dorsal margin elevated in front, sloping very gently backwards, and ending in an angle at the hinder extremity; ventral margin nearly straight; seen from above, the outline is compressed, much more than twice as long as broad, subhexagonal, with nearly parallel sides, which converge gradually towards the front, but very abruptly behind; the extremities form thick truncated prominences; end view octagonal, widest in the middle, the four oblique margins deeply sinuated. Surface of the shell irregularly undulated, having an elevated longitudinal crest running parallel with the ventral margin, and ending abruptly behind the middle; the margins produced into a thick encircling flange. Length, 1-43d of an inch (·575 mm.).

Dredged off Booby Island (Station 187), 6 to 8 fathoms.

[Pl. XIX. fig. 6, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

51. *Cythere obtusalata*, n. sp. (Pl. XII. fig. 1, *a–c*).

Valves, seen from the side, subquadrangular, highest over the anterior hinge; anterior extremity obliquely rounded, posterior produced below the middle into a broad, irregularly dentated, beak-like process; dorsal margin sloping gently from the rather gibbous anterior extremity, ventral straight; height equal to more than half the length; seen from above, the lateral margins form a median alæform projection which ends abruptly behind, and tapers gently away towards the front. The surface of the shell is marked throughout with closely-set and not very large subangular excavations, but has no trace of ribbed ornament. Length, 1-43d of an inch (·57 mm.).

Only detached valves of this species were found in the following dredgings:—Off East Moncœur Island, Bass Straits, 38 to 40 fathoms, and in 16 to 25 fathoms off Admiralty Islands.

[Pl. XII. fig. 1, *a–c*. *a* Right valve seen from side, *b* from above, *c* from front. Magnified 60 diameters.]

52. *Cythere lactea*, G. S. Brady (Pl. XXII. fig. 1, *a–d*).

Cythere lactea, Brady, Trans. Zool. Soc. (1865), vol. v. p. 377, pl. lx. fig. 3, *a–c*.

Carapace, seen from the side, oblong, quadrangular, higher in front than behind, greatest height equal to nearly two-thirds of the length; anterior extremity broadly rounded; posterior truncated, slightly toothed below and excavated above the middle; dorsal margin sinuated behind the anterior hinge, thence sloping gently to the posterior extremity; ventral margin straight; seen from above, the outline is irregularly hexagonal, oblong, with subparallel sides, which are deeply indented in the middle, and converge abruptly and sinuously towards the obtuse, truncated extremities; the end view is subtriangular, with irregularly notched sides, and broad, rather convex, base. The surface of the shell is covered with closely-set angular excavations; within the ventral and posterior margins runs an elevated ridge, and on the front of each valve is a rounded tubercular prominence (not shown in the plate). Length, 1-50th of an inch (·5 mm.).

From a sounding made in a depth of 420 fathoms (mid-Pacific, about lat. 40° S.).

These specimens appear to be referable to a *Cythere* which was described by me from one shell only, under the name *lactea*, in the Transactions of the Zoological Society (*loc. cit.*). The type specimen is more sharply sculptured and rather longer than those now figured and described, but considerable latitude must be allowed for difference of race and habitat. As a general rule, Ostracoda dredged from great depths are more blurred in their features than the same species from shallower water.

[Pl. XXII. fig. 1, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

53. *Cythere prava* (Baird), (Pl. XXII. fig. 4, *a–f*).

Cythereis prava, Baird, Proc. Zool. Soc. (1850), part xviii. p. 254 (Annulosa), pl. 18, figs. 13–15.
Cythereis deformis, *idem*, *ibidem*, pl. xviii. figs. 4–6.

This, though much resembling *Cythere lactea*, is a larger and more coarsely-sculptured species, the sides of the valves show two or three flexuous, more or less prominent, longitudinal ridges running along almost the entire length of the shell; the dorsal margin is more irregularly broken, and the shell is wider in proportion to its length; the width and height are equal, and, in the female, exceed half the length. The end view is irregularly quadrate, very broad dorsally. Length, 1-38th of an inch (·66 mm.).

Dredged at Nares' Harbour and other stations off the Admiralty Islands, in depths of 16 to 25 fathoms.

The types of this species, described by Dr Baird, were from the Mediterranean (Tenedos), and my own collection contains a series of specimens from the same place. The Challenger specimens here referred to are altogether coarser and clumsier in general aspect; the longitudinal ribbing is not so clean cut, nor is the pitted sculpturing of the shell so well defined, and, seen dorsally, the outline is more obese and less attenuated towards the extremities. But though the differences are thus rather considerable, it would not be easy to fix upon a line of separation, and I therefore prefer to consider these specimens as local varieties of Dr Baird's species.

[Pl. XXII. fig. 4, *a–f*. *a* Shell of female seen from left side, *b* from above, *c* from below, *d* from front, *e* male seen from left side, *f* from above. All magnified 60 diameters.]

54. *Cythere convoluta*, G. S. Brady (Pl. XXII. fig. 3, *a–d*).

Cythere convoluta, Brady, Ann. and Mag. Nat. Hist. (1868), ser. 4, vol. ii. p. 182, pl xii. figs. 3, 4.

Shell, seen from the side, subquadrangular, greatest height situated in front, and equal to about two-thirds of the length; anterior extremity smooth and broadly rounded, posterior subtruncate and irregularly toothed, produced below and excavated above the middle; dorsal margin sloping from before backwards, abruptly and irregularly sinuous, ventral slightly convex; seen from above, the outline is irregularly ovate, widest in the middle, with broad truncated extremities and irregularly jagged sides (the jags not sufficiently marked in the plate); width equal to the height; end view vaulted, base nearly straight, sides boldly curved and deeply indented. The surface of the valves is marked with numerous prominent, twisted, and sharply-cut longitudinal ribs, the intervals of which are irregularly reticulated. Length, 1-42d of an inch (·6 mm.).

Dredged off Tongatabu, 18 fathoms (Station 172), and in 40 fathoms off the reefs at Honolulu; in both places amongst coral. The types were from Mauritius.

[Pl. XXII. fig. 3, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

55. *Cythere fungoides* (G. S. Brady), (Pl. XIX. fig. 7, *a–d*).

Cythereis fungoides, Brady, Trans. Zool. Soc. (1865), vol. v. p. 385, pl. lxi. fig. 7, *a–d*.

Shell very tumid; seen from the side, subtrapezoidal, nearly equal in height throughout, height equal to more than half the length, the entire circumference irregularly indented and spinous; extremities nearly equal, obliquely subtruncate, scarcely rounded; dorsal margin sloping slightly backwards, irregularly indented, almost laciniated; ventral irregular, slightly convex; seen from above, the outline is irregular and subhexagonal, greatest width behind the middle, and equal to two-thirds of the length; lateral margins converging slightly towards the front and much more abruptly behind; extremities broad and truncated; the whole outline, except the extreme front, much jagged and dentated; end view pentagonal; height scarcely as great as the width. The surface of the shell is rough, especially on the dorsal aspect, with irregular crests and tubercles. Length, 1-38th of an inch (·66 mm.).

Dredged off Booby Island (Station 187) in 6 to 8 fathoms; off Bermudas, 435 fathoms (Station 33); and in lat. 9° 59′ S., long. 137° 50′ E., 28 fathoms (Station 189).

The type specimen is Australian, and is even more laciniated in its sculpture than that here figured.

[Pl. XIX. fig. 7, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

56. *Cythere patagoniensis*, n. sp. (Pl. XXIII. fig. 3, *a–d*).

Shell oblong, compressed; seen from the side, the greatest height is situated in front of the middle, and is equal to more than half the length; anterior extremity broad, well rounded, and divided into a series of broad blunt teeth, posterior narrow, scarcely rounded, armed with five or six short blunt teeth below the middle; the dorsal margin is gibbous in front, thence sloping steeply backwards in an irregularly sinuous line; ventral margin straight; seen from above, the outline is compressed, subhastate, more than twice as long as broad, widest behind the middle, from which point the sides converge very gradually towards the front, and sink at an abrupt angle behind, thus forming a deep excavation; the extremities broad and truncated, with dentated margins; end view subtriangular, with sinuous sides and broadly rounded apex, the base-line broadly keeled. Surface of the shell very irregularly nodulated. Length, 1-40th of an inch (·65 mm.).

Several specimens were dredged off the coast of Patagonia in lat. 50° 10′ S., long. 74° 42′ W., 175 fathoms.

[Pl. XXIII. fig. 3, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

Cythere viminea, n. sp. (Pl. XVIII. fig. 3, *a–c*).

Valves, seen laterally, oblong, subovate, greatest height situated near the anterior extremity and equal to nearly two-thirds of the length; extremities well rounded and fringed below the middle with a series of six or eight small but stout spines; dorsal margin sloping gently from before backwards, and slightly sinuated, ventral nearly straight; seen from above, the lateral margin is angular, nearly straight in the middle, then sloping suddenly to either end, the extremities forming broad truncated projections. Shell sculptured with closely-set polygonal fossæ, and produced round the margins so as to form a stout encircling flange. Length, 1-38th of an inch (·66 mm.).

One valve dredged in 1375 fathoms, lat. 46° 46′ S., long. 45° 31′ E. (Station 146).

[Pl. XVIII. fig. 3, *a–c*. *a* Right valve seen from side, *b* from above, *c* from front. Magnified 50 diameters.]

58. *Cythere lepralioides*, n. sp. (Pl. XIX. fig. 5, *a–d*).

Carapace oblong, subovate, tumid, seen from the side, rather higher in front than behind, the height being about equal to half the length; anterior extremity obliquely rounded and bordered by even lines of short blunt teeth; posterior extremity narrowed, unevenly notched; dorsal margin gibbous in front over the hinge-tubercle, thence sloping gently backwards; ventral margin slightly convex; seen from above, the shell is oblong-ovate, twice as long as broad, widest behind the middle, lateral margins evenly convex, extremities obtuse and emarginate; end view very broadly ovate. Surface of the shell marked with closely-packed, large angular excavations and depressed on the dorsal and ventral surfaces along the lines of contact of the valves. Length, 1-32d of an inch (·775 mm.).

Dredged at Simon's Bay, South Africa (Station 140), in a depth of 15 to 20 fathoms, and off the Cape of Good Hope (Station 142) in 150 fathoms.

[Pl. XIX. fig. 5, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

59. *Cythere hodgii*, G. S. Brady (Pl. XXV. fig. 1, *a–d*).

Cythere hodgii, Brady, Trans. Zool. Soc. (1865), vol. v. p. 373, pl. lix. fig. 3, *a*, *b*.

Carapace of the female oblong-ovate; seen from the side, subovate or subrhomboidal, scarcely higher in front than behind, height equal to somewhat more than half the length; extremities obliquely rounded, the anterior bearing on the lower half of each valve a variable number (3 to 8) of short downward-pointing spines, the posterior one a much larger spine, which also points obliquely downwards (sometimes there are one or two supplementary small spines); seen from above, the outline is regularly ovate, widest near the middle, about twice as long as broad, somewhat more tapered in front than behind, showing two prominent spines at each extremity, the anterior two closely approximated, the posterior two much wider apart and divergent; end view subcircular, emarginate above and below. The surface of the shell is marked with numerous subovate or angular fossæ which, toward the middle of the valves, are arranged in longitudinal rows, but towards the margins, in more or less distinctly concentric lines. Length, 1-38th of an inch (·66 mm.). The male carapace (fig. 1, *e–g*) differs, it will be seen, from the female in its more attenuated form, and in the depression of the dorsal and ventral surfaces. The species occurred plentifully in a dredging from the Inland Sea, Japan, lat. 34° 20′ N., long. 133° 35′ E., 15 fathoms (Station 233*b*).

The type specimen was found amongst sponge sand, which was said to have come from the Levant, but this may well be doubted. It differs from these Japanese examples in being much more sparingly sculptured, the excavations, in fact, being obsolete except on the hinder portion of the valve: in shape, too, the European (?) specimen is rather more slender. Possibly the two forms might fairly be separated as well-marked varieties, but they seem to me to be certainly referable to one and the same species. It remains to be noted that I have seen other specimens of *Cythere hodgii* collected in various parts of the Malayan Archipelago, and that some of the young shells exhibit a close approach to the single valve described in the Zoological Transactions.

[Pl. XXV. fig. 1, *a–g*. *a* Shell of female seen from left side, *b* from above, *c* from below, *d* from front; *e* male seen from left side, *f* from below, *g* from front. All magnified 50 diameters.]

60. *Cythere papuensis*, n. sp. (Pl. XXV. fig. 5, *a–d*).

Shell oblong, subovate; seen laterally, higher in front than behind, the height being equal to more than half the length; anterior extremity broad, obliquely rounded and divided into numerous short teeth, posterior narrowed and having on each valve three or four spines, the lowermost of which is the longest; these are directed straight backwards as those of the anterior margin are forward: dorsal margin sloping from the front with a gentle curve, ventral nearly straight; seen from above, the appearance is almost exactly that of *Cythere hodgii*, but that the spines of the posterior extremity are more numerous and more closely approximated; the end view is subtriangular, equilateral, with rounded angles and convex side; the sculpture also is very similar to that of *Cythere hodgii*, but the cavities have not any concentric or linear arrangement. Length, 1-38th of an inch (·66 mm.).

This species was found only in a dredging from a depth of 37 fathoms in Humboldt Bay, Papua.

[Pl. XXV. fig. 5, *a–d*).—*a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

61. *Cythere euplectella*, G. S. Brady (Pl. XXV. fig. 3, *a–d*).

Cythere euplectella, Brady, Les Fonds de la Mer, p. 157, pl. xvi. figs. 5–7.

Shell tumid, subovate; seen laterally, oblong, rather higher in front than behind, height equal to more than half the length; anterior extremity rounded, bordered with a row of small, blunt teeth, and distinctly angulated at its junction with the dorsum; posterior narrowed, irregularly jagged, produced in the middle, and bearing four or five spines of irregular lengths; seen from above, the outline is ovate, tumid, greatest width behind the middle, and equal to two-thirds of the length; extremities rounded, the posterior much the wider of the two; the spines of the anterior and posterior extremities project strongly, and give a marked character to the shell; end view broadly cordate. The surface of the shell is marked with a network of ribs, which cross each other at right angles, enclosing deep fossæ; the longitudinal ribs are more prominent than the transverse. Length, 1-45th of an inch (·53 mm.).

Found only in a dredging from Station 189, lat. 9° 59′ S., long. 137° 50′ E., 28 fathoms. The type specimens are from Hong Kong. The species is well characterised by the peculiar, and, in well-marked specimens, the very beautiful shell-sculpture. The cavities with which the shells of Ostracoda are so commonly adorned, usually appear as if simply scooped out of the substance of the valves, but in the case of *Cythere euplectella*, they give the impression of being formed by the crossing of two series of ribs. I know of no other species in which precisely the same structure occurs.

[Pl. XXV. fig. 3, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. All magnified 50 diameters.]

62. *Cythere goujoni*, G. S. Brady (Pl. XXV. fig. 7, *a–g*).

Cythere goujoni, Brady, Les Fonds de la Mer, tom. i. p. 78, pl. x. figs. 9, 10.

This species very closely approaches *Cythere papuensis*, but is more angular in its contour, both as viewed from above and from the side. Seen laterally, it is highest near the front, the height of the female being equal to more than half the length; the anterior margin is rounded, and has several distant sharp spines; the posterior is truncated, angular at its upper termination, and bears a few small, blunt spines below the middle; the dorsal margin is sinuated behind its highest point, and then slopes with a gentle curve backwards; ventral margin slightly convex; seen from above, the outline is subovate, about twice as long as broad, and widest near the middle, the extremities are truncated, but the anterior is considerably broader than the posterior, and there are two conspicuous lateral spines, one on each valve, near the hinder extremity; end view very broadly ovate. Surface of the valves covered with closely-set angular cavities. Length, 1-38th of an inch (·66 mm.).

This species was noticed in three dredgings:—from Port Jackson, 2 to 10 fathoms;

off Booby Island (Station 187), 6 to 8 fathoms; and Hong Kong Harbour, 7 fathoms. It was first described from specimens taken in the China Seas.

[Pl. XXV. fig. 7, *a–g*. *a* Shell of female seen from left side, *b* from above, *c* from below, *d* from front, *e* male seen from left side, *f* from below, *g* from front. All magnified 50 diameters.]

63. *Cythere adunca*, G. S. Brady (Pl. XXV. fig. 6, *a–d*).

Cythere cerebralis, Brady, Les Fonds de la Mer, tom. i. p. 63, pl. vii. figs. 12–14.

Shell, seen from the side, oblong, flexuous, irregularly subrhomboidal, rather higher in front than behind, height equal to more than half the length; anterior extremity obliquely rounded, not spinous, posterior truncated, narrow and sinuous; dorsal margin very irregularly sinuous, and prominent over the hinge-tubercle, ventral strongly convex and sharply up-turned towards the hinder extremity; seen from above, the outline is subovate, twice as long as broad, the greatest width situated near the middle; the sides are irregularly jagged, and have a spinous projection near the posterior extremity, the anterior extremity is broad and truncated, the posterior obtusely rounded; end view subtriangular, with rounded angles, very convex base, and truncated apex. Surface of the valves very uneven and irregularly excavated, and on the anterior and inferior margins bordered by a wide, tumid lip or flange. Length, 1-42d of an inch (·6 mm.).

Dredged in lat. 9° 59′ S., long. 137° 50′ E., 28 fathoms (Station 189), and in lat. 5° 26′ S., long. 133° 19′ E., 580 fathoms (Station 196*a*).

The type-specimens of *Cythere adunca* are from Batavia, Pamalang, and Pamanockan (Java), localities not far removed from those of the Challenger dredgings in which it was found. The species might almost be taken to be *Cythere goujoni*, with all its characters gnarled and distorted; the one looks rotund, sleek, and well fed, the other shrunken, angular, and bony; there is scarcely more difference than between an alderman and a crossing-sweeper. Between *Cythere papuensis*, *Cythere goujoni*, and *Cythere cerebralis*, possibly specimens may be found completely to bridge over the gaps; to a certain extent, indeed, this may already be done from the material brought home by the Challenger, and it is quite likely that further investigation might even bring into the same series *Cythere hodgii* and *Cythere darwini*. The specific name *cerebralis*, previously applied to this species is withdrawn, having been already used for another member of the genus by M. Bosquet.

[Pl. XXV. fig. 6, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

64. *Cythere darwini*, G. S. Brady (Pl. XXV. fig. 2, *a–g*).

Cythere darwini, Brady, Les Fonds de la Mer, tom. i. p. 71, pl. viii. figs. 17, 18.

Shell of the female, seen laterally, subquadrangular, height greater than half the length, and equal throughout; anterior extremity slightly rounded, and bordered with a row of short, broad, and blunt teeth; posterior extremity irregularly rounded, and more or less broken into spine-like processes; dorsal margin straight or nearly straight, angulated at its junction with the posterior extremity, ventral slightly convex; seen from above, the outline is regularly ovate, with slightly jagged edges, greatest width equal to the height, and situated in the middle; extremities broadly rounded; end view very broadly ovate, almost cordate. The surface of the shell is granular in appearance, and is marked throughout by closely-packed, deep, angular fossæ; the spinous armature is very variable in its degree of development, and as a rule is dependent largely upon age and sex, stronger in males than in females. Male specimens are figured at *e, f, g,* and besides being strongly spined are larger and of more slender proportions than the females. Length (of females), 1-38th of an inch (·66 mm.).

Found in anchor-mud from a depth of 7 fathoms, Hong Kong Harbour, and in a dredging from 15 fathoms, Inland Sea, Japan (Station 233*b*). The specimens described in Les Fonds de la Mer were dredged at the north point of Java ("North Watcher").

[Pl. XXV. fig. 2, *a–g*. *a* Shell of female seen from left side, *b* from above, *c* from below, *d* from front, *e* shell of male seen from left side, *f* from below, *g* variety of male, right valve seen from side. All magnified 50 diameters.]

65. *Cythere cribriformis*, G. S. Brady (Pl. XIX. fig. 3, *a–d*).

Cythère cribriformis, Brady, Trans. Zool. Soc., 1865, vol. v. p. 379, pl. lxi. fig. 6, *a–d*.

Shell tumid, subovate; seen from the side, oblong, subquadrangular, scarcely higher in front than behind, height equal to more than half the length; anterior extremity moderately rounded; posterior narrower, and well-rounded; dorsal margin elevated into an angular prominence over the anterior hinge, behind which it is almost straight; ventral slightly convex; the entire circumference, especially the anterior and posterior margins, is irregularly broken and dentated; seen from above the outline is broadly ovate, strongly jagged, or dentated, widest behind the middle, greatest width equal to nearly two-thirds of the length, very broadly rounded behind, narrower in front; end view very broad, the width greater than the height, centrally emarginate both above and below. The surface-sculpture is very similar in character to that of *Cythere darwini,* but is more strongly marked, and there are no distinct marginal spines, the marginal irregularities being only such as are produced by the general roughness of the surface; the edges of the valves are strongly depressed on the ventral, and more especially on the dorsal, aspect. Length, 1-40th of an inch (·65 mm.).

This species was noticed only in anchor-mud from Hong Kong Harbour, 7 fathoms.

[Pl. XIX. fig. 3, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

66. *Cythere sulcatoperforata*, n. sp. (Pl. XXVI. fig. 1, *a–d*).

Valves, seen from the side, subquadrangular, nearly equal in height throughout, height equal to two-thirds of the length; anterior extremity boldly rounded; posterior nearly as broad as the anterior, produced in the middle; dorsal margin elevated into a gibbous prominence at each end, between which points it is irregularly spinous; ventral margin convex, slightly sinuated in front and dentated behind; seen from above, the outline of the shell is ovate, with dentated margins; the end view has its sides broken with two deep angular excavations, corresponding with two longitudinal furrows which run nearly the whole length of each valve. The shell-surface is sculptured with numerous scattered subangular fossæ, arranged in interrupted, more or less longitudinal, rows. Length, 1-23d of an inch (1·1 mm.).

Only one or two detached valves of this species were found in a dredging from 1375 fathoms, lat. 33° 42′ S., long. 78° 18′ W. (Station 300).

[Pl. XXVI. fig. 1, *a–d*. *a* Left valve seen from side, *b* from above, *c* from below, *d* from front. Magnified 40 diameters.]

67. *Cythere dictyon*, n. sp. (Pl. XXIV. fig. 1, *a–y*).

Shell of the female, seen from the side, oblong, subquadrangular, not much higher in front than behind; height equal to more than half the length; anterior extremity well rounded, fringed below the middle with numerous short teeth; posterior subtruncated, scarcely rounded, irregularly toothed on the lower half; the dorsal margin slopes gently from before backwards, and is always, in adult specimens, more or less irregularly jagged, while in some cases (figs. *j* and *v*) the indentations are remarkably deep; ventral margin more or less convex; seen from above, the outline is lozenge-shaped or somewhat hastate, about twice as long as broad, sides subparallel or converging gently towards the front, extremities broad and truncated; end view subtriangular, with convex margins and rounded angles. Shell-surface covered with an irregular network of ribs, the main lines of which have often an obscurely radiate arrangement, originating in an obsolete central tubercle; just within and parallel with the ventral margin is a prominent, sharply-cut ridge, which is often produced behind the middle of the valve into a strong spine, but is continued in a less prominent style round the anterior and posterior portions of the shell, thus enclosing an elevated central area. The shell of the male is shown at figures *e–g*, and has usually a more strongly developed spinous armature than is seen in the female. Length, 1-25th of an inch (1 mm.).

I have thought it desirable to figure more copiously than usual some of the more remarkable forms, as well as various stages of growth, of this widely-distributed and variable species. Many intermediate varieties might have been added to those given in the plate, but a careful examination of these figures will, I think, be sufficient to show pretty conclusively the unity of the series. The ventral ridge is conspicuous even in the very youngest shells (*r–u*), and in these the surface-ornament, though much more delicate than in the adult, is sufficiently obvious; this character becomes increasingly distinct with the age of the animal, until in what appear to be the very oldest examples (*j*, *v*) the reticulations have become very massive and rounded by constant depositions of calcareous substance, while the intervening fossæ are proportionally deepened. It is not uncommon to find the sculptured ornament of Ostracoda filled up and partly obliterated in old age; possibly this might be the case in still older specimens of *Cythere dictyon* than those which have come under my observation, but at present I have seen no trace of the obliterating process in this species. The tapering form of the valves in the earlier stages of growth is plainly shown in the plate, as also the absence or comparative feebleness of spinous armature. The adult varieties do not call for much remark; the spinous termination of the ventral ridge is seen in figures *f*, *g*, and *i*, and a marked difference of contour is apparent in the dorsal views (*b*, *i*); this may perhaps be dependent on growth, or possibly on distinction of race. I long hesitated as to whether or not the forms shown in figures *j* and *v* should be considered to belong to *Cythere dictyon*. The chief points of divergence are the very convex ventral margin, the contracted and strongly-indented dorsum, and (in figure *v*) the marked projection of the infero-posteal angle; I believe, however, that these conditions are mere exaggerations of characters which belong to the species, and which may be found developed with variable degrees of distinctness in different examples.

Cythere dictyon occurred in a great number of the Challenger dredgings,—mostly in those from deep water,—in some of which it was the most abundant species. The following is a list of the localities :—

Off Culebra Island, West Indies, . . .	390 fathoms,	Station 24
Lat. 35° 35′ N., long. 50° 27′ W., . .	2750 „	„ 64
„ 38° 30′ N., „ 31° 14′ W., . .	1000 „	„ 73
„ 38° 25′ N., „ 35° 50′ W., . .	1675 „	„ 70
„ 38° 37′ N., „ 28° 30′ W., . .	450 „	„ 75
„ 37° 34′ N., „ 25° 13′ W., . .	1000 „	„ 76
„ 37° 24′ N., „ 25° 13′ W., . .	1000 „	„ 78
„ 8° 37′ S., „ 34° 28′ W., . .	675 „	„ 120
„ 9° 5′ S., „ 34° 49′ W., . .	350 „	„ 122
„ 46° 46′ S., „ 45° 31′ E., . .	1375 „	„ 146
„ 52° 4′ S., „ 71° 22′ E., . .	150 „	„ 150
Off Sydney, New South Wales, . . .	410 „	„ 164*a*
Lat. 5° 26′ S., long. 133° 19′ E., . . .	580 „	„ 191*a*
Humboldt Bay, Papua, ...	37 „	...
Lat. 2° 33′ S., long. 144° 4′ E., . .	1070 „	„ 218
„ 7° 45′ N., „ 144° 20′ E., . .	1850 „	„ 224
„ 36° 10′ N., „ 178° 0′ S., . .	2050 „	„ 246
„ 18° 40′ S., „ 149° 52′ W., . .	1940 „	„ 280
„ 38° 6′ S., „ 88° 2′ W., .	1825 „	„ 296
„ 33° 42′ S., „ 78° 18′ W., . .	1375 „	„ 300

Lat. 42° 43′ S., long. 82° 11′ W.,	. .	1450 fathoms,	Station 302
„ 47° 48′ S., „ 74° 48′ W.,	. .	120 „	„ 305
„ 50° 10′ S., „ 74° 42′ W.,	. .	175 „	„ 308
„ 37° 29′ S., „ 27° 31′ W.,	. .	2220 „	„ 332
, 32° 24′ S., „ 13° 5′ W.,	. .	1425 „	„ 335

The species is evidently ubiquitous, or nearly so, in the deep sea, the foregoing list of localities extending over the North and South Atlantic, the Indian, and Pacific Oceans; in very shallow water it is uniformly wanting, the smallest depth in its list of habitats being 120 fathoms, while the greater number of the dredgings in which it occurs range from 1000 to 2000 fathoms.

[Pl. XXIV. fig. 1, *a–y*. Figures *a–d* are drawn from a female shell, and *e–g* from a male of the common type; figures *h, i* show a variety of the female with well-developed posterior spines (Station 280); figures *j, k* are from valves of a different type (Station 296); figures *v–y* are drawn from a very strongly-sculptured specimen of extreme type (Station 191*a*); the figures from *l* to *u* exhibit various stages of growth, and are from Station 300. All magnified 40 diameters, except *v–y*, which are × 50.]

68. *Cythere arata*, n. sp. (Pl. XXIV. fig. 2, *a–c*).

Valves, seen from the side, subquadrangular, equal in height throughout; anterior extremity obliquely rounded, and bearing numerous short marginal teeth; posterior subtruncate, irregularly spinous, sloping steeply forwards above the middle to its upper termination, where it is strongly angulated and bears a prominent spine; dorsal margin more or less sinuated and dentate, ventral slightly convex, and forming a sharp ridge which ends posteriorly in a strong spine; seen from above, the margin of the valve forms a tolerably regular curve, and is widest behind the middle where there is a conspicuous spine. Shell-surface marked with minute scattered puncta, in the middle with several transverse furrows, within the ventral and anterior margins with a number of irregular deep fossæ. Length, 1-24th of an inch (1·05 mm.).

A few valves only of this species were found in a dredging from a depth of 150 fathoms, lat. 39° 32′ S., long. 171° 48′ E. (Station 167). Though more angular in outline than any examples of *Cythere dictyon* which I have yet seen, it yet closely approaches that species; but the style of surface ornament is entirely different, both from *Cythere dictyon*, and, so far as I know, from all other species.

[Pl. XXIV. fig. 2, *a–c*. *a* Left valve seen from side, *b* from above, *c* right valve seen from side. Magnified 40 diameters.]

69. *Cythere normani*, G. S. Brady (Pl. XVII. fig. 3, *a–d*, and (?) Pl. XXVI. fig. 4, *a*, *b*).

Cythere normani, Brady, Trans. Zool. Soc., 1865, vol. v. p. 379, pl. lxi. fig. 5, *a–d*.

Valves, seen laterally, trapezoidal, slightly higher in front than behind, height equal to rather more than half the length; anterior extremity obliquely rounded and usually more or less beset with short spines; posterior obliquely truncated, only slightly curved, more or less spinous; dorsal margin gently arcuated and irregularly indented, ventral convex much longer than the dorsal margin owing to the obliquity of the extremities; seen from above the valves are widest behind the middle, thence tapering with a gentle curve toward the front, abruptly backwards, and prominently angular at the widest point. The surface of the shell is sculptured with deep, irregularly-shaped cavities of considerable size. Length, 1-30th of an inch (·8 mm.).

A few detached valves only found in a dredging from lat. 52° 4′ S., long. 71° 22′ E., 150 fathoms (Station 150), and doubtfully at Station 296. These valves differ from the type specimen in having a much rougher and more irregular style of shell-sculpture, but in general shape and character agree closely with it. The peculiarity of sculpture may very probably depend on the age of the specimens.

[Pl. XVII. fig. 3, *a–d*. *a*, *b* Right valve seen from side, *c* from above, *d* from front. Magnified 50 diameters. Pl. XXVI. fig. 4, *a*, *b*. These figures are doubtfully referred to *Cythere normani*.]

70. *Cythere radula*, n. sp. (Pl. XIX. fig. 4, *a*, *b*).

Valves, seen laterally, oblong, quadrangular, higher in front than behind, the greatest height equal to more than half the length; anterior extremity well rounded, posterior narrowed and obliquely truncated; dorsal margin almost straight, but indented at intervals, ventral convex; the whole circumference, except on the dorsum, is broken with strong, irregularly disposed spines of variable shape, but mostly short, acuminate, and wide at the base; seen from above the lateral margin is curved, widest behind the middle, extremities obtusely rounded. The surface of the shell is very rough, covered with a coarse net-work of ribbed sculpture, enclosing angular areolæ, at the intersections of which are occasional spines or tubercles. Length, 1-30th of an inch (·85 mm.).

A single valve of this species was found in a dredging from off the Ki Islands, 580 fathoms, Station 191*a*. It is not unlike Bosquet's *Cythere arachnoidea*, but wants the regularity of sculpture, and especially the longitudinal rib-work belonging to that species.

[Pl. XIX. fig. 4, *a*, *b*. *a* Left valve seen from side, *b* the same from above. Magnified 50 diameters.]

71. *Cythere dorsoserrata*, n. sp. (Pl. XXIII. fig. 1, *a–d*).

Shell compressed, oblong; seen from the side, subovate, greatest height in front, and equal to half the length; anterior extremity broad, well rounded, posterior narrowed and produced in the middle to a sharp point; dorsal margin gently sloping backwards, and finely serrated or dentated throughout the greater part of its course, ventral gently sinuated in the middle; seen from above, the outline is narrow and subhastate, with rounded angles, greatest width situated behind the middle, and somewhat less than half the length; from the widest point the sides converge gradually towards the front, but with an abrupt curve backwards, each extremity forming a broad truncated prominence; the margins are throughout profusely and irregularly dentated; end view ovate, tumid, with very convex sides, and strongly-keeled broad base. The surface of the shell is covered thickly with nodular elevations, and the extremities are produced into flanges which are marked with transverse hair-like lines. Length, 1-33d of an inch (·77 mm.).

Dredged north of Tristan d'Acunha in lat. 32° 24′ S., long. 13° 5′ W., 1425 fathoms.

[Pl. XXIII. fig. 1, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

72. *Cythere scabrocuneata*, n. sp. (Pl. XVII. fig. 5, *a–f*, and Pl. XXIII. fig. 2, *a–c*).

Very like *Cythere dorsoserrata*, but more tumid, more nearly ovate in its dorsal aspect, and having all its margins more uneven; seen from the side, the shape of the female shell is that of a long triangle with the apex behind, all the margins, but especially the dorsal, denticulated or jagged, highest in front, the dorsal and ventral margins gently curved and converging equally to the pointed posterior extremity; seen from above, the outline is ovate, twice as long as broad, and widest near the middle, extremities broad and rounded off, lateral margins curved and converging rather more abruptly behind than in front. Shell-surface rough, with prominent nodules and scattered ill-defined ridges. Length, 1-33d of an inch (·77 mm.). The shell of the male is a good deal narrower and longer.

Dredged off East Moncœur Island, Bass' Straits, in 38 to 40 fathoms (Station 162); in the Inland Sea, Japan, lat. 34° 20′ N., long. 133° 35′ E., 15 fathoms (Station 233*b*); and in Wellington Harbour, New Zealand.

The lateral aspect of the specimens referred to *Cythere scabrocuneata* is so closely similar to that of *Cythere dorsoserrata* as to lead to the suspicion that the two forms may be specifically identical. And still more doubt may be entertained as to the proper position of the valves figured in Pl. XXIII. fig. 2, *a–c*, which I consider for the present as a variety of *Cythere scabrocuneata*. This is one of the numerous cases in which further observation on a more extensive series of specimens is required before a satisfactory decision can be arrived at.

[Pl. XVII. fig. 5, *a–f*. *a* Shell of female seen from left side, *b* from above, *c* from below, *d* from front, *e* male seen from left side, *f* from above; Pl. XXIII. fig. 2, *a–c*, *a*, left valve (variety) from side, *b* left valve (variety) from side, *c* the same from above. All magnified 50 diameters.]

73. *Cythere tetrica*, n. sp. (Pl. XXIII. fig. 5, *a–d*).

Carapace, seen from the side, oblong, subovate, greatest height near the front, and equal to half the length; anterior extremity rounded and divided into numerous small crenulations; posterior subtruncated, slightly jagged, rounded off at the angles; dorsal margin sloping gently from the front and broken up by numerous irregular indentations; ventral nearly straight; seen from above, the outline is ovate, more than twice as long as broad, with gently curved subparallel sides, and broadly rounded extremities, the margins throughout very much broken; end view irregularly ovate, with a lateral tuberosity on each side above the middle. The surface of the shell is thickly covered with large nodules of irregular size and shape, and has an irregular longitudinal ridge just within the ventral margin. Length, 1-45th of an inch (·53 min.).

Dredged off Booby Island, lat. 10° 36′ S., long. 141° 55′ E., 6 to 8 fathoms (Station 187).

[Pl. XXIII. fig. 5, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

74. *Cythere acanthoderma*, n. sp. (Pl. XVIII. fig. 5, *a–e*).

Shell oblong, subovate, tumid, covered everywhere with more or less strongly-developed, very irregular, blunt and ragged spines; seen from the side, the valves are subovate or somewhat pear-shaped, highest near the front, the height being equal to nearly two-thirds of the length; anterior extremity well rounded, posterior produced in the middle; dorsal margin sloping backwards and very much laciniated, ventral slightly convex; seen from above, the outline is subovate, not twice as long as broad, widest near the middle; sides curved, converging gradually towards the front and abruptly behind; extremities wide and truncated; the end view is subtriangular, equilateral, with convex sides and rounded angles; the margins of the shell, from whatever aspect it is viewed, are excessively rugged, and the spines with which it is everywhere thickly beset have a tendency to enlarge at their apices, often becoming bifurcate or even trifurcate; in this character it differs very remarkably from the next species (*Cythere dasyderma*), in which the spines never take on any development of this nature. *Cythere acanthoderma* occurred in moderate numbers in several of the Challenger dredgings:—

Lat. 35° 35′ N., long. 50° 27′ W.,	. .	2750 fathoms,	Station 64
,, 38° 30′ N., ,, 31° 14′ W.,	. .	1000 ,,	,, 73
,, 46° 46′ S., ,, 45° 31′ E.,	. .	1375 ,,	,, 146
,, 5° 26′ S., ,, 133° 19′ E.,	. .	580 ,,	,, 191*a*
,, 36° 10′ N., ,, 178° 0′ E.,	. .	2050 ,,	,, 246
,, 38° 6′ S., ,, 88° 2′ W.,	. .	1825 ,,	,, 296
,, 42° 43′ S., ,, 82° 11′ W.,	. .	1450 ,,	,, 302

Like *Cythere dictyon* and *Cythere dasyderma* this species seems to be cosmopolitan in its range over the deep sea-bed, and like them also to be confined to great depths, the shallowest reading in the foregoing list being 580 fathoms.

[Pl. XVIII. fig. 5, *a–e*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. All magnified 50 diameters. *e* Right valve, magnified 40 diameters.]

75. *Cythere dasyderma*, n. sp. (Pl. XVII. fig. 4, *a–f*, and Pl. XVIII. fig. 4, *a–f*).

Carapace tumid, ovate; seen from the side, oblong, subovate or subquadrangular; greatest height situated near the front, and equal to about two-thirds of the length; anterior extremity boldly rounded, posterior narrower, rounded or subtruncate; dorsal margin sloping gently backwards from the front, which is elevated over the hinge-joint; ventral margin slightly convex; the entire circumference broken into closely-set, but short and blunt teeth; seen from above, the outline is ovate, widest near the middle, about twice as long as broad, lateral margins gently and evenly curved, extremities broad and nearly equal, obtusely rounded or truncated; end view broadly ovate, rounded off above, broad and centrally emarginate below. Shell-surface covered with closely-packed, rather small, angular excavations, from the intervals between which arise numberless (usually short and blunt) spines, the shell in every aspect presenting a rough appearance. Length, 1-40th to 1-28th of an inch (·65 to ·9 mm.).

Like *Cythere dictyon* and *Cythere acanthoderma*, this species seems to occur in all the deep places of the sea. The following list embraces all the dredgings in which I have noticed it :—

Lat. 24° 20′ N.,	long. 24° 28′ W.,	. .	2740 fathoms,	Station	5
„ 38° 25′ N.,	„ 35° 50′ W.,	. .	1675 „	„	70
„ 28° 42′ N.,	„ 18° 6′ W.,	. .	1125 „	„	85
„ 9° 5′ S.,	„ 34° 49′ W.,	. .	350 „	„	122
„ 46° 46′ S.,	„ 45° 31′ E.,	. .	1375 „	„	146
„ 34° 13′ S.,	„ 151° 38′ E.,	. .	410 „	„	164*a*
„ 39° 32′ S.,	„ 171° 48′ E.,	. .	150 „	„	167
„ 11° 35′ S.,	„ 144° 3′ E.,	. .	155 „	„	185
„ 5° 26′ S.,	„ 133° 19′ E.,	. .	580 „	„	191*a*
„ 2° 33′ S.,	„ 144° 4′ E.,	. .	1070 „	„	218
„ 36° 10′ N.,	„ 178° 0′ E.,	. .	2050 „	„	246
„ 38° 6′ S.,	„ 88° 2′ W.,	. .	1825 „	„	296
„ 33° 42′ S.,	„ 78° 18′ W.,	. .	1375 „	„	300
„ 42° 43′ S.,	„ 82° 11′ W.,	. .	1450 „	„	302
„	„		160 „	„	305 (?)
„ 52° 50′ S.,	„ 73° 53′ W.,	. .	245 „	„	311
„ 48° 37′ S.,	„ 55° 17′ W.,	. .	1035 „	„	317
„ 37° 29′ S.,	„ 27° 31′ W.,	. .	2200 „	„	332
„ 32° 24′ S.,	„ 13° 5′ W.,	. .	1425 „	„	335
„ 2° 42′ S.,	„ 14° 41′ W.,	. .	2350 „	„	346

[Pl. XVII. fig. 4, *a–f*. Figures *a–d* are drawn from a specimen from Station No. 317

(magnified 50 diameters), *e, f* from Station No. 122 (magnified 60 diameters); Pl. XVIII. fig. 4, *a–f*, figures *a–d*, from Station No. 246, *e, f*, from Station 300 (magnified 50 diameters).]

76. *Cythere circumdentata*, n. sp. (Pl. XXVI. fig. 2, *a–c*).

Valves, seen laterally, oblong, subquadrangular, rather higher in front than behind, height equal to half the length; anterior extremity well rounded posterior rounded below, angular at its junction with the dorsal margin; dorsal margin straight, ventral sinuated in the middle, the whole circumference of the shell strongly but irregularly dentated. The outline, as seen from above, is exactly similar to that of *Cythere dasyderma*. Surface of the valves beset with deep polygonal fossæ, and round the marginal portions with numerous short spines. Length, 1-24th of an inch (1·05 mm.).

This comes very close to *Cythere dasyderma*, and may, perhaps, be but an extreme form of that species; it is, however, somewhat larger, more oblong in shape, has a surface sculpture composed of larger pits, and is only sparingly spiniferous, except near the margins. Detached valves were found in two dredgings only; in lat. 36° 10′ N., long. 178° 0′ E., 2050 fathoms (Station 246), and in lat. 13° 28′ S., long. 149° 30′ W., 2350 fathoms (Station 276).

[Pl. XXVI. fig. 2, *a–c*. *a* Left valve (Station 276) seen from outside, *b* the same from above, *c* left valve (Station 246) seen from above. All magnified 40 diameters.]

77. *Cythere suhmi*, n. sp. (Pl. XXVI. fig. 3, *a–h*).

Carapace of the female, seen from the side, subquadrangular, scarcely higher in front than behind, height equal to nearly two-thirds of the length; extremities rounded and beset, somewhat sparingly, with spines of irregular length; dorsal and ventral margins nearly straight, the former irregularly indented and spinous; seen from above, the shell is about twice as long as broad, widest in the middle, the lateral margins extremely convex, converging with a gentle curve towards the front, but very abruptly behind, the extremities forming very large and broad, truncated prominences, armed with divergent terminal spines; the hinder portion of the central mass bears also several stout backward-pointing spines; end view irregularly five-sided; the elevated central portion of the valves is limited in front and behind by a flattened zone which forms, when seen from the dorsal or ventral surfaces, two strong terminal projections, the margins (except the ventral) are irregularly spinous and the general surface is vaguely undulated. Length, 1-24th of an inch (1·95 mm.).

Only one perfect specimen and a few separated valves of this fine species have been seen. These occurred in a dredging from lat 35° 41′ N., long. 157° 42′ E.; 2300 fathoms (Station 241), and off Prince Edward's Island, 50 to 150 fathoms. The valves figured at 4, *a*, *b*, which at one time I took to belong to *Cythere suhmi* probably belong to some other species, perhaps to *Cythere normani;* they were dredged at Station 296. The species is named after M. Von Willemoes Suhm, whose death during the voyage of the Challenger was an irreparable loss not only to the Expedition but to zoological science in general.

[Pl. XXVI. fig. 3, *a–h*. *a* Shell of female (Station 241) seen from left side, *b* from above, *c* from below, *d* from front,—magnified 40 diameters; *e–h* left valve of immature male probably (Prince Edward's Island),—magnified 50 diameters.]

78. *Cythere irpex*, n. sp. (Pl. XVII. fig. 2, *a–d*).

Valves, seen from the side, subquadrangular, rather higher in front than behind, greatest height equal to nearly two-thirds of the length; anterior extremity boldly and evenly rounded, posterior narrower, truncate, very slightly rounded, obscurely angular both above and below; dorsal margin sloping gently, almost in a straight line from the front, ventral slightly convex; seen from above, the sides of the valve form a continuous curve from end to end and are widest in the middle, extremities produced and obtusely rounded. The right valve is less angular in outline than the left. Surface of the shell uneven and covered closely with small stout spines, which are arranged in more or less distinctly concentric rows; on the ventral surface the spines coalesce, forming a longitudinal rib-work; the margins of the shell are uniformly dentated, the teeth being strongest on the anterior and dorsal regions. Length, 1-25th of an inch (1 mm.).

This is a deep-sea species, and occurred in three dredgings: lat. 38° 30′ N., long. 31° 14′ W., 1000 fathoms (Station 73); lat. 37° 34′ N., long. 25° 13′ W., 1000 fathoms (Station 78); lat. 32° 24′ S., long. 13° 5′ W., 1425 fathoms (Station 335).

[Pl. XVII. fig. 2, *a–d*. *a* Left valve seen from side, *b* from above, *c* from below, *d* right valve seen from side. Magnified 50 diameters.]

79. *Cythere ericea*, n. sp. (Pl. XVII. fig. 1, *a–d*).

Valves, seen from the side, quadrate, equal in height before and behind, sculptured with numerous but not very large rounded excavations, and thickly beset with long circular spines; anterior extremity rounded off, posterior truncated, well-rounded below, but only slightly at the upper angle, height equal to two-thirds of the length; seen from above the outline is ovate, evenly curved, widest behind the middle, tapering gradually towards the front but more rapidly behind. Length, 1-25th of an inch (1 mm.).

This species has been seen only in one dredging., from lat. 8° 37′ S., long 34° 28′ W., 675 fathoms. The valve shown at figure *d* is totally denuded of spines, no doubt by abrasion, and it is certain that in perfect condition the shell would be much more profusely spined than is represented even in figure *a*.

[Pl. XVII. fig. 1, *a–d*. *c* Left valve seen from side, *b* from above, *c* from front, *d* left valve (another example) denuded of spines. All magnified 50 diameters.]

80. *Cythere melobesioides*, G. S. Brady (Pl. XVIII. fig. 1, *a–g*).

Cythere melobesioides, Brady, Les Fonds de la Mer, tom. i. p. 162, pl. xix. figs. 10, 11.
Cythere nodulifera, Brady, Les Fonds de la Mer, tom. i. p. 163, pl. xix. figs. 24, 25.

Shell, seen from the side, oblong; height equal to half the length, the same before and behind; anterior extremity well rounded, posterior oblique, only slightly rounded; dorsal and ventral margins straight, the former much the shorter of the two owing to the obliquity of the extremities; seen from above the outline is compressed, oval, twice as long as broad, widest about the middle, sides nearly parallel, and converging rather suddenly to the extremities which are equal and broadly rounded; end view subcircular; shell-surface everywhere rough with small subspinous nodules, from which structure the margins of the shell in every aspect appear minutely dentated. Length, 1-35th of an inch (·75 mm.).

The foregoing description applies to the example shown in figures *a–d*, but not quite accurately to *e–g*, which latter specimen shows some rather important differences chiefly in the lateral contour. Still it seems best for the present to consider both as belonging to the same species; possibly the differences may be sexual. Figures *a–d* are drawn from one of a series dredged off Booby Island in a depth of 6 to 8 fathoms (Station 187), figures *e–g* from a single valve; the latter agrees more closely than the other with the specimens from Mauritius described in "Les Fonds de la Mer."

[Pl. XVIII. fig. 1, *a–g*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front, *e* left valve (variety) seen from side, *f* from above, *g* from front. Magnified 50 diameters.]

81. *Cythere irrorata*, n. sp. (Pl. XVIII. fig. 2, *a–d*).

Shell oblong, tumid; seen from the side, subquadrangular, nearly equal in height throughout, height equal to at least half the length; anterior extremity rounded off above and below, posterior oblique, truncated, scarcely rounded, provided with a row of five or six small blunt teeth below the middle; dorsal margin very slightly arched, ending behind in a prominent angle; ventral margin nearly straight, but finely crenulated, as is also the front of the shell; seen from above, the outline is irregularly six-sided, nearly twice as long as broad; sides straight and parallel in the middle, converging suddenly in front, and terminating in a broadly-rounded extremity,—behind the middle, converging abruptly at a right angle, and then running obliquely backwards, and terminating much as in front; end view triangular, with very convex sides and rounded angles. The surface of the shell is closely covered with small irregularly rounded nodules and flexuous grooves. Length, 1-42d of an inch (·6 mm.).

This species was found only in one dredging from near the Admiralty Islands in a depth of 16 to 25 fathoms.

[Pl. XVIII. fig. 2, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

82. *Cythere scutigera*, G. S. Brady (Pl. XXII. fig. 5, *a–f*).

Cythere scutigera, Brady, Les Fonds de la Mer, tom. i. p. 70, pl. viii. figs. 15, 16.

Shell of the female, seen from the side, oblong, subquadrangular, scarcely higher in front than behind, height equal to half the length; anterior extremity rounded, and divided below the middle into a number of short and stout blunt teeth; posterior extremity obliquely rounded, the lower angle rounded off; dorsal margin sloping slightly backwards, and broken by numerous large strong spines; ventral margin almost straight; seen from above, irregularly ovate, twice as long as broad, the margins very irregular and broken, extremities equal, broad and truncated; end view irregularly hexagonal, width and height equal. The male is much more elongated and slender, as well as more sharply spinous. The valves are armed with several large shield-like circular bosses which are more or less spinous at the summit, and the rest of the surface is closely beset with spines or spiniferous tubercles. Length, 1-48th to 1-24th of an inch (·52 to 1·1 mm.).

Specimens which I take to belong to *Cythere scutigera* were dredged in several places, all, however, in the Eastern Archipelago, Amboyna, 15 to 20 fathoms (Station 163); in lat. 39° 32′ S., long. 171° 48′ E., 150 fathoms (Station 167); in Humboldt Bay, Papua, 37 fathoms; and in lat. 33° 42′ S., long. 78° 18′ W., 1375 fathoms (Station 300).

The type specimens described in Les Fonds de la Mer, and taken off the north of Java, are much more strongly marked in their spinous armature than any of those found in the Challenger dredgings, but the general character of the shells is closely similar.

[Pl. XX. fig. 5, *a–f*. *a* Left valve of male (Amboyna) seen from side, *b* from above (both magnified 40 diameters); *c* shell of female (Station 167), seen from left side, *d* from above, *e* from below, *f* from front (magnified 50 diameters).]

83. *Cythere clavigera*, n. sp. (Pl. XXIII. fig. 7, *a–d*).

Cythere subcoronata, Brady, Trans. Zool. Soc., vol. v. p. 384, pl. lx. fig. 9, *a–e*.

Shell, seen from the side, ovate, oblong, greatest height situated in front of the middle, and equal to half the length; anterior extremity boldly rounded, completely bordered with a series of short and broad blunt spines, posterior extremity narrower, and likewise beset with spines, much longer and stronger than those of the front; dorsal margin sloping rather steeply backwards, and broken by a series of five or six spines of irregular size, one conspicuous spine just behind the anterior hinge-tubercle; the dorsal margin is nearly straight, but is also broken by continuous and irregular tooth-like projections; seen from above the outline is compressed, ovate, more than twice as long as broad, and having its greatest width in the middle; extremities broadly truncated, the whole outline much broken and spinous; end view irregularly hexagonal, much higher than broad. The middle of each valve bears an irregularly lacinated longitudinal ridge, from which the surface slopes away in an undulating curve to the dorsal and ventral margins, the curved surface being more or less tuberculated or spinous; within the anterior and ventral margins runs a plaited or dentated ridge; and the whole circumference bears rows of spines as before described. Length, 1-33d of an inch (·77 mm.).

This species was found only in a dredging from a depth of 2 to 10 fathoms at Port Jackson, Australia. It is either identical with, or very nearly allied to, a form found in the Mediterranean, and previously assigned by me to *Cythere subcoronata*, Speyer, but which I now think to be distinct from that species. And it is just possible that an Australian species described in the same memoir (*Cythereis militaris*) may represent a very young form of *Cythere clavigera.*

[Pl. XXIII. fig. 7, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. All magnified 50 diameters.]

84. *Cythere squalidentata*, n. sp. (Pl. XXIII. fig. 8, *a–d*).

Shell tumid behind, compressed in front; seen from the side much higher in front than behind, the greatest height equal to two-thirds of the length; anterior extremity broad and boldly rounded, posterior narrow and truncated; dorsal margin sloping steeply backwards, and bearing on each valve a series of four long curved slender spines, arranged one behind another, the hindermost being the longest; ventral margin nearly straight; seen from above the shell is broadly club-shaped, the greatest width equal to more than half the length, and situated behind the middle; at this point the sides are very protuberant, running forwards towards the front in a sinuous line, and backwards with a full curve, from the middle of which, on each valve, springs a strong spine pointing obliquely backwards and outwards; the anterior extremity is truncated, and has a deep central emargination; the posterior broadly rounded and dentate; end view irregular, with strongly jagged margins. Surface of the shell very irregularly undulated and finely punctate, length, 1-70th of an inch (·38 mm.).

One specimen only was found in a dredging from Station 323, lat. 35° 39′ S., long. 50° 47′ W., 1900 fathoms.

[Pl. XXIII. fig. 8, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 80 diameters.]

85. *Cythere tricristata*, n. sp. (Pl. XXIII. fig. 6, *a–d*).

Seen from the side, the shell is quadrangular, highest near the front, the height at that point being equal to more than half the length; anterior extremity broadly rounded, posterior narrow and truncated; dorsal margin sloping rather steeply backwards, ventral nearly straight, the entire circumference broken into broad, blunt tooth-like processes of no great length, but fewer and more prominent on the dorsal margin; the posterior dorsal angle has one spine somewhat larger and more conspicuous than the rest; seen from above, the outline is very irregular, consisting of a central mass which has on each side a deep median indentation, and of two broad truncated terminal portions; seen endwise, it is likewise of irregular form, having two strongly-developed lateral protuberances projecting from a broad central portion. The central mass of the shell is bounded on all sides, except the dorsal, by a transversely corrugated encircling zone, the edges of which are irregularly dentated; and on the sides of the valves, placed one behind another, in the middle line are three short strongly-elevated crests, each of which is divided into three or four tooth-like segments. Length, 1-40th of an inch (·65 mm.).

Dredged at Port Jackson, 2 to 10 fathoms, and in 16 to 25 fathoms off the Admiralty Islands.

[Pl. XXIII. fig. 6, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. All magnified 50 diameters.]

86. *Cythere velivola*, n. sp. (Pl. XXIII. fig. 4, *a–c*).

Valves, seen laterally, oblong, much higher in front than behind, height equal to two-thirds of the length; anterior extremity broadly rounded, divided into numerous broad, blunt squamous teeth of various sizes; posterior extremely narrow, rounded, and bearing four or five thick, gnarled teeth, those at the ventral angle being longer than the rest; dorsal margin cut up into several broad squamous processes, and bearing at its posterior angle a very long and stout curved spine; the ventral margin is nearly straight, and in the middle third of its course is produced laterally, forming a very strongly projecting alæform plate; seen from above, the outline is excessively compressed and almost linear, except in the middle, where the lateral ala forms a remarkable angular projection. The general surface of the valves is much depressed and sinks towards the extremities, forming a sort of trough, which is bounded externally by a somewhat elevated and irregularly lacinated belt; the central area is slightly undulated, and bears a few scattered circular papillæ. Length, 1-40th of an inch (·65 mm.).

A few detached valves of this remarkable little species were found in a dredging from Station 189, lat. 9° 59′ S., long. 137° 50′ E., 28 fathoms.

[Pl. XXIII, fig. 4, *a–c*. *a* Left valve seen from side, *b* right valve seen from side, *c* left valve seen from below. Magnified 60 diameters.]

Cytheridea, Bosquet.

Cytheridea, Bosquet, Entom. fossil. des Terres tertiair. (1850).

Valves unequal, the left mostly larger than the right, ovate or subtriangular, highest in front; surface smooth, or marked with scattered circular tubercles, impressed puncta or concentric furrows; anterior extremity rarely spinous, posterior sometimes armed with a spine at the lower angle. Muscle spots arranged in a transverse row of three or four, with two detached (sometimes coalescent) spots in front. Hinges composed of two crenulated crests on the left (occasionally the right) valve, which articulate with corresponding depressions of the opposite valve. Anterior antennæ very robust, mostly five-jointed, and bearing strong spines, last joint narrow and elongated; posterior antennæ four-jointed, urticating setæ long and slender, bi-articulate. Mandibles large and numerously toothed; palp three-jointed, and bearing a distinct branchial appendage. The right foot of the first and second pairs in the male different from the rest, that of the first pair very strong and prehensile; of the second very feeble, the apical portion rudimentary and destitute of a terminal claw. Eyes distinct.

Certain species of this genus are amongst the most abundant of European Ostracoda, and several have been described from distant parts of the world, while in the Tertiary epoch the genus seems to have been at least equally abundant. The almost complete absence of this group from the Challenger dredgings is, therefore, very remarkable, nor do I see any reasonable way of accounting for it except on the supposition that these animals prefer shallower waters than those to which the work of the Challenger was almost exclusively confined. At any rate, the only example found amongst these dredgings is—

Cytheridea spinulosa, G. S. Brady (Pl. XXXIII. fig. 6, *a–d*).

Cytheridea spinulosa, Brady, Ann. and Mag. Nat. Hist., ser. 4, vol. ii. p. 182, pl. xiii. figs. 1–6.

Carapace, seen from the side, subquadrangular, oblong, not much higher in front than behind, height equal to rather more than half the length; anterior extremity moderately well rounded, posterior scarcely rounded, subtruncate; dorsal margin sloping gently and almost in a right line from before backwards, ventral straight; seen from above, the outline is subcuneiform, being widest at the posterior extremity, width and height nearly equal; the lateral margins converge gradually towards the front, which is wide, obtuse, and scarcely pointed in the middle, hinder extremity subtruncate, convex, and mucronate in the middle; end view nearly circular. Shell-surface beset with closely-set, large circular pittings, fringed on the anterior and front of the inferior margin with numerous short teeth, and below the middle of the posterior extremity with a smaller number (usually six or eight) of larger and unequal teeth. Length, 1-45th of an inch (·54 mm.).

Cytheridea spinulosa was found only in a dredging from a depth of 15 to 20 fathoms at Amboyna, and in a sounding made in 420 fathoms (October 20, 1875, near Station 287). The type specimens were found at Mauritius.

[Pl. XXXIII. fig. 6, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

Krithe, Brady, Crosskey, and Robertson.

Ilyobates, G. O. Sars, Oversigt af Norges marine Ostracoder, 1865.
Krithe, Brady, Crosskey, and Robertson, Post-Tertiary Entomostraca of Scotland, &c., 1874.

Valves thin and (except in old age) pellucid, subovate, truncate behind, smooth, polished, and set with very small distant circular papillæ. Hinge-joint simple, formed by a slight projection of the left valve, which is received into a corresponding depression of the right. Anterior antennæ very stout, five-jointed, the first two joints much thickened, the rest short and bearing long curved spines; posterior antennæ four-jointed. Mandibles small, with unusually long slender teeth; palp three-jointed, the second joint elongated, branchial appendage having one rudimentary and two long ciliated setæ. Maxillæ of the usual form. Feet very short, the first two pairs three-jointed, last pair four-jointed; "right foot of the last pair, in the male, prehensile and only three-jointed, terminal claw very large and strong. Abdomen of the female very convex above, the post-abdominal lobes bearing two short hairs." Eyes wanting.

The members of this genus are at once recognisable by their smooth, ovate outline and sharply truncated posterior extremity. Though widely distributed, the number of specific forms does not appear to be large, and amongst fossil species I know of none which can with certainty be referred here except *Bairdia pernoides* and *Bairdia lævissima*, Bornemann,[1] and two British Tertiary and Post-Tertiary species, *Krithe bartonensis* (Jones), and *Krithe glacialis* (B., C., and R.), the first-named of which occurs also plentifully living in the British and Scandinavian seas.

The generic name *Krithe* was proposed on account of the preoccupation of the word *Ilyobates,* applied by Sars to these animals in 1865. The anatomical details given in the foregoing description are taken almost entirely from Sars' statement. I have myself had scarcely any opportunity of examining the living animals.

1. *Krithe bartonensis,* Jones (Pl. XXVII. fig. 2, *a–d*).

Cytherideis bartonensis, Jones, Monog. Tert. Entom., p. 50, pl. v. figs. 2, *a*, *b*; 3, *a*, *b* (1856).
Ilyobates pretexta, G. O. Sars, Oversigt Norges Mar. Ostrac., p. 60 (1865).
Ilyobates bartonensis, Brady, Monog. Rec. Brit. Ostrac., p. 432, pl. xxxiv. figs. 11–14, pl. xl. fig. 5 (1868).
Krithe bartonensis, Brady, Crosskey, and Robertson, Monog. Post-Tertiary Entom., p. 184, pl. ii. figs. 22–26 (1874).

Carapace elongated, subovate, in general outline not unlike a grain of wheat; seen from the side, the shell is oblong and subquadrangular, the height being equal to about one-half of the length and nearly alike at all points; the extremities are nearly equal in height, the anterior evenly rounded, the posterior somewhat flattened, rounded off at its upper, and obscurely angular at its lower, termination; dorsal and ventral margins

[1] Die Mikroskopische Fauna des Septarienthones von Hermsdorf bei Berlin (Zeitschr. d. deutsch. Geol., Ges., 1855).

straight, or very slightly convex and sub-parallel; seen from above, the outline is ovate, tapering with a gentle curve towards the front and more suddenly behind; the anterior extremity is obtusely pointed, the posterior broader and deeply emarginate; width only a little less than the height; end view subcircular. Surface of the shell perfectly smooth and polished, marked sometimes with a few scattered circular papillæ, and in old specimens becoming of an opaque milky or yellowish-white. Length, 1-34th of an inch (·75 mm.).

I have memoranda of the occurrence of this species off Christmas Harbour, Kerguelen Island, in a depth of 120 fathoms (Station 149); and off the Ki Islands, 580 fathoms (Station 191).

2. *Krithe producta*, n. sp. (Pl. XXVII. fig. 1, *a–j*).

Carapace of the female more flexuous and more tumid than that of *Krithe bartonensis;* seen from the side, subreniform; greatest height situated in the middle, and equal to more than half the length; anterior extremity rounded off, posterior oblique, rounded off above and obscurely angulated below; dorsal margin moderately arched, ventral sinuated in the middle; seen from above, ovate, widest in the middle, width equal to half the length, pointed in front; posterior extremity wide, truncate, and centrally emarginate; shell-surface quite smooth, or beset with numerous minute closely-set punctures and a few distant circular tubercles. The shell of the male (figures *e–g*) is much narrower and more elongated, and has its ventral and dorsal margins almost straight. Length, 1-34th of an inch (·75 mm.).

This species is either a cosmopolitan one, and very variable as to shape, or the figures given under its name in Pl. XXVII. fig. 1, *h–j*, which are fairly representative of many different examples, must belong to other undescribed species. I prefer, however, to consider them as forms of *Krithe producta*, the variations observable in a large series of specimens being almost countless, and, as I think, in many cases fairly referable to differences of age, sex, or race. This, however, may be doubted in such a case as that of the valve represented at *j*, which is not only very remarkable in shape, but is also very much larger than the normal forms of *Krithe producta*.

Specimens which, for the present at least, must be held to belong to this species occurred in the following dredgings :—

Lat. 38° 25′ N., long. 35° 50′ W.,	1675	fathoms,	Station 70
„ 38° 11′ N., „ 27° 9′ W.,	900	„	„ 76
„ 28° 42′ N., „ 18° 6′ W.,	1125	„	„ 85
„ 8° 37′ S., „ 34° 28′ W.,	675	„	„ 120
Off North Brazil,	350	„	„ 122
Off Prince Edward's Island,	50–150	„	...
Lat. 46° 46′ S., long. 45° 31′ E.,	1375	„	„ 146
Off Sydney,	410	„	„ 164*a*

Lat. 39° 32′ S., long. 171° 48′ E.,	. .	150 fathoms,	Station 167
„ 19° 10′ S., „ 178° 10′ E.,	. .	610 „	„ 174
„ 38° 6′ S., „ 88° 2′ W.,	. .	1825 „	„ 296
„ 33° 42′ S., „ 78° 18′ W.,	. .	1375 „	„ 300
„ 42° 43′ S., „ 82° 11′ W.,	. .	1450 „	„ 302
„ 47° 48′ S., „ 74° 43′ W.,	. .	160 „	„ 305
„ 50° 10′ S., „ 74° 42′ W.,	. .	175 „	„ 308
„ 52° 50′ S., „ 73° 53′ W.,	. .	245 „	„ 311
„ 32° 24′ S., „ 13° 5′ W.,	. .	1425 „	„ 335

[Pl. XXVII. fig. 1, *a–j*. *a* Carapace of female seen from left side, *b* from above, *c* from below, *d* from front; *e* male seen from left side, *f* from below, *g* from front, *h–j* valves of left side. All magnified 50 diameters.]

3. *Krithe hyalina*, n. sp. (Pl. XXVII. fig. 3, *a–d*).

Carapace, as seen from the side, subovate, higher in front than behind, greatest height situated near the middle, and equal to at least half the length; anterior extremity broadly rounded, posterior narrower and rather oblique, dorsal margin slightly arched, flattened, and sloping somewhat steeply behind the middle, ventral margin nearly straight; seen from above, oblong, ovate, widest in the middle, width equal to scarcely half the length; anterior extremity subacuminate, posterior wider and deeply emarginate; end view subcircular. Shell translucent, polished, marked with a few scattered circular papillæ. Length, 1-52d of an inch (·49 mm.).

The smaller size, more ovate form and posterior depression of the shell, are the characters on which I depend to separate this from other species of the same genus. The only dredging in which I have found it is that from the Inland Sea of Japan, where it occurred in a depth of 15 fathoms on a muddy bottom (Station 233*b*).

[Pl. XXVII. fig. 3, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

4. *Krithe tumida*, n. sp. (Pl. XXVII. fig. 4, *a–d*).

Shell oblong, tumid; seen from the side, subovate, somewhat lower in front than behind, height equal to about two-thirds of the length; anterior extremity rounded off, posterior broader, oblique, and scarcely rounded; dorsal margin very slightly arched, highest near the middle, ventral gently convex; seen from above, the outline is broadly ovate, the greatest width in the middle, and exactly equal to the height; the lateral margins are subparallel until near the two extremities, where in front they converge suddenly forming an acute angular extremity, and behind are broadly rounded off, but show a moderate central indentation; the end view is subcircular, but broadly indented at the ventral margin. Surface of the shell quite smooth. Length, 1-48th of an inch (·51 mm.).

A few specimens only of this species were met with in a dredging from lat. 35° 39′ S., long. 50° 47′ W. Depth, 1900 fathoms.

[Pl. XXVII. fig. 4, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

Loxoconcha, G. O. Sars.

Loxoconcha, Sars, Oversigt, &c., 1865.
Normania, Brady, Trans. Zool. Soc., 1865.

Valves nearly equal, subrhomboidal, mostly flexuous in outline, and evenly convex. Surface smooth, or marked with concentrically arranged impressed puncta, or with polygonal fossæ, often also with minute circular papillæ. Ventral margins usually forming a prominent compressed keel towards the hinder extremity of the shell; postero-superior angle obliquely truncate. There is usually a prominent, shining tubercle over the anterior end of the hinge in each valve. Hinge-joint formed by two small teeth at the extremities of the hinge-line of each valve. Limbs of the animal slender and colourless. Anterior antennæ very slender, six-jointed, the last joint very long, linear, and bearing long, simple setæ; posterior antennæ four-jointed, the third joint long and narrow; flagellum long and biarticulate, mandible-palp three-jointed, bearing a distinct branchial appendage. Lowest seta of the branchial plate of the first pair of jaws deflexed. Feet long and slender, alike in male and female. Abdomen terminated by a hairy conical process; postabdominal lobes bearing two moderately long subequal setæ.

The "peach-stone" or obliquely quadrangular shape, and the bevelled-off postero-superior angle of the shell, are characters usually sufficiently pronounced to distinguish at a glance the members of this genus. The genus is cosmopolitan, and contains even now a considerable number of recent species, to which we may expect further research to add very largely. In gatherings from between tide marks or from very shallow water it will doubtless be found in greatest abundance. One British species, *Loxoconcha elliptica*, occurs only in the brackish water of estuaries and salt-marshes; and another, *Loxoconcha impressa*, has occasionally been found in fresh water altogether out of reach of the sea, and in such cases may probably be looked upon as a relic of some old marine fauna. There can be no doubt that the brackish and subbrackish waters of tropical and equatorial countries will some day yield an abundant and highly-interesting harvest to students of the Entomostraca.

Many fossil species described by authors under various generic terms—*Cythere*, *Cytherina*, *Bairdia*, &c.—belong by rights to *Loxoconcha*.

The difference in shape between males and females is strongly marked, the females being usually tumid, flexuous, and having all their angles, except the postero-superior, well-rounded off; the males more compressed, with a flatter dorsal margin, elongated and angular.

1. *Loxoconcha avellana*, G. S. Brady (Pl. XXVIII. fig. 1, *a–f*).

Normania avellana, Brady, Trans. Zool. Soc., vol. v. (1865), p. 382, pl. lxi. fig. 15, *a–c*.

Carapace of the female, as seen from the side, flexuous, broadly pear-shaped, higher behind than in front, greatest height in the middle, and equal to two-thirds of the length; anterior extremity depressed, rounded, posterior broadly rounded and emarginate at the upper angle; dorsal margin excessively arched, almost gibbous, ventral deeply sinuated in front of the middle; seen from above, the outline is broadly ovate, scarcely twice as long as broad, widest in the middle and tapering evenly to the extremities, which are pointed; end view broadly ovate, obtusely subangular at base and apex, height rather greater than the width. Surface of the shell marked with distant, concentrically arranged circular pits, which on the ventral surface run together so as to form beaded longitudinal grooves. The shell of the male (figures *e, f*) is longer and not so strongly arched dorsally. Length of female, 1-42d of an inch (·6 mm.).

Dredged at Port Jackson, Australia, in a depth of 2 to 10 fathoms; and off Tongatabu, 18 fathoms (Station 172).

The single specimen from which the species was first described was got in the West Indies.

[Pl. XXVIII. fig. 1, *a–f*. *a* Carapace of female seen from left side, *b* from above, *c* from below, *d* from front; *e* male seen from left side, *f* from below. Magnified 50 diameters.]

2. *Loxoconcha honoluliensis*, n. sp. (Pl. XXVIII. fig. 6, *a–f*).

Carapace of the female, seen from the side, flexuous, subrhomboidal, highest behind the middle, height equal to two-thirds of the length, anterior extremity broad and well-rounded, posterior oblique, produced above the middle into a very broad, truncated beak; dorsal margin flattened in front, convex behind; ventral sinuated in front of the middle, strongly convex and keeled behind; seen from above, the outline is lozenge-shaped, widest in the middle, thence tapering without much curve to the extremities which are subacuminate, width equal to more than half the length; end view very broadly ovate. Surface of the shell marked with distant circular punctures, or irregularly reticulated. The shell of the male (figures *a–d*) is, as usual, more compressed and less strongly arcuate dorsally. Length, 1-42d of an inch (·6 mm.).

Dredged in 40 fathoms off the reefs, Honolulu. A very well-marked species, distinctly characterised by the large beak-like projection of the posterior dorsal angle and the very pronounced keeled convexity of the ventral surface. The two forms represented in the plate, besides sexual differences of shape, are somewhat different also in style of shell-sculpture, the one being distinctly reticulated, the other marked merely with distinct circular impressions. Should these characters prove to be constant, we could scarcely consider the two to belong to the same species; but it is not uncommon amongst Ostracoda to find shells strongly sculptured in the earlier stages of life becoming encrusted with a limy deposit, and thus losing their original surface-markings in old age. A process of this kind I suppose to have taken place in the specimens figured at *a–d*. At any rate, it would be unreasonable to refer to distinct species shells occurring together in one dredging only, and at the same time so much alike in general character.

[Pl. XXVIII. fig. 6, *a–f*. *a* Carapace of male seen from left side, *b* from above, *c* from below, *d* from front; *e* female seen from left side, *f* from above. Magnified 50 diameters.]

4. *Loxoconcha africana*, n. sp. (Pl. XXVIII. fig. 3, *a–d*).

Carapace, seen from the side, flexuous, subovate, highest about the middle, slightly depressed in front, height equal to at least two-thirds of the length; anterior extremity well and evenly rounded, posterior scarcely broader than the anterior, rounded, gently emarginate at the upper angle, not produced; dorsal margin evenly and moderately arched, ventral sinuated in front, convex behind; seen from above, ovate, acuminate in front, rounded off and mucronate behind, greatest width in the middle, and equal to more than half the length; end view broadly ovate, rounded both at base and apex, dorsal very nearly as wide as the ventral margin, height not very much greater than the width. Surface of the shell smooth, partially marked with small circular punctures, and with a few scattered circular papillæ. Length, 1-42d of an inch (·6 mm.).

Dredged off St Vincent, Cape Verde, in 1070 to 1150 fathoms, muddy bottom.

[Pl. XXVIII. fig. 3, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

5. *Loxoconcha pumicosa*, n. sp. (Pl. XXVIII. fig. 2, *a–d*).

Carapace short, tumid; seen from the side, subrhomboidal, greatest height situated in the middle, and equal to two-thirds of the length; extremities about equal in height, anterior rounded, posterior oblique, produced above the middle into a short, truncated beak, dorsal margin moderately arched, and slightly sinuated behind the middle, ventral gently convex; seen from above, the outline is lozenge-shaped, very wide in the middle, and tapering equally to the extremities which are subacute, width about equal to the height; end view broadly heart-shaped, wide, and nearly flat below, rounded, and but slightly tapered above. The surface of the shell is sculptured with rather closely- and concentrically-set subrotund excavations of moderate size, which on the ventral surface are arranged in longitudinal furrows. Length, 1-48th of an inch (·52 mm.).

Dredged off Booby Island, lat. 10° 36′ S., long. 141° 55′ E., 6 to 8 fathoms (Station 187); and at Nares' Harbour, Admiralty Islands, 16 fathoms.

[Pl. XXVIII. fig. 2, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

6. *Loxoconcha sculpta*, G. S. Brady (Pl. XXIX. fig. 5, *a–d*).

Loxoconcha sculpta, Brady, Les Fonds de la Mer, tom. i. p. 140, pl. xviii. figs. 5, 6.

Carapace of the female (?), seen from the side, short, subrhomboidal, greatest height in the middle, and equal to about two-thirds of the length; anterior extremity obliquely rounded, posterior produced in the middle into a wide truncated beak; dorsal margin high, and somewhat arched near the middle, thence sloping backwards in a right line; ventral margin gently convex; seen from above the outline is compressed, and nearly diamond-shaped, widest in the middle, the width being equal to half the length, tapering to the extremities which are subacuminate; end view subtrapezoidal, considerably higher than broad, widest at the base, which is concave, apex wide and subtruncate, sides greatly curved. Shell-surface sculptured with large and closely-set angular pits; anterior margin sometimes slightly denticulated below the middle; at the posterior dorsal angles are two prominent subconical eminences, which are especially conspicuous when viewed from above or below, forming rectangular lateral projections. Length, 1-50th of an inch (·5 mm.).

Dredged off Booby Island, lat. 10° 36′ S., long. 141° 55′ E., 6 to 8 fathoms.

The type specimens described in Les Fonds de la Mer were dredged at St Vincent, Cape Verde.

[Pl. XXIX. fig. 5, *a–d*. *a* Carapace of female (?) seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

7. *Loxoconcha australis*, n. sp. (Pl. XXVIII. fig. 5, *a–f*, and Pl. XXIX. fig. 3, *a–d*).

Carapace of the female tumid; seen from the side, subrhomboidal, nearly equal in height throughout; anterior extremity well rounded, posterior rounded, prominent in the middle, and emarginate at the upper angle; dorsal margin nearly straight, ventral slightly sinuated; height equal to nearly two-thirds of the length; seen from above, broadly ovate, with strongly mucronate extremities, greatest width situated in the middle, and equal to the height; end view subcordate, wide below, and obtusely pointed above. Surface of the shell marked with rather large and closely-set angular excavations, which have an obscurely concentric arrangement; ventral surface strongly grooved longitudinally, the pittings being placed in the furrows. The shell of the male (Pl. XXVIII. fig. 5, *e–f*), is longer and narrower, but in other respects shows much the same characters as that of the female. Length of the male, 1-38th of an inch (·66 mm.); of the female, 1-48th of an inch (·52 mm.).

Dredged at Port Jackson, Australia, in a depth of 2 to 10 fathoms, and off Booby Island, lat. 10° 36′ S., long. 141° 55′ E., 6 to 8 fathoms.

The specimens shown in Plate XXIX. I at first thought to be specifically distinct from those got at Booby Island, but though there is a considerable difference in form as well as in sculpture, I believe this may be accounted for by supposing the Port Jackson specimens to be of more advanced growth; something also may be allowed for local variation.

[Pl. XXVIII. fig. 5, *a–f*. *a* Carapace of female (Booby Island) seen from left side, *b* from above, *c* from below, *d* from front; *e* male seen from left side, *f* from above. Pl. XXIX. fig. 3, *a–d*. *a* Carapace of female (?) (Port Jackson), seen from left side, *b* from above, *c* from below, *d* from front. All magnified 50 diameters.]

8. *Loxoconcha sinensis*, G. S. Brady (Pl. XXIX. fig. 2, *a–d*).

Loxoconcha sinensis, Brady, Les Fonds de la Mer, p. 158, pl. xvi. figs. 17, 18 (*Icones malæ*).

Carapace oblong, tumid; seen from the side, subrhomboidal, slightly higher in front than behind, height equal to nearly two-thirds of the length; anterior extremity rounded, posterior slightly produced in the middle, and obliquely sinuated above, dorsal and ventral margins nearly straight; seen from above the outline is somewhat hastate, with subparallel curved sides which converge rather abruptly towards the front, and end in an acuminate apex, the posterior extremity is broadly rounded, and mucronate in the middle, width equal to the height; end view subcordate, broadly rounded below, angulated at the apex. Surface sculptured much as in *Loxoconcha guttata*. Length, 1-48th of an inch (·52 mm.).

Loxoconcha sinensis was found only in dredgings from Hong Kong Harbour, and from the Inland Sea, Japan, in a depth of 15 fathoms on a muddy bottom (Station 233*b*). The type specimens were from Hong Kong.

[Pl. XXIX. fig. 2, *a–d*. *a* Carapace seen from side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

9. *Loxoconcha guttata*, Norman (Pl. XXIX. fig. 1, *a–f*).

Cythere guttata, Norman, Nat. Hist. Trans. Northumberland and Durham, vol. i. 1865, p. 19, pl. vi. figs. 9–12.
Loxoconcha guttata, Brady, Monog. Recent Brit. Ostrac., 1868, p. 436, pl. xxvii. figs. 40–44.
Loxoconcha guttata, Brady, Crosskey, and Robertson, Post-Tertiary Entomostraca, p. 186, pl. viii. figs. 5–7.

Carapace of the female oblong, tumid; seen from the side, peach-stone shaped, about equal in height before and behind, height equal to nearly two-thirds of the length; anterior extremity rounded, posterior produced in the middle and emarginate above the middle; dorsal margin nearly straight behind, curved in front; ventral convex behind, sinuated in front; seen from above, ovate, widest in the middle, twice as long as broad;

extremities broad, mucronate; end view broadly ovate, width nearly as great as the height. Surface of the shell sculptured with deep and closely-set angular excavations, which are usually fainter, and sometimes wanting altogether, in the centre of the valves. Shell of the male (figures *e–f*) narrower and more compressed, the dorsal and ventral margins nearly parallel. Length, 1-45th of an inch (·53 mm.).

An extremely well-marked species, the range of which seems to be very restricted. In the recent state it is known only as an inhabitant of the western shores of Europe (Norway, the British Islands, France, and Spain), and as a fossil it occurs not uncommonly in the Post-Tertiary deposits of Britain and Norway. The specimens here figured were found in anchor-mud from Vigo Bay.

[Pl. XXIX. fig. 1, *a–f.* *a* Carapace of female seen from left side, *b* from above, *c* from below, *d* from front, *e* male seen from left side, *f* from above. Magnified 50 diameters.]

10. *Loxoconcha subrhomboidea*, n. sp. (Pl. XXVIII. fig. 4, *a–d*).

Carapace short, and rather tumid; seen from the side, subrhomboidal, equal in height before and behind, height equal to two-thirds of the length; extremities broad and obliquely rounded, dorsal margin nearly straight, ventral slightly convex; seen from above, ovate, widest near the middle, scarcely twice as long as broad, extremities rounded and mucronate; end view subcordate, slightly tapered towards the apex. Surface of the shell marked with angular excavations, as in the preceding species. Length, 1-60th of an inch (·425 mm.).

Dredged in Simon's Bay, South Africa, in a depth of 15 to 20 fathoms (Station 140).

[Pl. XXVIII. fig. 4, *a–d.* *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

11. *Loxoconcha variolata*, G. S. Brady (Pl. XXIX. fig. 6, *a–d*).

Loxoconcha variolata, Brady, Ostracoda of Antwerp Crag, Trans. Zool. Soc., vol. x. pt. 8, 1878, p. 400, pl. lxviii. fig. 4, *a–d*.

Carapace, as seen from the side, oblong, rather higher in front than behind; height equal to more than half the length, anterior extremity broad, and evenly rounded, posterior narrower, rounded, not produced nor emarginate, dorsal margin straight, ventral slightly convex; seen from above, hastate, with parallel sides, which converge abruptly to a mucronate apex in front, and terminate rectangularly behind the middle, thence converging sharply backwards in a bisinuated line to the mucronate posterior termination; width equal to the height; from below, the posterior lateral angulation is seen to be carried across the ventral surface of the shell, forming a sharp ridge; viewed from the front, the outline is rounded, not much wider at the base than at the apex. Surface beset with angular pittings which, on the ventral aspect, are arranged in longitudinal grooves. Length, 1-52d of an inch (·49 mm.).

Dredged off Booby Island (Station 187), in a depth of 6 to 8 fathoms.

The specimens here noted differ somewhat from the types described in my monograph of the Antwerp Crag Ostracoda, being less tapered in front when seen dorsally, rounder and more narrowed behind when seen from the side. Nevertheless, the Challenger specimens in general style and appearance so closely approximate to those from the Antwerp Crag, that I do not think it safe to propose for them a separate specific name. Two other fossil species, *Cythere subtriangularis*, Speyer, and *Cythere hastata*, Reuss, Egger, are also very nearly allied, but without the opportunity of examining authentic specimens, one cannot pronounce with certainty respecting them. Among recent species *Loxoconcha angustata*, Brady, *Loxoconcha alata*, Brady, and *Loxoconcha multifora* (Norman), are all near relatives, but distinct.

[Pl. XXIX. fig. 6, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

12. *Loxoconcha alata*, G. S. Brady (Pl. XXVII. fig. 6, *a–j*).

Loxoconcha alata, Brady, Ann. and Mag. Nat. Hist., ser. 4, vol. ii. (1868), p. 223, pl. xiv. figs. 8–13.

Carapace of the female oblong, tumid; seen from the side, subrhomboidal, equal in height throughout, height equal to rather more than half the length; anterior extremity evenly rounded; posterior oblique, produced above the middle into a short, blunt beak; dorsal margin straight, or very slightly hollowed, ventral almost straight; seen from above, the outline is irregularly lozenge-shaped, each valve having a conspicuous lateral prominence behind the middle; greatest width situated behind the middle, and equal to about three-fourths of the length; the extremities are broad and strongly mucronate, the end view is somewhat trapezoidal in outline, its height and width being about equal, and its angles produced or gibbous. The surface of the shell is marked with numerous small angular hollows, which, on the ventral surface, are disposed in longitudinal grooves; and towards the hinder extremity of the ventral margin on each valve is a conspicuous, bluntly angular alæform process or tubercle; there is also usually a distinct polished tubercle over the anterior hinge-joint. Length, 1-55th of an inch (·44 mm.).

A considerable number of specimens of *Loxoconcha alata* were found in a dredging made off the reefs at Honolulu, in a depth of 40 fathoms. These differ somewhat from the type-specimens which were got at Mauritius, but not so much, I think, as to warrant my calling them by a new name. The Honolulu specimens are not nearly so sharp at the ends; when seen from above, they are also rather more tumid, and the sculpturing is considerably coarser; but the general build and appearance is exactly that of the Mauritius species. The three series of figures given in Pl. XXVII. represent various stages of growth, figures *a–c* being probably the adult female, and *h–j* perhaps the young male.

This is very nearly allied to the preceding species (*Loxoconcha variolata*), but as will be at once seen on reference to the figures in Pl. XXIX., it is more angular in its contours, and the lateral alæ are very much more prominent. *Loxoconcha hastata*, Brady (see Les Fonds de la Mer), is another closely related species.

[Pl. XXVII. fig. 6, *a–j*. *a* Carapace of adult female seen from left side, *b* from below, *c* from front, *d* younger female seen from left side, *e* from above, *f* from below, *g* from front; *h* male (?) seen from left side, *i* from below, *j* from front. Magnified 50 diameters.]

13. *Loxoconcha anomala*, n. sp. (Pl. XXVII. fig. 5, *a–d*).

Carapace as seen from the side, flexuous, subrhomboidal, greatest height situated near the middle, and equal to two-thirds of the length; anterior extremity rounded, posterior oblique, produced above the middle into a broad truncated beak; superior margin forming a flattened arch which slopes gently toward the front, but more abruptly, and with a slight sinuation behind, ventral margin rather prominently convex behind the middle; seen from above, the outline would be almost a perfect rhomboid, but for the abrupt constriction behind the lateral alæ which project a little behind the middle of the shell; the extremities are acuminate, and the greatest width across the alæ is equal to two-thirds of the length. Seen from the front the outline is subtriangular and equilateral, being almost exactly like the hull of a vessel seen "end on," the apex of the triangle corresponding with the ventral margin, and produced into a distinct keel, the sides evenly convex, and the base, which corresponds with the dorsum, angularly elevated in the middle. The surface of the shell is marked by numerous irregular shallow pittings of moderate size. Length, 1-50th of an inch (·5 mm.).

Of this remarkable species only a few examples were found in the 40 fathoms dredging from the reefs at Honolulu, It is not a little remarkable that two forms so *outré*, and so closely resembling each other in lateral outline, as this species and *Loxoconcha honoluliensis* should have occurred in this one dredging. But though so much alike when viewed sideways, the difference between the two from all other points of view is very striking, especially in the laterally projecting alæ and in the remarkably broad dorsal and narrowed ventral surface, a condition of which I know no other so marked an example amongst the Ostracoda.

[Pl. XXVII. fig 5, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

Xestoleberis, G. O. Sars (1865).

Shell smooth and polished, ornamented with small, round, distant papillæ, or rarely marked with sculptured pittings, much lower in front than behind, and in the female very tumid behind. Hinge-joint formed by a dentated projecting crest of the left, which is received into an excavation of the right valve; ventral margin of both valves incurved in front of the middle, and forming on the ventral surface a central hollow; anterior antennæ six-jointed, the last four joints successively decreasing in length, and bearing very short, simple setæ; posterior antennæ short, four-jointed, flagellum of moderate length. Mandible-palp four-jointed; branchial appendage small, and bearing only two setæ. Jaws as in *Loxoconcha.* Feet small; post-abdominal lobes bearing two setæ. Eyes distinct. Ova and immature young borne within the shell of the female,

This genus is at a glance distinguishable by the generally rounded outline, the depressed and pointed front, and the rounded, tumid posterior end of the shell. It is widely distributed, containing apparently a very large number of species, and occurring abundantly in the seas of all parts of the world. So far, however, as we know of it palæontologically, it would seem to be a genus of comparatively recent development, the only described fossil species which can be unmistakably referred to it—so far as I know —being *Cytherina impressa*, Reuss (a chalk-marl species extremely like in the published figures to the recent European species, *Xestoleberis depressa* and *aurantia*), *Cytheridea tumida*, Egger (=? *Cytherina tumida*, Reuss), and *Bairdia glutea*, Egger, the last two being Miocene species. Zoologically, the most remarkable character of *Xestoleberis* is its being viviparous; the fry are retained within the shell of the mother until very fully developed: this, perhaps, may account for the great posterior expansion of the female carapace.

1. *Xestoleberis depressa*, G. O. Sars (Pl. XXXI. fig. 1, *a–g*).

Xestoleberis depressa, Sars, Oversigt af Norges marine Ostracoder, p. 68, 1865.
Xestoleberis depressa, Brady, Monog. Recent Brit. Ostrac., Trans. Lin. Soc., 1868, p. 438, pl. xxvii. figs. 27–33.
Xestoleberis depressa, Brady, Crosskey, and Robertson, Post-Tertiary Entomostraca, p. 190, pl. vii. figs. 13–19.
(?) *Cytherina tumida*, Reuss, Foss. Entom. Oesterr. Tert., Beckens, p. 57, pl. viii. fig. 29, 1850.
(?) *Cytheridea tumida*, Egger, Ostrak. Miocän-Schicht, Ortenburg, p. 17, pl. ii. fig. 11.

Carapace of the female tumid; seen from the side, oblong, sub-semicircular, highest near the middle, height equal to more than half the length; subacutely pointed in front, broadly rounded behind, dorsal margin boldly arched and forming one continuous curve from the anterior to the posterior ends of the ventral margin, which is straight, except for a slight sinuation in front of the middle. Seen from above, the outline is cordate, pointed in front and broad behind, width equal to two-thirds of the length; end view depressed, broad below and boldly arched above, width greater than the height. Surface of the shell smooth, iridescent, marked with numerous small circular papillæ. The shell of the male is smaller, much less tumid, and has its posterior portion compressed and narrowly rounded. Length of the female, 1-35th of an inch (·75 mm.); of the male 1-42d of an inch (·65 mm.).

The only dredgings in which I have seen this species are from Balfour Bay, Kerguelen Island, 20 to 25 fathoms; and from lat. 52° 4′ S., long. 71° 22′ E., 150 fathoms. It is to be borne in mind, however, that the distinctions between this and the next species, if valid at all, are very slight; and it is not unlikely that the two may prove to be identical. *Xestoleberis depressa* is a common species in the Northern Hemisphere, having been found in the seas of Great Britain, Ireland, Norway, Spitzbergen, and in the Gulf of St Lawrence, while as a Post-Tertiary fossil it occurs abundantly in Scotland, Ireland, Norway, and Canada.

In size the northern specimens agree with *Xestoleberis setigera*, while in shape they approach more closely to the Balfour Bay specimens here assigned to *depressa*.

[Pl. XXXI. fig. 1, *a–g*. *a* Carapace of female seen from left side, *b* from above, *c* from below, *d* from front; *e* carapace of male seen from left side, *f* from below, *g* from front. All magnified 50 diameters.]

2. *Xestoleberis setigera*, n. sp. (Pl. XXXI. fig. 2, *a–d*, and fig. 3, *a–c*).

Very closely similar to *Xestoleberis depressa*, but, when seen from the dorsal surface, less tumid both in front and behind; the width, also, is considerably greater than the height, so that the end view is much depressed. The surface of the shell is studded with small papillæ, many of which bear single minute setæ. Length, 1-42d of an inch (·65 mm.).

I have notes of the occurrence of this species as follows:—Off Christmas Harbour, Kerguelen Island, 120 fathoms, specimen figured (fig. 3, *a–c*); off Heard Island, 75 fathoms, mud, Station 151; off Prince Edward's Island, 50 to 150 fathoms.

[Pl. XXXI. fig. 2, *a–d*. *a* Carapace of male seen from left side, *b* from above, *c* from below, *d* from front; fig. 3, *a–c*, *a* female seen from left side, *b* from below, *c* from front. All magnified 50 diameters.]

3. *Xestoleberis granulosa*, n. sp. (Pl. XXX. fig. 5, *a–d*).

Carapace compressed, oblong; seen from the side, subreniform, highest behind the middle, height equal to more than half the length, extremities rounded off, the posterior the broader of the two, dorsal margin well arched, ventral slightly sinuated in front of the middle; seen from above, compressed, ovate, twice as long as broad, widest near the middle, subacuminate in front, rounded behind; end view nearly circular, height slightly exceeding the width. Surface of the shell smooth, somewhat granular in appearance, and sparingly papillose. Length, 1-43d of an inch (·575 mm.).

Taken off East Moncœur Island, Bass' Strait, 38 to 40 fathoms, sand (Station 162); Port Jackson, Australia, 2 to 10 fathoms.

This species is more slender in outline than any other with which I am acquainted, excepting, perhaps, *Xestoleberis intermedia*, Brady (Mediterranean); and *Xestoleberis labiata*, Brady and Robertson (British), from which latter, however, it differs somewhat in shape as well as in the want of the peculiar labiate prolongation of the shell from which the British species takes it name.

[Pl. XXX. fig. 5, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

4. *Xestoleberis nana*, n. sp. (Pl. XXXI. fig. 5, *a–c*).

Carapace very tumid; as seen from the side, sub-semicircular, highest near the middle; extremities obliquely rounded, dorsal margin boldly arched, ventral nearly straight, height equal to more than half the length; seen from above the outline is very broadly ovate, subacuminate in front, broadly rounded behind, greatest width in the middle, and equal to nearly three-fourths of the length; end view depressed, the width much greater than the height. Surface of the shell perfectly smooth. Length, 1-58th of an inch (·45 mm.).

Found in a dredging, from a depth of 18 fathoms, off Tongatabu, coral bottom (Station 172).

[Pl. XXXI. fig. 5, *a–c*. *a* Carapace seen from left side, *b* from below, *c* from front. Magnified 50 diameters.]

5. *Xestoleberis africana*, n. sp. (Pl. XXX. fig. 4, *a–c*).

Carapace very tumid; seen from the side, broadly subovate, height greatest a little behind the middle, and equal to about three-fourths of the length; obliquely rounded, and somewhat narrowed in front, broad, and well rounded behind, dorsal margin boldly arched, ventral decidedly convex; seen from above broadly ovate, widest in the middle, abruptly tapered and subacuminate in front, rounded behind, width equal to two-thirds of the length; end view subcircular, base somewhat emarginate; height greater than the width. Surface of the shell smooth, slightly papillose. Length, 1-50th of an inch (·5 mm.).

Dredged in Simon's Bay, South Africa, in a depth of 15 to 20 fathoms. (Station 140.)

[Pl. XXX. fig. 4, *a–c*. *a* Carapace seen from left side, *b* from below, *c* from front. Magnified 60 diameters.]

6. *Xestoleberis curta*, G. S. Brady (Pl. XXXI. fig. 6, *a–d*).

Cytheridea (?) *curta*, Brady, Trans. Zool. Soc., 1865, vol. v. p. 370, pl. lviii. fig. 7, *a–b*.
Xestoleberis curta, Brady, Les Fonds de la Mer, p. 79, pl. x. figs. 16–18 (*Icon. mal.*).

Carapace, as seen from the side, oblong, subovate, greatest width situated behind the middle, and equal to more than half the length; extremities well rounded; dorsal margin moderately arched, inferior slightly sinuated in front; seen from above the outline is ovate, tapering only slightly towards the extremities, scarcely pointed in front, rounded behind; the width, which is greatest about the middle is just equal to the height; end view nearly circular. Surface of the shell perfectly smooth. Length, 1-52d of an inch (·49 mm.).

The following are the dredgings in which *Xestoleberis curta* has been noticed:—Off Bermudas, 435 fathoms, mud (Station 33); Royal Sound, Kerguelen Island, 28 fathoms (Station 149); Port Jackson, Australia, 2 to 10 fathoms; off Booby Island, lat. 10° 36′ S., long. 141° 55′ E.; 6 to 8 fathoms (Station 187); off reefs at Honolulu, 40 fathoms; in lat. 33° 42′ S., long 78° 18′ W.; 1375 fathoms (Station 300). The type-specimen described in the Zoological Society's Transactions (*loc. cit.*) was from the West Indies, and differs in no important respect from those here described, though the measurement is somewhat larger—1-42d of an inch.

[Pl. XXXI. fig. 6, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

7. *Xestoleberis polita*, G. S. Brady (Pl. XXXI. fig. 7, *a–c*).

Xestoleberis polita, Brady, Les Fonds de la Mer, tom. i. p. 202, pl. xxvii. figs. 15, 16.

Carapace as seen from the side, pear-shaped, highest behind the middle; anterior extremity narrow, posterior broad, both well rounded, dorsal margin moderately arched, inferior straight or slightly convex, height equal to two-thirds of the length; seen from above, compressed, ovate, narrowed, and obtusely pointed in front, somewhat broader and rounded behind; width rather less than the height; end view nearly circular. Surface of the shell smooth, very sparingly papillose. Length, 1-52d of an inch (·49 mm.).

The Challenger specimens of this species were found in mud brought up on the anchor from a depth of 6 fathoms in Stanley Harbour, Falkland Islands (Station 316). The type-specimens were taken in a locality not very far distant—Halt Bay, Straits of Magellan.

[Pl. XXXI. fig. 7, *a–c*. *a* Carapace seen from left side, *b* from below, *c* from front. Magnified 50 diameters.]

8. *Xestoleberis margaritea*, G. S. Brady (Pl. XXX. fig. 2, *a–g*).

Cytheridea margaritea, Brady, Trans. Zool. Soc., 1865, vol. v. p. 370, pl. lviii. fig. 6, *a–d*.
(?) *Cytherina ovulum*, Reuss, Haidinger's Abhandl., Band iii. p. 55, pl. viii. fig. 19.

Carapace of the female, tumid; seen from the side, ovate, greatest height situated behind the middle, and equal to two-thirds of the length; extremities evenly rounded, dorsal margin moderately arched, ventral slightly sinuated in front of the middle; seen from above, the outline is broadly ovate, pointed in front, and well rounded behind; width equal to the height; end view obscurely angulated above, broad, and somewhat emarginate below. Surface of the shell smooth, marked with a few distant small papillæ. Length, 1-50th of an inch (·5 mm.). The shell represented in figures *e–g* is perhaps referable to the male of this species, being found in company with the more tumid form (figures *a–d*). The broken line shown by the artist in fig. 5, has been inserted by mistake, probably from the accidental adhesion of some foreign body to the shell.

Xestoleberis margaritea has been met with only in one of the Challenger dredgings, off Booby Island, lat. 10° 36′ S., long. 140° 55′ E.; 6 to 8 fathoms (Station 187). The type-specimens are from the Mediterranean, where the species seems to be plentiful; and I have seen others from the Mauritius which are probably referable to the same.

[Pl. XXX. fig. 2, *a–g*. *a* Carapace of the female, seen from left side, *b* from above, *c* from below, *d* from front, *e* male (?), seen from left side, *f* from below, *g* from front. All magnified 60 diameters.]

9. *Xestoleberis intermedia* (?), G. S. Brady (Pl. XXXIII. fig. 2, *a–d*).

Xestoleberis intermedia (?), Brady, Les Fonds de la Mer, tom. i. p. 94, pl. xii. figs. 3–7.

Shell, seen from the side, subovate, depressed in front, highest in the middle, height equal to more than half the length; extremities rounded, the anterior narrower than the posterior; dorsal margin boldly arched, ventral gently convex; seen from above, the outline is regularly ovate, widest near the middle, the width equal to the height; extremities acuminate, the posterior, however, broader than the anterior; end view subcircular. Surface of the shell smooth, and ornamented with a few scattered circular papillæ, each of which bears a minute seta. Length, 1-70th of an inch (·37 mm.).

Found in Torres' Straits, lat. 11° 35′ S., long. 144° 3′ E., 155 fathoms (Station 185).

The few specimens referred to in the foregoing description differ to some extent from the type-specimens of *Xestoleberis intermedia*, especially in being much smaller, and in the convex character of the ventral surface. I have thought it better, however, to assign them to that species, than to coin a new name, on what might probably prove to be insufficient grounds.

[Pl. XXXIII. fig. 2, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. All magnified 80 diameters.]

10. *Xestoleberis tumefacta*, n. sp. (Pl. XXXI. fig. 4, *a–d*).

Carapace tumid; seen from the side, subovate, not much higher behind than in front, height equal to two-thirds of the length; extremities obliquely rounded, dorsal margin moderately arched, ventral sinuated in front of the middle; seen from above, ovate, widest in the middle, tapering equally to the extremities, which are pointed; width equal to the height; end view subcircular, scarcely at all tapered towards the apex. Surface of the shell smooth, marked with numerous small circular papillæ and with irregular light or dark coloured blotches. Length, 1-43d of an inch (·57 mm.).

Found in a dredging from Nares' Harbour, Admiralty Islands, in a depth of 16 fathoms. This has very much the general aspect of *Loxoconcha*, but there is no angulation at the supero-posteal portion of the margin, and on that account chiefly I think it is best referred to *Xestoleberis*.

[Pl. XXXI. fig. 4, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

11. *Xestoleberis variegata*, n. sp. (Pl. XXXI. fig. 8, *a–g*).

Carapace of the female, tumid; seen from the side, broadly pear-shaped, highest near the middle, extremities well rounded, the anterior, however, much narrower than the posterior; dorsal margin boldly arched, ventral sinuated in front, and convex behind the middle; seen from above, broadly ovate, tapering, and pointed in front, rather broadly rounded behind, width scarcely equal to the height; end view subcircular. Surface of the shell smooth, variegated with blotches of dark upon a pale ground. Length, 1-43d of an inch (·57 mm.). Specimens which I believe to belong to the male of this species are represented in figures *c–g*, and, as usual, are more elongated and slender than those of the opposite sex.

Xestoleberis variegata was noticed in dredgings from off St Vincent, Cape Verde, in 1070 to 1150 fathoms (Stations 93, 94); and off Tongatabu, 18 fathoms (Station 172).

[Pl. XXXI. fig. 8, *a–g*. *a* Carapace of female, seen from left side, *b* from above, *c* from below, *d* from front, *e* male seen from left side, *f* from below, *g* from front. All magnified 50 diameters.]

12. *Xestoleberis expansa*, n. sp. (Pl. XXX. fig. 3, *a–d*).

Carapace excessively ventricose; seen from the side, oblong, subovate, highest a little behind the middle, extremities broad and rounded, dorsal margin boldly arched, somewhat gibbous, ventral nearly straight; height equal to two-thirds of the length; seen from above, very broadly ovate, greatest width situated in the middle, and equal to three-fourths of the length, abruptly tapered towards the anterior extremity, which is subacute; posterior extremity broadly rounded, and slightly emarginate in the middle; end view subtriangular, widest at the ventral margin, width much greater than the height, apex acute, lateral angles rounded. Surface of the shell smooth and polished. Length, 1-58th of an inch (·44 mm.).

One specimen only, dredged in a depth of 1900 fathoms, in lat. 35° 39′ S., long. 50° 47′ W.; grey mud (Station 323).

The remarkably ventricose character, and broadly triangular end-view separate this species unmistakably from any other with which I am acquainted.

[Pl. XXX. fig. 3, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

13. *Xestoleberis foveolata*, n. sp. (Pl. XXX. fig. 1, *a–g*).

Carapace of the female, subcordate, very tumid; seen from the side, the greatest height is situated near the middle, and is equal to more than two-thirds of the length; anterior extremity rounded, and only slightly depressed, posterior very broadly rounded, and somewhat produced in the middle; dorsal margin very boldly arched, ventral nearly straight; seen from above, broadly and obtusely wedge-shaped, tapering rather abruptly near the anterior extremity, which is obtusely pointed, posterior extremity wide, subtruncate, with rounded angles, and a central submucronate projection; greatest width situated behind the middle and equal to three-fourths of the length; end view subtriangular, with extremely convex sides, and rounded lateral angles, apex obtusely angulated, width rather greater than the height. Surface of the shell ornamented with closely-set, and rather large angular excavations, and, on the ventral surface, also with deep longitudinal furrows. Length, 1-45th of an inch (·53 mm.). The male differs from the female in having the superior margin almost angular in the middle, the dorsal view being regularly ovate, and the end view subtriangular.

This remarkable species, differing from all other known members of the genus in the strongly pitted character of its shell, was dredged plentifully in a depth of 6 to 8 fathoms, off Booby Island, lat. 10° 36′ S., long. 141° 55′ E. (Station 187).

[Pl. XXX. fig. 1, *a–g*. *a* Carapace of female seen from left side, *b* from above, *c* from below, *d* from front; *e* male seen from left side, *f* from below, *g* from front. Magnified 60 diameters.]

Cytherura, G. O. Sars (1865).

Valves unequal and dissimilar in form, the right more or less overlapping the left on the dorsal margin; surface smooth, reticulated, punctated, deeply excavated, or bearing irregularly disposed ribs or protuberances, and mostly marked with a central darkly-coloured areola; in shape oblong or subtriangular and produced at the hinder end into a more or less prominent beak; hinge-processes mostly obsolete. Anterior antennæ shortly setose, six-jointed, gradually tapered; second joint bearing a rather long seta on the middle of its posterior margin; posterior antenna five-jointed, with short terminal claws; flagellum long, triarticulate. Mandibles robust, bluntly toothed; palp three-jointed, its branchial appendage small and bearing only two recurved setæ. Terminal lobes of the first pair of maxillæ long and narrow; branchial plate bearing on its external margin two non-ciliated setæ, which are directed downwards and arise from a separate lobe. Feet small, with short, recurved claws; eyes distinct. Copulative organs of the male very complex, provided with several irregular processes and a very long spirally convoluted tube.

The members of this genus appear to be distributed abundantly over the whole globe, and are perhaps equally common in the Arctic Seas, as in those of the tropical and temperate regions. With very few exceptions, they are the smallest of all the Ostracoda, the usual range of length being between 1-50th and 1-70th of an inch.

1. *Cytherura curvistriata*, n. sp. (Pl. XXXII. fig. 10, *a–d*).

Carapace oblong, tumid; seen from the side, subrhomboidal, about equal in height throughout, scarcely twice as long as high; anterior extremity obliquely rounded, posterior angular, tapering abruptly and broadly truncated in the middle; dorsal and ventral margins parallel and nearly straight; seen from above, the outline is broadly ovate, greatest width behind the middle and equal to more than half the length, broadly mucronate in front, hinder extremity broadly rounded and irregularly emarginate; end view subelliptical, height less than the width. Surface of the shell marked with not very prominent, flexuous, longitudinal ribs, the intervals between which are pitted with angular cavities. Length, 1-62d of an inch (·40 mm.).

Dredged at Port Jackson, Australia, in a depth of 2 to 10 fathoms.

[Pl. XXXII. fig. 10, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

2. *Cytherura obliqua*, n. sp. (Pl. XXXII. fig. 1, *a–d*).

Carapace oblong, tumid; seen from the side, flexuous, subrhomboidal, higher in front than behind, height equal to about two-thirds of the length; anterior extremity broad and obliquely rounded off, posterior rounded but much narrower, not beaked; dorsal margin moderately arched, ventral somewhat convex and sinuated towards the front; seen from above, the outline is hexagonal, scarcely twice as long as broad; the sides parallel in the middle but converging rather abruptly towards the ends; end view heart-shaped, broad at the base and tapering to an obtusely rounded summit, height greater than the width. Shell marked with rather large angular excavations, and on the ventral surface with sinuous longitudinal grooves. Length, 1-43d of an inch (·58 mm.).

The only dredging in which I have seen *Cytherura obliqua* is from 20 to 50 fathoms at Balfour Bay, Kerguelen Island (Station 149). The species is rather anomalous in character, having a good deal of the general contour of *Loxoconcha*, and being destitute of the beak, which is the chief external mark of *Cytherura*. The same remarks apply partially to the two next described species *Cytherura rudis* and *Cytherura cribrosa*; the generic position here assigned to them must be looked upon as merely conjectural.

[Pl. XXXII. fig. 1, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

3. *Cytherura rudis* (?) G. S. Brady (Pl. XXXII. fig. 3, *a–d*).

Cytherura rudis, Brady, Ann. and Mag. Nat. Hist., ser. 4, vol. ii. (1868), p. 34, pl. v. figs. 15–17.

Carapace oblong, rather compressed; seen from the side rhomboidal, greatest height situated near the front and equal to more than half the length; anterior extremity broad, oblique, only slightly rounded, posterior narrower, oblique, produced near the middle into a very short and broad beak; dorsal margin sloping backwards with a very gentle curve from the front, ventral slightly sinuated in front; dorsal view elongated, subhexagonal, slightly wider in front than behind, anterior extremity abruptly tapered, obtusely pointed, posterior broad, subtruncate, with a wide central mucro; end view hexagonal, the dorsal much shorter than the ventral line; height a little greater than the width. Surface of the shell marked with polygonal excavations and faint flexuous longitudinal ribs, much as in the preceding species. Length, 1-52d of an inch (·49 mm.).

This is rather more angular in contour than the type-specimens which came from Davis' Straits, but in other respects the two entirely agree. The Challenger specimens were got in the Straits of Magellan, 55 fathoms (Station 313).

[Pl. XXXII. fig. 3, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below *d* from front. Magnified 60 diameters.]

4. *Cytherura cribrosa*, n. sp. (Pl. XXXII. fig. 5, *a–d*).

Carapace, as seen from the side, subquadrate, scarcely higher in front than behind, greatest height situated in the middle, and equal to about two-thirds of the length; anterior extremity obliquely rounded, posterior produced in the middle into a broad, subacute beak; dorsal margin moderately arched, ventral nearly straight; seen from above, ovate, widest in the middle, subacuminate in front, mucronate behind, twice as long as broad; end view subquadrate, height considerably greater than the width. Shell marked over the whole surface with rather large angular excavations. Length, 1-45th of an inch (·54 mm.).

Found only in a dredging from a depth of 160 fathoms. January 13, 1876. (Station 305).

[Pl. XXXII. fig. 5, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

5. *Cytherura lilljeborgi*, n. sp. (Pl. XXXII. fig. 6, *a–d*).

Carapace elongated, compressed, rather higher in front than behind; seen from the side, subovate, greatest height situated in front of the middle and equal to half the length; anterior extremity obliquely rounded, and jagged below the middle with three or four small teeth, posterior rather narrower and produced in the middle into a broad truncated beak; superior margin moderately arched, inferior straight; seen from above, the outline is oblong-ovate, more than twice as long as broad, widest near the front, tapering abruptly towards the obtusely-pointed anterior, and gradually towards the broadly mucronate posterior extremity; end view hexagonal, with concave margins; valves marked in the middle of the lateral aspect with a longitudinal flexuous ridge and on the ventral surface with numerous longitudinal ridges, the other portions of the surface being irregularly and coarsely reticulated with prominent ribs. Length, 1-60th of an inch (·42 mm.).

This very well-marked species occurred in a dredging from Balfour Bay, Kerguelen Island, in 20 to 50 fathoms. Its nearest known ally is probably *Cytherura clathrata*, Sars, with which it closely agrees in style of surface-sculpture though quite different in proportions and general contour.

[Pl. XXXII. fig. 6, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 75 diameters.]

6. *Cytherura clavata*, n. sp. (Pl. XXIX. fig. 7, *a–d*).

Carapace, as seen from the side, oblong, nearly equal in height throughout, length equal to twice the height; anterior extremity well rounded, posterior produced in the middle into a short and broadly truncated beak; dorsal and ventral margins parallel and nearly straight; seen from above, the outline is subcuneate, widest behind, more or less constricted in the middle (the constriction more marked in the female), extremities centrally mucronate, the anterior broadly rounded, posterior subtruncate, width about equal to the height; end view subcircular, broad at the base and somewhat angulated at the apex. Surface of the shell marked with numerous delicate longitudinal anastomosing ridges; each valve has also a wide transverse groove or depression across the middle. Length 1-40th of an inch (·65 mm.).

A considerable number of specimens of *Cytherura clavata* were found in a dredging from Stanley Harbour, Falkland Islands,—6 fathoms. The species is not unlike *Cytherura gibba* (Müller), but is much more wedge-shaped when seen from the dorsal or ventral aspect. Some specimens have a much more distinct transverse groove than others, as shown in the two figures *b*, *c*. The difference is probably sexual.

[Pl. XXIX. fig. 7. *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

7. *Cytherura mucronata*, n. sp. (Pl. XXXII. fig. 9, *a–d*).

Carapace, as seen from the side, subrhomboidal, highest about the middle, height equal to fully half the length; anterior extremity obliquely rounded, posterior produced into a large tapering central beak; dorsal margin forming a flattened arch, ventral convex, slightly sinuated in front of the middle; seen from above the outline is compressed-ovate, widest in the middle and tapering evenly to the extremities, the anterior being subacuminate, the posterior strongly mucronate; end-view subtriangular, height greater than the width, widest at the base, apex truncate. Surface of the shell marked with distant rounded punctures which are arranged in curved longitudinal rows. Length, 1-50th of an inch (·5 mm.).

Dredged in Simon's Bay, South Africa, in a depth of 15 to 20 fathoms. A very distinct species somewhat like the British *Cytherura producta*, but more robust and much higher in proportion to its length, distinctly sculptured also,—the British species being quite smooth.

[Pl. XXXII. fig. 9, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

8. *Cytherura costellata*, n. sp. (Pl. XXXII. fig. 7, *a–d*).

Carapace elongated, compressed; seen from the side oblong, narrow, highest in the middle, height equal to half the length, anterior extremity evenly rounded, posterior obliquely truncate, and produced above the middle into a prominent conical beak; dorsal margin gently and evenly arched, ventral straight; seen from above, oblong, subhexagonal; sides straight and parallel, converging rather abruptly to the extremities, both of which are strongly mucronate, width less than the height; end view pentagonal, much and irregularly emarginate. Shell-surface ornamented with numerous waved and anastomosing ribs forming an irregularly reticulated pattern. Length, 1-50th of an inch (·5 mm.).

Dredged in Balfour Bay, Kerguelen Island, in 20 to 50 fathoms (Station 149).

[Pl. XXXII. fig. 7, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

9. *Cytherura clausi*, n. sp. (Pl. XXXII. fig. 8, *a–d*).

Carapace tumid; seen from the side, oblong, height nearly the same behind and before, and equal to half the length, anterior extremity rounded, posterior produced above the middle into a large, conical, truncated beak, dorsal margin slightly arched, ventral straight; seen from above, ovate, widest in the middle, tapering gradually to the anterior extremity, which is broadly pointed, posterior extremity rounded, with a large central mucro; end view subtriangular, width and height about equal. Surface of the valves honey-combed with numerous irregularly angular cavities. Length, 1-50th of an inch (·5 mm.).

Dredged in Simon's Bay, South Africa, 15 to 20 fathoms (Station 140).

[Pl. XXXII. fig. 8, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, from front. Magnified 60 diameters.]

10. *Cytherura cryptifera*, n. sp. (Pl. XXXII. fig. 4, *a–c*).

Valves, as seen from the side, oblong, subrhomboidal, a little lower in front than behind, height equal to half the length; anterior extremity rounded and divided below the middle into four or five small teeth; posterior obliquely truncated, irregularly notched and produced above the middle into a wide prominent beak, dorsal and ventral margins nearly straight; seen from above, the outline is broadly ovate, with pointed extremities; end-view subhexagonal, excavated between the angles. The surface of each valve is divided into several large angular hollows by sharply-cut flexuous ribs, the two principal of which run from a point near the anterior border to the posterior extremity of the valve, diverging at an acute angle, and enclosing a large portion of the area of the valve in one large cavity, the surrounding portion being cut up into irregular hollows by shorter separating ribs. Length, 1-62d of an inch (·40 mm.).

One specimen of this remarkably sculptured species was found in the dredging from off East Moncœur Island, Bass' Strait, in a depth of 38 to 40 fathoms. Though at first perfect, the two valves, unfortunately, became separated in examination, so that I have not been able to figure the complete shell.

[Pl. XXXII. fig. 4, *a–c*. *a* Left valve seen from side, *b* the same from above, *c* from front. Magnified 60 diameters.]

Cytheropteron, G. O. Sars (1865).

Valves mostly subrhomboidal, tumid, unequal, and different in shape, the right valve more or less overlapping the left on the dorsal margin; surface of the shell variously sculptured, punctate, papillose, reticulated, or transversely rugose, ventral surface produced laterally into a prominent rounded or spinous ala; posterior margin produced into a more or less distinct but obtuse beak; hinge formed by two small terminal teeth on the right, and by a minutely-crenated median bar on the left, valve. Muscle-spots usually four, linear-oblong, arranged in an obliquely transverse row just above the middle of the ventral margin. Anterior antennæ shortly setiferous, and composed of five joints; the penultimate joint elongated, and bearing on the middle of the anterior margin two hairs; posterior antennæ distinctly five-jointed, flagellum long. Mandibles of moderate size; palp three-jointed, branchial appendage bearing two very small setæ; maxillæ as in the preceding genus. Feet long and slender, with slender terminal claws. Abdomen ending in a long, narrow process; postabdominal lobes bearing three short hairs. Copulative organs of the male armed behind with three spiniform processes, one of which is trifurcate. Eyes wanting.

This is a cosmopolitan genus, containing a considerable number of species, of which the best known are *Cytheropteron latissimum* (Norman), and *Cytheropteron nodosum*, Brady. Both of these are northern species ranging across the Atlantic from Canada to Norway, and extending, in the case of the first named, as far northward as Baffin's Bay and Spitzbergen, and occurring also very plentifully in the Post-Tertiary formations of

Canada, Great Britain, and Norway. Many other forms, both recent and fossil, have been described, ranging as far back as the Cretaceous formations.

1. *Cytheropteron scaphoides*, n. sp. (Pl. XXXIII. fig. 1, *a–d*).

Shell compressed, oblong; seen from the side, elongated, subtriangular, highest in the middle, the greatest height being nearly equal to half the length; anterior extremity depressed, narrowly and sharply rounded, posterior produced, much depressed, subacutely pointed; dorsal margin boldly arched, sloping more steeply behind than in front, ventral gently convex; seen from above, the outline is compressed, oblong, obscurely hexagonal, with rounded angles, width scarcely equal to half the length; sides nearly straight, and converging somewhat abruptly towards the extremities which are subacuminate; end view depressed, broadly oval, ventral surface indented. Surface of the shell smooth, marked with a few faint and distant curved longitudinal striæ. Length, 1-80th of an inch (·325 mm.).

A few specimens found in a dredging from Balfour Bay, Kerguelen Island, 20 to 50 fathoms (Station 149).

This is not unlike in general character to *Cytheropteron subcircinatum*, Sars, but is very much less tumid.

[Pl. XXXIII. fig. 1, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 80 diameters.]

2. *Cytheropteron wellingtoniense*, n. sp. (Pl. XXXIV. fig. 4, *a–d*).

Shell, seen from the side, flexuous in outline, subrhomboidal, highest in the middle, height equal to nearly two-thirds of the length, anterior extremity depressed, rounded off, posterior wider, looking obliquely downwards, produced in the middle into a short, broad, and obtuse beak, dorsal margin boldly and evenly rounded, ventral convex, sinuated in front and behind the middle; seen from above, the outline is subovate, widest behind the middle, where the lateral alæ project only very slightly; from this point the lateral margins slope with a gentle curve towards the anterior extremity, which is obtuse and slightly mucronate, more abruptly and almost in a straight line to the hinder extremity, which is acuminate; width equal to the height; the end view is equilaterally triangular, the angles rounded, and the lateral margins rather boldly curved, ventral line nearly straight. The shell is almost smooth, but marked on parts of its surface with closely-set minute puncta, the ventral surface is indented longitudinally along the median line, and bears also a few faint curved striæ; the lateral alæ are curved, scarcely angular, and but slightly prominent. Length, 1-43d of an inch (·575 mm.).

Several specimens of this species were found in a dredging from Wellington Harbour, New Zealand. They were taken in the tow-net at trawl, but at what depth is not stated. In shape this is almost exactly similar to *Cytheropteron latissimum* (Norman), a northern species, yet the absence of any but very faint sculpturing of the shells seems to preclude the possibility of uniting it with that species.

[Pl. XXXIV. fig. 4, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

3. *Cytheropteron* (?) *angustatum*, n. sp. (Pl. XXXIV. fig. 5, *a*, *b*).

Valves, seen from side, oblong, subrhomboidal, higher in front than behind, height equal to more than half the length; anterior extremity broad, rounded below the middle, thence sloping almost in a right line to the dorsum, posterior extremity narrower, evenly rounded, dorsal margin short, straight, abruptly angular at both ends, ventral gently convex, slightly sinuated in front, and bent upwards behind; seen from above, the outline is regularly ovate, without any alæform proportion. Shell-surface marked with numerous moderately large angular excavations. Length, 1-50th of an inch (·5 mm.).

The proper generic position of this shell must be considered doubtful; it may possibly be a young undeveloped form, but as specimens have been found in two widely distant localities, it seems best to give it, provisionally, a specific name. Possibly the genus *Cythere* might have been a more fitting receptacle in this case, but from a few detached valves only it is not easy to arrive at an accurate conclusion. The specimens were found at Balfour Bay, Kerguelen Island, 20 to 50 fathoms (Station 149), and Torres' Straits, lat. 11° 35′ S., long. 144° 3′ E., 155 fathoms (Station 185).

[Pl. XXXIV. fig. 5, *a*, *b*. *a* Left valve seen from side, *b* from above. Magnified 50 diameters.]

4. *Cytheropteron intermedium*, G. S. Brady (Pl. XXXIV. fig. 1, *a–d*).

Cytheropteron intermedium, Brady, Ostracoda of the Antwerp Crag (Trans. Zool. Soc., 1878), p. 403, pl. lxix. fig. 3, *a–c*.

Shell elongated; seen from the side, flexuous, subrhomboidal, depressed in front, highest near the middle, height equal to more than half the length; anterior extremity obliquely rounded, posterior produced above the middle into a small, slender beak, below which it looks downwards with an oblique gentle curve, dorsal margin moderately arched, ventral sinuated in front, convex behind the middle; seen from above, the outline is hastate, widest behind the middle where the lateral alæ project at an obtuse angle; from this point the lateral margins converge in a gentle curve towards the front, terminating in a produced subacuminate extremity; backwards the sides converge at first almost rectangularly, then more gradually, the posterior extremity being, like the anterior, subacute; end view equilaterally triangular, obtusely rounded at the apex, lateral angles produced and truncated, sides gently convex. Shell almost smooth; ventral surface slightly nodulated and irregular. Length, 1-50th of an inch (·5 mm.).

The type-specimens of *Cytheropteron intermedium*, which differ scarcely in any degree from those here described, were fossils from the Antwerp Crag (Tertiary). The Challenger specimens are from Vigo Bay, 11 fathoms.

[Pl. XXXIV. fig. 1, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

5. *Cytheropteron abyssorum*, n. sp. (Pl. XXXIV. fig. 3, *a–d*).

Shell tumid; seen from the side, subrhomboidal, highest in the middle, height equal to about two-thirds of the length; anterior extremity obliquely rounded, posterior produced into a median acuminate beak; dorsal margin moderately arched, sloping gently towards the front, and very steeply behind, ventral strongly convex; seen from above, the shape is irregularly hexagonal, widest behind the middle over the alar prominences, width a little greater than the height; from the alar processes the lateral margins converge gently and with a slight sinuation towards the front for about one-third of the length of the shell, then converging abruptly, terminate anteriorly in a large acuminate process; behind the alæ the sides converge for a short space rectangularly, then are directed backwards, meeting at an acute angle in a long acuminate projection; end-view triangular, apex acute, lateral angles broad and produced; lateral margins gently convex, ventral almost straight. Surface of the valves marked partially on the sides with angular excavations, and on the ventral surface with irregular longitudinal sulci. Length, 1-50th of an inch (·5 mm.).

A very well-marked species, if we exclude the possibility of its being a sexual form or the young of that next to be described, *Cytheropteron assimile*, to which it bears considerable resemblance. *Cytheropteron assimile*, however, is much larger, the contours much more rounded, and the lateral alæ not so prominent as in *Cytheropteron abyssorum*. Dredged in lat. 42° 42′ S., long. 134° 10′ E., 2600 fathoms (Station 160).

[Pl. XXXIV. fig. 3, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

6. *Cytheropteron assimile*, n. sp. (Pl. XXXIV. fig. 3, *a–d*).

Shell, seen from the side, oblong, flexuous, subrhomboidal, not much lower in front than behind, highest near the middle, the height being equal to more than half the length; anterior extremity evenly rounded, posterior produced in the middle into a wide, obtusely rounded beak, above which it is rather deeply excavated, nearly straight below and looking obliquely backwards and downwards, dorsal margin boldly arched, ventral convex behind and almost straight in front; seen from above, almost like *Cytheropteron abyssorum*, but narrower in proportion to the length; the end view is much broader and more rounded dorsally than in *Cytheropteron abyssorum*, while the ventral surface is rather deeply indented, and the angles, instead of being produced, are rounded off. The lateral surface of the shell is thickly beset with subangular excavations, and the ventral surface is longitudinally furrowed. Length, 1-35th of an inch (·75 mm.).

Found off Christmas Harbour, Kerguelen Island, in a depth of 120 fathoms (Station 149), and off Heard Island in 75 fathoms (Station 151).

Though bearing considerable resemblance to the northern species *Cytheropteron latissimum* (Norman), this is easily distinguished by the character of the surface-sculpture, which shows no tendency to run into transverse grooves; the lateral alæ, too, are considerably more prominent.

[Pl. XXXIV. fig. 2, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. All magnified 50 diameters.]

7. *Cytheropteron patagoniense*, n. sp. (Pl. XXXIII. fig. 7, *a–d*).

Carapace tumid; seen from the side, irregularly rhomboidal, highest a little in front of the middle, height equal to two-thirds of the length, anterior extremity scarcely rounded, depressed, posterior produced in the middle into a narrow truncated beak; dorsal margin high in the middle, irregularly angular, sloping steeply toward the front, but more gently behind, ventral slightly protuberant behind the middle; seen from above, the outline is broadly ovate, widest near the middle, width about equal to the height, extremities obtusely pointed; seen endwise, the outline is subtriangular, the ventral line strongly convex, the apex obtuse. Surface of the valves marked by a broad, rounded, and encircling ridge, which is best developed towards the anterior and ventral margins, the space thus enclosed being crossed obliquely near the middle by another similar ridge, and marked also with numerous small circular impressed punctures; the ventral surface shows similar pittings arranged in curved longitudinal lines. Length, 1-50th of an inch (·5 mm.).

A few valves found in a sounding from 160 fathoms off the Coast of Patagonia (Station 305). Approaching closely in general appearance to *Cytheropteron nodosum*, Brady (a European species), but much more angular in outline and more tumid; different also in some minor details of surface-sculpture.

[Pl. XXXIII. fig. 7, *a–d*. *a* Right valve seen from side, *b* from above, *c* from below, *d* from front. All magnified 60 diameters.]

8. *Cytheropteron fenestratum*, n. sp. (Pl. XXXIV. fig. 6, *a–d*).

Shell, seen from the side, oblong, subovate, much higher in front than behind, greatest height situated in the middle, and equal to more than half the length; anterior extremity broadly rounded and fringed with a series of twelve to fifteen short, broad, and nearly equal teeth; posterior extremity produced and narrowed, bordered with a squamous lamina, which is divided into a number of short, subequal teeth; dorsal margin boldly arched, rather flattened in the middle, and sloping steeply towards each extremity, ventral very slightly convex; seen from above, the outline is ovate, widest in the middle, the greatest width being fully equal to the height of the shell, the lateral margins are regularly and evenly convex, the extremities broad and subtruncate, with a bimucronate central projection, that of the posterior extremity being very large and stout; end view triangular, sides convex, base straight, with a deep sinuation on each side of the middle, basal angles rounded and slightly produced, apex much produced and subacute. The general surface of the shell is smooth, the sides evenly convex, the ventral surface flattened and irregularly nodulated; within the ventral margin of each valve, and along nearly its whole length, runs an elevated crest, which is pierced by numerous (20 to 30) circular foramina. Length, 1-22d of an inch (1·1 mm.).

Of this fine and very distinct species several specimens were obtained off Christmas Harbour, Kerguelen Island, in a depth of 120 fathoms (Station 149); also at Station 335, north of Tristan d'Acunha, lat. 32° 24′ S., long. 13° 5′ W., 1425 fathoms.

[Pl. XXXIV. fig. 6, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. All magnified 50 diameters.]

9. *Cytheropteron mucronalatum*, n. sp. (Pl. XXXIII. fig. 8, *a–d*).

In form very similar to the preceding species, but more robust and higher in proportion to its length, and devoid of the fenestrated alæform ridge; seen from the side, broadly subovate, height equal to more than two-thirds of the length; anterior extremity broadly rounded, irregularly and roughly dentate, posterior narrower, but not produced, and bearing a few blunt spines; dorsal margin very boldly arched, not flattened, highest in the middle, ventral gently convex; seen from above the outline is ovate, widest in the middle, width less than the height; the sides are irregularly convex, and converge gradually towards the front, but more abruptly behind, both extremities running out into broad obtusely mucronate projections; end view triangular, the sides only slightly convex, and much longer than the base, which is indented in the middle, angles acute; the general surface of the shell is smooth, sides evenly convex, ventral suface almost flat, except for a central longitudinal depression; within and parallel to the anterior and ventral margins of the valves runs an elevated ridge, which terminates not far from the posterior extremity of the shell in a strong, but not very long spinous projection. Length, 1-20th of an inch (1·3 mm.).

This species, though nowhere abundant, occurred in several dredgings—

Lat. 38° 25′ N.,	long. 35° 50′ W.,	1675 fathoms,	Station 70
„ 7° 45′ N.,	„ 144° 20′ E.,	1580 „	„ 224
„ 36° 10′ N.,	„ 178° 0′ E.,	2050 „	„ 246
„ 38° 6′ S.,	„ 88° 2′ W.,	1825 „	„ 296
„ 33° 42′ S.,	„ 78° 18′ W.,	1375 „	„ 300
„ 42° 43′ S.,	„ 82° 11′ W.,	1450 „	„ 302

From this list it appears that *Cytheropteron mucronalatum* is an inhabitant exclusively of deep water, these localities ranging from 1375 to 2050 fathoms, while, as to geographical distribution, the range is over the Pacific Ocean, from Japan to Patagonia; and probably also over the Atlantic, seeing that the neighbourhood of the Azores also yielded specimens.

[Pl. XXXIII. fig. 8, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. All magnified 50 diameters.]

Bythocythere, G. O. Sars (1865).

Valves subequal, smooth, or sparingly sculptured, almost destitute of hairs; thin and fragile; hinge-joint quite simple, or composed of a slight bar and furrow; no teeth. Anterior antennæ elongated, seven-jointed; the second joint large and thick, and bearing a seta on its anterior and posterior margins; the other joints suddenly much narrower, forming a long slender lash, which bears several setæ; penultimate joint linear, and destitute of setæ. Posterior antennæ tolerably robust, four-jointed; second joint large; flagellum long, biarticulate, its last joint long and setiform. Mandibles constricted above the distal extremity, and strongly toothed; palp four-jointed, bearing a well-developed branchial plate, which is set with numerous ciliated setæ. Terminal lobes of the first pair of jaws very short and thick; branchial plate large, ovate, bearing numerous marginal ciliated setæ, and at the base four long, deflexed simple setæ. Feet elongated, terminal claw very long and slender, second and third joints bearing each a short apical setæ; basal joint of the first pair furnished at the base with a small lobe which bears two very large and densely ciliated, and two smaller and simple setæ. Abdomen ending in a very large and acuminated process; postabdominal lobes narrow and bearing three hairs. Eyes mostly absent.

This genus is very nearly allied to *Cytheropteron*, and, like it, is represented in the Northern Seas, and in the British Post-Tertiary deposits, by two tolerably abundant species,—*Bythocythere simplex* (Norman), and *Bythocythere constricta*, G. O. Sars,—as well as by others which are less common.

1. *Bythocythere orientalis*, G. S. Brady (Pl. VI. fig. 6, *a–d*, and Pl. XXXII. fig. 2, *a–c*).

Bythocythere orientalis, Brady, Les Fonds de la Mer, tom. i. p. 159, pl. xvi. figs. 21–23.

The outline of the shell of this species is very closely similar to that next to be described (*Bythocythere arenacea*), differing from it chiefly in having the lateral view less acutely pointed behind, the surfaces, both ventral and lateral, less convex, and the shell quite devoid of tubercular ornamentation. The ventral surface is marked with irregular, sinuous, longitudinal furrows, and the general surface is vaguely undulated. Length, 1-48th of an inch (·52 mm.).

One or two detached valves only found in anchor mud, from a depth of 7 fathoms in Hong Kong Harbour, from which place the type-specimens also were brought. Specimens, perhaps referable to a variety of this species, were dredged in Torres' Straits, and are figured in Plate XXXII. fig. 2, *a–c*; their chief characteristic being a large tubercle on the dorsal portion of the valve.

[Pl. VI. fig. 6, *a–d*. *a* Right valve seen from side, *b* from above, *c* from below, *d* from front; magnified 60 diameters. Pl. XXXII. fig. 2, *a–c*. *a* Right valve seen from side, *b* from above, *c* from front; magnified 50 diameters.]

2. *Bythocythere arenacea*, n. sp. (Pl. XXXIII. fig. 3, *a–g*).

Carapace of the female, seen from the side, oblong, somewhat helmet-shaped, truncated in front, acutely pointed behind, height equal to about half the length; anterior extremity nearly straight, looking obliquely upwards, rounded off at the upper and lower angles, posterior extremity much produced, and ending in an acute median point; dorsal and ventral margins straight, and almost parallel; seen from above the lateral margins are strongly convex, converging with a gradual curve towards the front, and almost at a right angle behind the middle, then running backwards to form a broad, triangular, acutely pointed posterior projection; end-view quadrangular, broadest at the base, ventral line strongly convex, dorsal about one-third as long, and deeply concave, lateral margins moderately convex. The surface of the shell is covered with small tubercular elevations of a coarsely granular or arenaceous appearance; the lateral alæ are only moderately prominent, and end behind in a rounded angle. The shell of the male differs from that of the female chiefly in being more elongated and less tumid. Length, 1-37th of an inch (·7 mm.).

The characters of *Bythocythere arenacea*, both as to shape and surface markings, suffice to distinguish it very obviously from any other species. Several examples occurred in a dredging from Torres' Straits, lat. 11° 35′ S., long. 144° 3′ E., 155 fathoms (Station 185).

[Pl. XXXIII. fig. 3, *a–g*. *a* Carapace of female seen from left side, *b* from above, *c* from below, *d* from front; *e* male right valve seen laterally, *f* from below, *g* from front. All magnified 50 diameters.]

3. *Bythocythere pumilio*, n. sp. (Pl. XXXIII. fig. 4, *a–d*).

Carapace elongated, tumid, depressed; seen from the side, oblong, quadrangular, nearly equal in height throughout; height equal to less than half the length, anterior extremity subtruncate, scarcely rounded, posterior rather narrower, imperfectly rounded, obscurely dentated below the middle; dorsal margin nearly straight through its whole length, ventral slightly convex, dentate in front, ending behind in an alæform projection, which is mucronate at the angle; seen from above the contour is hexagonal, with parallel sides, the width equal to somewhat less than two-thirds of the length; sides converging equally and rather abruptly, and ending in a subacuminate process both in front and behind; the posterior margin is broken also by the projecting mucronate processes of the lateral alæ; end view irregularly quadrilateral, widest near the base, height equal to about two-thirds of the width only; dorsal line nearly flat, ventral deeply excavated in the middle, and ending in broad, well-rounded angles; lateral margins sinuated in the middle. The surface of the shell is onamented in a manner very similar to that of *Bythocythere arenacea*, but the ventral area is depressed, and marked with longitudinal furrows. Length, 1-66th of an inch (·39 mm.).

Found only at Balfour Bay, Kerguelen Island, in a depth of 20 to 50 fathoms (Station 149).

[Pl. XXXIII. fig. 4, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 80 diameters.]

4. *Bythocythere velifera*, n. sp. (Pl. XXXIII. fig. 5, *a–c*).

Valves, seen from the side, subrhomboidal, height equal to more than half the length, anterior extremity oblique, subtruncate, only slightly rounded, posterior looking obliquely downwards, almost straight, and ending above in an acute angle, dorsal margin straight, slightly curved downwards at the hinder end, ventral margin formed for the most part by a huge lateral ala which occupies the larger part of the inferior half of the valve, its lower border being nearly straight, the anterior joining the surface of the valve with a forwards curve, the posterior almost at a right angle; seen from below the lateral alæ form the entire central part of the shell, the extremities constituting two broad mucronate projections, the margins of the lateral alæ sweep forwards in a full curve from the posterior angle which is slightly produced, while behind they converge in a sinuated line, but almost at a right angle; the width of the complete shell would seem to be greater than the length, but single valves only have been seen. Surface smooth, and slightly undulated. Length, 1-48th of an inch (·52 mm.).

A few detached valves only found in Torres' Straits, lat. 11° 35′ S., long. 144° 3′ E., 155 fathoms.

[Pl. XXXIII. fig. 5, *a–c*. *a* Left valve seen from side, *b* from above, *c* from front. Magnified 50 diameters.]

5. *Bythocythere* (?) *exigua*, n. sp. (Pl. VI. fig. 7, *a–d*).

Carapace, seen from the side, subovate, smaller in front than behind, highest in the middle, the height being equal to more than half the length; anterior margin narrow, and imperfectly rounded, posterior broader, and more distinctly rounded; dorsal margin arched, slightly gibbous in the middle, ventral nearly straight behind the middle, then rather suddenly bent upwards towards the front; seen from above, the outline is broadly oval, widest in the middle, margins fully curved, anterior extremity obtuse, scarcely pointed, posterior narrow, subtruncate and emarginate in the middle, width equal to the height; end view almost circular, slightly keeled in the middle of the ventral margin.

The surface of the shell is smooth, and faintly marked out into polygonal areolæ, the line of junction of the valves on the dorsal surface is depressed in front of and behind the middle, while the contact margins on the ventral surface are produced into a longitudinal keel. Length, 1-55th of an inch (·44 mm.).

This species, which, probably, when the anatomical structure is known, will have to be made the type of a new genus, was found in a dredging from the Straits of Magellan, lat. 52° 20′ S., long. 68° 0′ W., depth 55 fathoms (Station 313).

[Pl. VI. fig. 7, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 80 diameters.]

Pseudocythere, G. O. Sars (1865).

Shell thin, pellucid, compressed, rounded in front, produced behind; hinge-joint simple. Anterior antennæ bearing several long setæ, seven-jointed; second joint stout, having a single seta on the middle of the anterior border, last joint narrow, long, and bearing very long apical setæ; posterior antennæ very slender, five-jointed, flagellum long and slender. Mandibles small, with slender curved claw-like teeth, palp narrow, four-jointed; branchial appendage bearing long setæ. Terminal lobes of the first pair of jaws narrow, and having a large elongated ovate branchial plate, which is provided at the base with three curved and deflexed setæ. Feet very long and slender; abdomen ending in a long slender process; postabdominal lobes narrow and setiferous. No eye.

Though differing from *Bythocythere* to some small extent in anatomical details, this genus is perhaps more distinctly characterised by the structure of the shell, which is extremely thin and delicate, nearly or quite devoid of sculptured ornament or definite microscopic structure, and very much compressed. As regards the species at present known to us, there is no difficulty in locating accurately the members of these two genera, but they approach each other so closely that if, as is most likely, new and intermediate species come to light, it may become impracticable to maintain the separation.

The genus *Pseudocythere* is widely distributed, occurring in the European Seas as well as in those distant regions of the Southern Hemisphere here noted.

As a fossil it has been recognised only in the Post-Tertiary deposits of the British Islands.

1. *Pseudocythere caudata*, G. O. Sars (Pl. I. fig. 6, *a–d*).

Pseudocythere caudata, Sars, Oversigt Norges marine Ostrac., p. 88.
Pseudocythere caudata, Brady, Monog. Recent Brit. Ostrac., p. 453, pl. xxxiv. figs. 49–52, pl. xli. fig. 6.
Pseudocythere caudata, Brady, Crosskey, and Robertson, Post-Tertiary Entomostraca, p. 210, pl. ii. fig. 9.

Carapace compressed, elongated; seen from the side, oblong, subquadrate, scarcely higher in front than behind; height equal to half the length; anterior extremity evenly rounded, posterior oblique, subtruncate, much compressed, so as to form a thin marginal flange, and produced at the upper angle into a broad, blunt beak, obtusely angulated at its junction with the ventral margin; dorsal margin quite straight, ventral straight in front, and suddenly bent upwards behind the middle; seen from above, the outline is narrow, ovate, widest in the middle, tapering to the extremities, both of which are acuminate, the posterior much attenuated; width equal to rather more than one-third of the length; end view subovate, compressed towards the apex, and strongly mucronate in the middle of the broad ventral border, width equal to two-thirds of the length. Shell perfectly smooth, thin, translucent, colourless or straw-coloured, with blotches of darker brown. Length, 1-40th of an inch (·65 mm.).

This species was noted in dredgings from Balfour Bay, 20 to 50 fathoms; and Christmas Harbour, 120 fathoms, both in Kerguelen Island (Station 149); also from off Prince Edward's Island, 50 to 150 fathoms, and from lat. 35° 39′ S., long. 50° 47′ W., 1900 fathoms (Station 323). The published figures of *Pseudocythere caudata*, in the Monographs of Recent British Ostracoda, and of the Post-Tertiary Entomostraca have been drawn from specimens higher in front, and more compressed laterally than those found in the Challenger dredgings,[1] so that I was at first disposed to refer the latter to a different species, but a re-examination of several sets of British specimens has shown that there is among them considerable variety in shape, and that the published drawings have been done from rather extreme examples as regards the development of the particular characters above referred to. I therefore believe that all, both Northern and Southern, ought to be referred to one species, *Pseudocythere caudata*.

[Pl. I. fig. 6, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

2. *Pseudocythere fuegiensis*, n. sp. (Pl. I. fig. 7, *a–d*).

Carapace compressed, elongated; seen from the side, subrhomboidal, rather higher in front than behind, height less than one-half of the length; anterior extremity broadly and obliquely rounded, posterior narrowed and produced in the middle into a broad conical beak; dorsal margin straight, ventral sinuated in front of the middle; seen from above, the outline is ovate, with compressed acuminate extremities, width about equal to the height; end view subcircular. Surface of the shell marked on the posterior half with delicate longitudinal striæ. Length, 1-22d of an inch (1·1 mm.).

One specimen found in a dredging from a depth of 245 fathoms in lat. 52° 50′ S., long. 73° 53′ W.

[Pl. I. fig. 7, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 35 diameters.]

[1] Perhaps sexual characters, or perhaps dependent on growth, but of this I am not at present able to speak positively.

Cytherideis, Jones.

Cytherideis, Jones, Post-Tert. Entom., 1856; Brady, Monog. Recent Brit. Ostrac., 1868; Brady, Crosskey, and Robertson, Post-Tertiary Entom., 1874.

Shell elongated, depressed in front, hinge-margins nearly simple; surface smooth, slightly punctate or grooved; right valve overlapping the left in the middle of the ventral surface. Anterior antennæ five-jointed, slender, sparingly and shortly setiferous; last three joints short, and bearing six tumid setæ; penultimate and antepenultimate joints, each with a single apical seta. Mandibles slender, curved, divided at the apex into about four very small indistinct teeth; palp four-jointed, bearing on the lower margin of the first joint a conical tooth-like process; third joint set along its entire length with a comb-like series of straight equal setæ, and bearing one large branchial seta; in other respects like *Cythere*. First segment of the maxillæ much stouter and larger than the rest, bearing a large branchial plate. The first pair of feet bear on the basal joint a large and stout ciliated process.

The animals belonging to the restricted genus *Cytherideis* are sufficiently well characterised both as to shell-structure and internal anatomy: only one species, however, the British *Cytherideis subulata*, has yet been submitted to any anatomical investigation,[1] and this by no means a complete one. A few details are here added to the generic description from further dissections of fresh specimens which I have, fortunately, had the opportunity of making, but more yet remains to be done. The Challenger specimens are very few, and seem to be all empty shells.

The genus is widely distributed, species having been described from the British Seas, the Mediterranean, the Gulf of St Lawrence, and the Atlantic, in addition to those noticed in the present memoir. It is probable, too, that not a few fossil species described by various palæontologists may belong here. The forms originally referred to *Cytherideis* by Professor T. Rupert Jones belong evidently to several distinct genera.[2]

1 *Cytherideis lævata*, n. sp. (Pl. VI. fig. 5, *a–d*, and Pl. XXXV. fig. 6, *a–d*).

Carapace elongated, compressed, cylindrical; seen from the side, oblong, equal in height throughout, extremities rather oblique and only slightly rounded; dorsal and ventral margins quite straight and parallel, height rather more than one-third of the length; seen from above, somewhat club-shaped, tapering a little toward the front, width greatest behind the middle, and equal to one-third of the length, broadly pointed in front, rounded off behind; end view nearly circular; surface of the shell perfectly smooth. Length 1-32d of an inch (·775 mm.).

[1] See Brady and Robertson on the Distribution of the British Ostracoda in Ann. and Mag. Nat. Hist., ser. 4, vol. ix. (1872).

[2] The name *Cytherideis nana* given in previous pages of this Report (pp. 11, 23) should have been erased. It refers to specimens whose characters are not distinct enough to be made the basis of a new species.

Dredged off Heard Island, in a depth of 75 fathoms. Mud. (Station 151.)

[Pl. XXXV. fig. 6, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

Sclerochilus, G. O. Sars (1865).

Valves elongated, very hard, especially towards the margins; surface smooth and shining, ornamented with minute scattered papillæ. Hinge-joint formed by a projecting median crest of the left valve. Muscle-spots linear, subparallel, arranged in an oblique oval patch below the centre of the valve. Antennæ robust; the anterior bearing on each side of its second joint a single seta, its last five joints successively smaller, and bearing numerous long setæ; posterior antennæ larger than the anterior, five-jointed, flagellum very long and slender. Poison-glands very large, and divided into several lobes. Mouth produced, conical; labrum strongly toothed. Mandibles small, teeth numerous and sharp; palp narrow, indistinctly three-jointed, and having a distinct branchial appendage. Terminal lobes of the first pair of jaws partly wanting; branchial plate narrow, almost lanceolate, and beset with numerous setæ on the outer and inner margins. Feet short and robust, second and third joints bearing in front a sharp seta; first pair armed with a single strong spine at the apex of the basal joint. Post-abdominal lobes larger than usual, forming two broad bilobed laminæ, each bearing five setæ. Eye single.

To this genus we can with certainty refer only the single species here noticed; a species which is, however, generally distributed on the Atlantic shores of Europe, reaching as far north as Spitzbergen. It occurs abundantly in almost all the Post-Tertiary beds of Great Britain and Ireland, as well as in those of Norway and Canada.

1. *Sclerochilus contortus* (Norman), (Pl. XXXV. fig. 8, *a*, *b*).

Cythere contorta, Norman, Ann. and Mag. Nat. Hist., vol. ix. p. 48, pl. ii. fig. 15; Trans. Tyneside Nat. Field Club, vol. v. p. 150, pl. iii. fig. 15 (1862).
Sclerochilus contortus, Sars, Oversigt. Norges marine Ostrac., p. 90 (1865).
Sclerochilus contortus, Brady, Mong. Rec. Brit. Ostr., p. 455, pl. xxxiv. figs. 5–10, and pl xli. fig. 7.
Sclerochilus contortus, Brady, Crosskey, and Robertson, Monog. Post-Tertiary Entom., p. 212, pl. x. figs. 33–35.

Carapace, as seen from the side, elongated, bean-shaped, higher behind than in front, height equal to about half the length; extremities well rounded, dorsal margin boldly arched, inferior deeply sinuated in front of the middle; seen from above, compressed, ovate, extremities acutely pointed, width scarcely equal to one-third of the length; end view ovate, rounded above, pointed below. Shell perfectly smooth. Length, 1-33d of an inch (·77 mm.).

Several specimens, all consisting of separated valves, were found in dredgings from Balfour Bay, Kerguelen Island, 20–50 fathoms; from off Heard Island, 75 fathoms; from Wellington Harbour, New Zealand (in tow-net at trawl).

[Pl. XXXV. fig. 8, *a*, *b*. *a* Right valve seen laterally, *b* the same from above. Magnified 50 diameters.]

Xiphichilus, Brady.

Xiphichilus, Brady, Nat. Hist. Trans. Northumberland and Durham, vol. iii. (1870).
Bythocythere, Norman, British Association Report (1868).

Shell thin and fragile, smooth; valves compressed, elongated, pointed at both ends, nearly equal; ventral margins much compressed, forming a flattened, knife-like plate, which is widest behind the middle, and often marked by several transverse hair-like lines; seen from above, compressed, bifusiform; hinge simple. Limbs excessively long and slender; anterior antennæ six-jointed and quite destitute of setæ; posterior sparingly setiferous. Mandibles very long and slender, styliform; palp (?) biarticulate, slender, and terminating in two long setæ. Abdomen produced into two long tapering processes.

1. *Xiphichilus complanatus*, n. sp. (Pl. XXXV. fig, 4, *a–d*).

Shell much compressed, elongated; seen from the side, oblong, subovate, highest behind the middle, height scarcely equal to half the length; anterior extremity narrow, rounded; posterior produced in the middle into an acute angle; dorsal margin boldly arched, highest behind the middle, ventral margin straight; seen from above, the outline is excessively compressed, somewhat lozenge-shaped, with subacute extremities, greatest width in the middle, and equal to somewhat less than one-fourth of the length; end view ovate, produced below into a keel-like flange. Surface of the shell perfectly smooth. Length, 1-33d of an inch (·77 mm.).

Found in a dredging from Christmas Harbour, Kerguelen Island, 120 fathoms.

[Pl. XXXV. fig. 4, *a–d*. *a* Carapace seen from the left side, *b* from above, *c* from below, *d* from front. Magnified 50 diameters.]

2. *Xiphichilus* (?) *arcuatus*, n. sp. (Pl. XXXV. fig. 2, *a–d*).

Carapace, seen from the side, subarcuate, height greatest in the middle, and equal to rather more than one-third of the length; extremities subacute; dorsal margin forming a continuous arch between the two extremities of the ventral margin, with which it forms an obtuse anterior and a subacute posterior angle; ventral margin rather convex; seen from above, compressed, ovate, widest in the middle, more than thrice as long as broad, extremities subacute; end view ovate, broad on the dorsal, and tapering to a keel at the ventral border. Shell-surface quite smooth. Length, 1-45th of an inch (·53 mm.).

This species was observed only in a dredging from lat. 19° 10′ S., long. 178° 10′ E.; 610 fathoms; bottom of globigerina ooze.

[Pl. XXXV. fig. 2, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

Paradoxostoma, Fischer.

Paradoxostoma, Fischer, Abhandl. d. Kgl. bayerisden Akad. d. Wissenschaften, Bd. vii. (1855).

Shell thin and fragile, smooth, shining, and having no definite structure; valves subequal, mostly much higher behind than in front, usually elongate-ovate. Muscle-spots as in *Sclerochilus*. Hingement simple; ventral margins emarginate in front, so that when the valves are closed there is still an elongated orifice through which the suctorial mouth can be protruded. Anterior antennæ extremely slender, six-jointed, and armed with short setæ; posterior shorter and more robust, five-jointed; flagellum large, and almost as thick as the antenna itself. Poison-glands large, and mostly lobulated. Mouth suctorial. Labrum and labium forming together a large and stout subconical process projecting downwards, and terminating in a disk, with elevated margins, in the middle of which is the orifice of the mouth. Mandibles very slender, protractile, styliform, subulate at the apex; palp very slender and elongated, indistinctly jointed, and without a branchial appendage. Terminal lobes of the first pair of jaws very narrow, branchial plate elongate-ovate, and bearing at the base two deflexed setæ. Feet short and robust, last joint elongated, and bearing a very short, curved, terminal claw; basal joint of the first pair armed at the apex with a single strong spine. Postabdominal lobes bearing two short hairs. One eye.

Not many examples of this genus have been found in the Challenger dredgings, nor is this to be wondered at, seeing that, in the British Seas at any rate, its members haunt almost exclusively the littoral and laminarian zones. Fourteen recent British species are known to us, and Sars has described seven from Norway, some of which are identical with British species; eight species (two of which are rather dubious) have been recognised in the British Post-Tertiary formations; but from other parts of the world we have no record of the occurrence of the genus, except in Dr Fischer's memoir, where one species only (*Păradoxostoma dispar*) is described. The foreign gatherings which have hitherto been described are exclusively from deep water; when littoral gatherings come to be examined, there can be no doubt that we shall have numerous examples of *Paradoxostoma*. We may, indeed, expect, considering the beautifully marked shells of many northern species, that among the sea-weed beds of the tropics wonderfully coloured species may possibly abound; the colouring of the shells of Ostracoda seeming to depend very largely upon that of the plants amongst which they live, and on which, in all probability, some of them, and especially *Paradoxostoma*, feed.

It is not a little remarkable that one of the two species described in this monograph (*Paradoxostoma ensiforme*) is from a European dredging, and is a well known European species, while the other, also known as an inhabitant of Europe, is from Kerguelen Island, a locality which, of all others, has shown in its entomostracan fauna a close resemblance to that of Europe.

1. *Paradoxostoma ensiforme*, G. S. Brady (Pl. XXXV. fig. 3, *a–d*).

Paradoxostoma ensiforme, Brady, Monog. Recent Brit. Ostrac., p. 460, pl. xxxv. figs. 8–11; *Paradoxostoma ensiforme*, Brady, Crosskey, and Robertson, Monog. Post-Tertiary Entom., p. 215, pl. x. figs. 27, 28.

Carapace, as seen from the side,[1] pear-shaped, much lower in front than behind; greatest height somewhat less than half the length, and situated behind the middle; anterior extremity attenuated and sharply rounded off, posterior more broadly rounded and almost angulated in the middle; dorsal margin forming a flattened arch, suddenly sloping and slightly sinuated towards the front, ventral margin nearly straight; seen from above, regularly ovate, widest in the middle, extremities equal and acuminate, thrice as long as broad; end view ovate, broadly rounded above, pointed below. Surface of the shell quite smooth. Length, 1-33d of an inch (·77 mm.).

Found only in mud brought up by the anchor in Vigo Bay from a depth of 11 fathoms.

[Pl. XXXV. fig. 3, *a–d*. *a* Carapace seen from right side, *b* from above, *c* from below, *d* from behind. Magnified 50 diameters.]

2. *Paradoxostoma abbreviatum*, G. O. Sars (Pl. XXXV. fig. 1, *a–d*).

Paradoxostoma abbreviatum, G. O. Sars, Oversigt af Norges marine Ostracoder, p. 94.
Paradoxostoma abbreviatum, Brady, Monog. Recent Brit. Ostrac., p. 458, pl. xxxv. figs. 22–25.
Paradoxostoma abbreviatum, Brady, Crosskey, and Robertson, Monog. Post-Tertiary Entomostr., p. 214.

Carapace, as seen from the side, broadly pear-shaped, highest near the hinder end, height equal to more than half the length; extremities rounded, anterior narrow and depressed, posterior very broad; dorsal margin boldly arched, ventral sinuated in the middle; seen from above, ovate, pointed in front, rounded off behind, greatest width in the middle and equal to one-third of the length; end view ovate, broad above, attenuated below; surface of the shell quite smooth. Length, 1-45th of an inch (·53 mm.).

One or two examples only found in a dredging from Balfour Bay, Kerguelen Island, 20 to 50 fathoms. Though agreeing in general features with *Paradoxostoma abbreviatum*, Sars, these specimens differ in having a more highly arched dorsum and a straighter ventral margin. Still, as no very decided characters appear, and as no sufficient series of specimens of the Balfour Bay form is at hand for comparison, it seems best to identify them, for the present at least, with the European species.

[1] The figures (Pl. XXXV. figs. 1 and 3, *a*, *b*, *c*) are by an oversight placed upside down, the anterior extremity being turned downwards instead of upwards.

[Pl. XXXV. fig. 1, *a–d*. *a* Carapace seen from right side, *b* from above, *c* from below, *d* from behind. Magnified 60 diameters].

Section MYODOCOPA.

Family I. Cypridinidæ, Baird.

Shell mostly hard and compact in structure (sometimes thin and flexible), usually smooth or finely punctate, but sometimes cavernous and strongly ribbed, notched at the antero-inferior angle, so that when the valves are closed there remains a large aperture for the protrusion of the antennæ. Anterior antennæ large, geniculated at the base, many-jointed, and having several long ringed setæ. Basal portion of the posterior antennæ broadly triangular, bearing a small secondary branch (different in the two sexes), and a large natatory branch, which is mostly nine-jointed, and bears several long ciliated setæ. Mandibles rudimentary, the palp very large, geniculated, pediform, four-jointed; first joint large and thick, bearing at the apex a slightly setose appendage like a rudimentary branchial plate; last joint very short and strongly clawed. Three pairs of subpediform jaws, the first pair having four spinous lobes, of which the external is largest and two-jointed, its first joint large, elongated, and subquadrangular, last very short, and beset with numerous spines or claws; second pair short and stout, composed of several setose or unguiculate segments; external segment short, three-lobed, beset with short, finely-ciliated setæ, and bearing at the base a very large semilinear branchial plate, which is provided with numerous marginal setæ; third pair smaller, composed of three spinous lobes, beneath which is a membranous subovate plate, bearing numerous finely-ciliated setæ. Feet, one pair only, forming a very long, flexuous, subcylindrical annulose body, and armed towards the apex with long prickly spines. Postabdomen large, composed of two broad closely adpressed laminæ, and armed on the posterior margin with a series of strong curved claws. Two compound pedunculated eyes, between which is a large simple eye, and a short cylindrical tentacle. Male of less height than the female; eyes more developed; copulative organs of complex structure; ova and embryos borne beneath the shell of the female.

The Cypridinidæ, owing to their considerable size and frequent capture in the surface-net, have attracted more general attention from zoologists than any other division of the Ostracoda; but, compared with the Cypridæ and Cytheridæ, the number both of species and individuals is very small. They appear to be most abundant in the warm surface-waters of the tropical seas, contributing largely to the phosphorescence of those regions. The males only (at any rate of those species which have been thoroughly examined) are endowed with swimming power, the females being non-natatory, and passing their lives wholly at the bottom, a condition imposed upon them by the absence of the tuft of long filaments attached to the first pair of antennæ which is characteristic of the males. The shape of the shell, too, is usually very different in the two sexes, the male being very long and slender in comparison with the female. Judging from the large number of fossil species belonging to this family which have been found in the Coal Measures[1] and other Palæozoic formations, we must suppose that the Cypridinidæ were much more abundant in old times than now; we may, perhaps, likewise infer that they were chiefly inhabitants of shallow warm water, possibly of brackish and estuarine localities. Some few species have been described from Cretaceous and Tertiary strata, but it would appear that the group attained its greatest development in the Carboniferous era, and has been gradually losing ground since that time, until it has in our days come to be almost swamped by the smaller, hardier, and, doubtless, also more prolific species of the families Cypridæ and Cytheridæ, animals evidently of much more plastic organisation, and more capable of adaptation to varied conditions of environment.

The following list comprises, so far as I know, all the recent species hitherto described. Of these the shell only has in many cases been examined, and in many more the contained animal, though partially described, has not been observed with sufficient accuracy to allow of certain generic reference. Several of the numerous forms here noted as *Cypridinæ* will, doubtless, when better known, be ranged under other genera.

Cypridina reynaudi, M. Edwards, 1840, Hist. Nat. Crust., tom. iii. p. 409, t. xxxvi. fig. 5 (Indian Ocean).

Cypridina (*Asterope*?) *adamsi*, Baird, 1848, Ann. and Mag. Nat. Hist., 2d series, vol. i. pl. viii. (South Atlantic).

Cypridina (?) *bimaculata*, Nicolet, 1849. (Marshes of Chile.)
Cypris bimaculata, Nicolet, Gay, Hist. Fisica y politica de Chile, t. iv. fig. 66.

Cypridina (?) *cærulea*, Nicolet, 1849. (Marshes of Chile.)
Cypris cærulea, Nicolet, Gay, Hist. Fisica de Chile, t. iv. fig. 66.

Cypridina zealandica, Baird, 1851, Proc. Zool. Soc. (Annulosa), t. xvii. figs. 11–13 (New Zealand).

Cypridina (?) *gibbosa*, Dana, 1853, Crustacea of United States' Exploring Expedition, p. 1295, t. xci. fig. 4 (Pacific Ocean).

Cypridina (?) *formosa*, Dana, 1853, Crustacea, United States' Exploring Expedition, p. 1296, t. xci. fig. 5 (Samoan Islands).

[1] See Jones and Kirkby, Entomostraca of the Carboniferous Formations (Palæontographical Society, 1874).

Cypridina (?) *luteola*, Dana, 1853, Crustacea, United States' Exploring Expedition, p. 1291, t. xci. fig. 1 (Sooloo Sea).

Cypridina (?) *punctata*, Dana, 1853, Crust., United States' Exploring Expedition, p. 1293, pl. xci. fig. 2 (Sooloo Sea).

Cypridina norvegica, Baird, 1860, Proc. Zool. Soc., part 28, p. 200, pl. lxxi. fig. 4, *a–d* (Norway and Shetland).

Cypridina (?) *godehevi*, Baird, 1860, Proc. Zool. Soc., part 28, p. 200, pl. lxxi. fig. 2, *a–c* (Madras).

Cypridina (?) *ovum*, Baird, 1860, Proc. Zool. Soc., part 28, p. 201, pl. lxxi. fig. 3, *a–b* (China).

Cypridina (?) *albo-maculata*, Baird, 1860, Proc. Zool. Soc., part 28, p. 201, fig. 1, *a–d* (Swan River, Australia).

Cypridina messinensis, Claus, 1865, Über die Organization der Cypridinen, Zeitsch. f. Wissensch. Zool., Bd. xv. p. 143, &c., pl. x. (Mediterranean).

Cypridina megalops, G. O. Sars, 1871, Undersögelser over Hardangerfiordens Fauna, I. Crustacea, p. 35 (Norway).

Cypridina (?) *japonica*, Brady, 1866, Trans. Zool. Soc., vol. v. p. 386, pl. lxii. fig. 8, *a–d* (Japan).

Cypridina (?) *elongata*, Brady, 1860, ibid., fig. 9, *a–d* (China).

Cypridina (?) *bairdi*, Brady, 1866, ibid., fig. 7, *a–m* (China).

Bradycinetus brenda, Baird, 1850 (North Atlantic, German Ocean, Bay of Fundy, Bay of Biscay).

Cypridina brenda, Baird, British Entomostraca, p. 181, pl. xxiii. fig. 1.

Cypridina excisa, Stimpson, Invertebrata of Grand Manan, Smithson. Contrib. to Knowledge, pl. ii. fig. 28, 1854 (see Baird, Proc. Zool. Soc., 1860, p. 200).

Cypridina globosa, ♀ Lilljeborg, De Crustaceis ex ordinibus tribus, Cladoc., Ostrac., and Copep. in Scaniâ occurrentibus, p. 171, t. xvii., figs. 2–10 (1853).

Bradycinetus globosus, ♀ G. O. Sars, Oversigt af Norges Ostrac., 1865.

Bradycinetus brenda, ♀ G. S. Brady, Monograph of Recent British Ostracoda, 1868.

Asterope grœnlandica, ♂ Fischer, Beitrage zur Kentniss der ostracoden (Abhandl. d. Konigl. Bayerisch. akad. der Wissenschaft, Bd. vii. p. 660, t. xx., figs. 26–34, 1854).

Philomedes globosus, Lillejeborg, 1875, De under svenska vetenskalpiga expeditionen till Spetsbergen, 1872–73, derstädes samlade Haf's Entomostraceer, p. 3.

Bradycinetus macandrei, Baird, 1848 (North Atlantic).

Cypridina macandrei, Baird, Ann. and Mag. Nat. Hist., 2d ser., vol. i. p. 21, pl. vi. B. fig. 1–7.

Bradycinetus lilljeborgi, G. O. Sars, 1865, Oversigt af Norges marine Ostracoder, p. 112 (Norway and North Atlantic).

Eurypylus petrosus, Brady, 1869, Les Fonds de la Mer, p. 141, pl. xviii. fig. 12 (St Vincent, Cape Verde).

Philomedes interpuncta, Baird, 1850 (Atlantic, North Sea, Bay of Biscay).

Cypridina interpuncta, ♂ Baird, Proc. Zool. Soc., part 18, p. 257, pl. xvii. figs. 8–10 (Annulosa).
Philomedes longicornis, Lilljeborg, De Crustaceis ex ord. trib., 1853.

Philomedes folini, Brady, 1871, Proc. Zool. Soc., 1871, p. 294, pl. xxvii. (Bay of Biscay).

Asterope mariæ, Baird, 1850 (North Atlantic, English Channel, Bay of Biscay).

Cypridina mariæ, Baird, Proc. Zool, Soc., 1850, p. 257, Annulosa, pl. xvii. figs. 5–7.
Cylindroleberis mariæ, Brady, Monog. Recent Brit. Ostrac., Trans. Lin. Soc., vol. xxvi. p. 465, pl. xxxiii. figs. 18–22, pl. xli. fig. 1.
Asterope mariæ, Brady, Proc. Zool., 1871, p. 295.

Asterope elliptica, Philippi, 1840, Archiv. für naturgeschicht, 1840, p. 188, pl. iii. figs. 9–11; Ann. and Mag. Nat. Hist., vol. vi. p. 94, pl. iii. figs. 9–11 (Mediterranean).

Asterope oblonga, Grube, 1859.

Cypridina oblonga, Grube, Archiv. f. naturg., 1859, p. 335, t. xii. figs. 2, 3; *idem*. Ein Ausflug. nach Triest und dem Quarnero, p. 93, &c., pl. v. (= *Asterope mariæ*?).

Asterope teres, Norman, 1861 (North Atlantic, English Channel).

Cypridina teres, Norman, Ann. and Mag. Nat. Hist., ser. 3, 1861, vol. viii. p. 280, pl. xiv. fig. 10.
Cylindroleberis teres, Brady, Trans. Lin. Soc., 1868, vol. xxvi. p. 465, pl. xxxiii. figs. 6–9, pl. xli. fig. 2, 1868.
Asterope teres, Brady, Proc. Zool. Soc., 1871, p. 295.

Asterope abyssicola, G. O. Sars. 1869, Nye Dybvandscrustaceer fra Lofoten, p. 26 (Norway).

Asterope norvegica, G. O. Sars, 1869, Undersögelser over Christianiafiordens Dybvandsfauna, p. 53 (Norway).

Asterope (?) *olivacea*, Dana, 1853 (Sooloo Sea).

Cypridina olivacea, Dana, Crustacea, United States' Exploring Expedition, p. 1294, pl. xci. fig. 3.

Asterope (?) *mediterranea*, Costa, 1845, Illustraz. Cypridina, &c., Dons Acad. Pontan. agli Scienz. d'Ital., p. 57, pl. i. figs. 1–13 (Mediterranean).

Cypridina, Milne-Edwards.

Cypridina, Milne Edwards (1838), Baird (1840), Dana (1855), Claus (1865), Brady (1866–71), Sars (1865).
Cyprella, Bosquet, 1847.
Daphnia, M'Coy, 1844.

Shell smooth, thin, and usually flexible; notch shallow, shell above the notch curved, and more or less sharply uncinate, rounded off below; posterior extremity rounded, or slightly exserted. Anterior antennæ seven-jointed, and bearing a few setæ of moderate length, the fifth joint, however, having one long apical seta; natatory branch of posterior antenna nine-jointed, each joint bearing a single long ciliated seta, except the first, which has none, and the last which has four; secondary branch slender, two or three-jointed. Basal joint of the mandibular foot (the mandible proper), bearing a subconical and densely hairy process; penultimate joint much elongated, and beset on the inner margin with numerous ringed setæ, last joint very short and almost obsolete. Outer lobe of the first pair of jaws provided with a narrow membranous appendage; second pair having two strongly ungulate segments. Eyes widely separated and situated against the central portion of each valve, deeply coloured, and much larger in the male than the female. The oviparous foot is divided into unequal uncinate processes at the apex, and on its distal half bears numerous long divaricating lateral setæ, which are dentated towards the apex, the teeth being opposite, and directed forwards, thus giving the appearance of a number of inverted arrow-heads. The distinctive character of the restricted genus *Cypridina* (as defined by G. O. Sars, whose description is followed with some little modification in the foregoing diagnosis) is the conical process attached to the base of the mandibular foot. It is perhaps doubtful whether the type species, described by Milne-Edwards, really belongs to the genus as thus restricted. Sars, however, excepts *Cypridina luteola*, Dana, *Cypridina messinensis*, Claus, and *Cypridina norvegica*, Baird, as members of the genus, and has himself described another species, *Cypridina megalops*.[1] Probably also *Cypridina japonica*,[2] Brady, may be taken for a true *Cypridina*.

1. *Cypridina formosa* (?), Dana (Pl. XLII. figs. 9–11).

Cypridina formosa, Dana, Crustacea of the United States' Exploring Expedition, p. 1296, pl. xci. fig. 5.

Shell thin and flexible, reticulated in structure, dark brown in colour; seen from the side, broadly oval, height equal to about three-fourths of the length, notch of moderate depth, and situated near the middle of the anterior margin; posterior extremity broadly rounded, and produced in the middle into a broad obtusely rounded prominence; dorsal and ventral margins boldly arched, ventral the more convex of the two; seen from above

[1] Undersögelser over Hardangerfjordlen's Fauna, 1871. [2] Trans. Zool. Soc., vol. v., 1865.

the outline is regularly ovate. Length, 1-14th of an inch (1·8 mm.); height, 1-17th of an inch (1·5 mm.).

Two specimens taken in the surface-net at Zamboangan, 25th October 1874.

This species belongs probably to the restricted genus *Cypridina,* but the dissection of a single very imperfect specimen has not been sufficient to settle the matter. Dana's description, penned long before the researches of G. O. Sars had led to the breaking up of the old genus *Cypridina,* is not sufficiently minute to help much, even if one were quite sure that it referred to the species here described. The resemblance to Dana's figures is, however, so close that we need scarcely entertain much doubt as to its identity.

[Pl. XLII. figs. 9–11. 9 Carapace seen from left side, magnified 40 diameters; 10 Portion of shell showing reticulated structure; 11 Secondary branch of posterior antenna.]

2. *Cypridina gracilis,* n. sp. (Pl. XXXVII. figs. 1–11).

Carapace oblong, ovate; seen from the side, rather narrower in front than behind, height equal to two-thirds of the length; notch of moderate size, beak short and sharp, posterior extremity broadly and evenly rounded, anterior considerably narrower, dorsal and ventral margins regularly and moderately arched; seen from above, the outline is compressed, ovate, rather narrower in front than behind, more than twice as long as broad; end view ovate, width equal to two-thirds of the height, rounded on the dorsal, and somewhat narrowed towards the ventral, margin. Surface of the shell quite smooth. The first and second joints of the anterior antennæ (fig. 4), are much the largest, the fourth and fifth considerably smaller, the third, sixth, and seventh, the smallest of all. The second joint of the mandibular foot (fig. 6) has at the apex two separate setæ, and a slender short bisetose appendage; the fourth joint is much elongated, constricted in the middle, and bears on its outer edge a series of about eight setæ. Length of the shell 1-5th of an inch (5 mm.).

Dredged in a depth of 1000 fathoms, lat. 37° 24′ N., long. 25° 13′ W., bottom of globigerina ooze (Station 78).

[Pl. XXXVII. figs. 1–11. 1 Carapace seen from right side, 2 from above, 3 from front (magnified 9 diameters), 4 anterior antenna, 5 posterior antenna, 6 mandibular foot, 7 first and third maxillæ, 8 second maxilla, 9 end of oviparous foot, 10 part of a spine of the same more highly magnified, 11 postabdominal laminæ.]

3. *Cypridina danæ,* n. sp. (Pl. XXXVI. fig. 2, *a–d*).

Carapace as seen laterally, irregularly subrhomboidal, notch of moderate size, and seated in the middle of the oblique anterior extremity, beak small and sharp, posterior extremity produced into a truncated or subconical median beak; dorsal margin boldly arched behind, flattened, and sloping almost in a right line towards the front, ventral margin regularly convex; the greatest height is situated in the middle and is equal to about three-fourths of the length; seen from above, the outline approaches a lozenge shape, is widest in the middle, and tapered to the extremities, which are acuminate; the lateral margins evenly curved, and slightly sinuated towards the posterior extremity; width equal to half the length; end-view oval, width equal to two-thirds of the height. Surface of the shell smooth, and covered with minute closely-set punctations. The ribbed markings and patches shown in the plate are probably the result of shrinkage of the more delicate parts of the shell in drying. The texture of the shell is tolerably firm, and calcareous over the greater portion of its area; but some parts, more especially along the ventral and posterior margins, are thinner and submembranaceous. Length, 23-100ths of an inch (6 mm.). The anatomical structure is in every way like that of the preceding species. One specimen only dredged off Kerguelen Island, in a depth of 120 fathoms. I have much pleasure in dedicating this fine species to the author of the "Crustacea of the United States' Exploring Expedition."

[Pl. XXXVI. fig. 2, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 10 diameters.]

Crossophorus,[1] n. gen.

Shape of the shell as in *Cypridina*, the posterior extremity broadly rounded; texture firm and calcareous; anterior antennæ six-jointed, the second, third, and fourth joints fringed with short setæ on the upper, and each bearing a fascicle of setæ on the lower margin; fifth joint bearing one long ringed "auditory" seta, the last joint four long and several shorter setæ of similar character. Posterior antennæ as in *Cypridina*, except that the secondary branch (Pl. XXXVIII. fig. 5, *a*) is powerfully clawed, the last joint forming a strongly-curved opposable claw; the first and second joints are robust, and each bear fascicles of short, stout setæ. The mandibular foot (fig. 6) is armed at the apex of the basal joint with a bifurcated hairy process, the second joint is very broad, bearing a few marginal setæ, and near the apex a transverse crescentic row of twelve hairs, which gradually increase in length from within outwards; at the apical angle of its outer margin is a slender digitiform process which has two terminal setæ; the third joint is very short and broad, and bears a fringe of about six long setæ; the last joint is long, slender, densely setose on its outer half, and has an apical fringe of about eight or ten stout setæ, and three or four strong curved spines, these latter being fixed to the outer angle. The first pair of maxillæ (fig. 7) consist of one principal biarticulate branch, and several smaller segments; all these are abundantly setiferous, and the apical joint of the main branch bears also several short claw-like spines; the second pair of maxillæ (fig. 8)

[1] *Κροσσοί*, fringe; *φέρω*, I carry.

do not differ materially from those of *Cypridina;* each is provided with a large oval branchial plate, and the spines of the various segments have strongly-toothed margins; the third maxilla (fig. 9) is composed of three or four short digitiform segments, which are densely clothed with short, stout setæ, and attached to these is a large subtriangular lamina, which bears along its outer margin several rows of plumose setæ; these are separated by a short interval from another series of about six branchial filaments which are attached to an apical process of the plate. The postabdominal laminæ (fig. 11) are beset with numerous strong curved marginal claws, which appear to be arranged in several series of two or three claws each, those of each set being graduated as to size and strength. Some of these claws are drawn *in situ* in figure 11, while the scars showing the points of attachment of the others show a gradation of size like that here described. The copulative organs of the male (fig. 10) consist of a right and left limb, one of which is hamate, the other obtuse, and beset at the apex with numerous spine-like setæ; both are attached to a large basal segment, from which springs also a stout process bearing on its expanded apex a series of nine curved setæ arranged in a somewhat fan-like manner and regularly graduated in length from one end of the series to the other. Some other points of structure in the organs I have not been able clearly to make out. Oviferous foot, almost exactly like that of *Cypridina.*

1. *Crossophorus imperator*, n. sp. (Pl. XXXVIII. figs. 1–11).

Shell dense, porcellaneous and polished; seen from the side, broadly and regularly oval; height equal to three-fourths of the length, notch of moderate size, and expanded laterally so as to produce two obliquely-placed depressed areas on the anterior face of the shell; beak curved and sharp; posterior extremity broadly rounded, dorsal and ventral margins equally convex; seen from above, the shell is oblong ovate, widest in the middle, subacuminate in front, and rounded behind, width equal to more than half the length; end view ovate. Length, ⅓d of an inch (8·4 mm.).

Of this noble species, certainly the largest of the known Cypridinidæ, one specimen was dredged in a depth of 1100 fathoms, in lat. 40° 28′ S., long. 177° 43′ E., the bottom temperature being 2·0 C.

The possibility should be borne in mind, however, of the creature having been captured in the upward passage of the dredge through the water. The characters of the genus are very like those of *Bradycinetus*, Sars, but the secondary branch of the posterior antennæ in the latter genus does not end in a claw, while the structure of the third pair of maxillæ, and the general style of setose and spinous armature seem to be so abnormal as to require the establishment of a new genus for their due expression.

[Pl. XXXVIII. figs. 1–11. 1 Carapace of the male seen from right side, 2 from above, 3 from front (magnified 6 diameters), 4 anterior antenna, 5 posterior antenna with (*a*) secondary branch, 6 mandibular foot, 7 maxilla of first pair, 8 maxilla of second pair, 9 maxilla of third pair, 10 male copulative organ, 11 portion of postabdominal lamina showing six claws *in situ*, with scars of attachment of the remainder.]

Philomedes, Lilljeborg (1853).

Shell of moderate strength and density, notch broad, anterior extremity obtuse, posterior extremity mostly produced or angulated; anterior antennæ six-jointed, in the female short and stout, and bearing several subequal terminal setæ of moderate length; in the male more elongated, two of the terminal setæ of excessive length, the antepenultimate joint bearing a stout and densely setose auditory filament. Natatory branch of posterior antenna nine-jointed, in the female having the first joint very long, the rest short and subequal; in the male the first and third joints long, second much shorter, the rest short and subequal; secondary branch in the female, indistinctly jointed, setose; in the male, long, three-jointed, the last joint forming an opposable curved claw. Mandibular feet nearly alike in both sexes, in the female armed with mandibuliform processes and spines; in the male, bearing on the basal joint a small tubercle with two short hairs representing the incisive portion of the mandible proper; penultimate joint shorter than in *Cypridina*, the anterior marginal setæ fewer and fasciculate; first pair of jaws slender, palp bearing only a small trisetose lobe; second pair in the female only, armed with mandibuliform processes and spines. Third pair as in *Cypridina*. Eyes large, distant, placed at the sides of the animal near the centre of each valve. "Animal swimming with long jerks" (Sars).

This genus was established by Professor Lilljeborg for the reception of a species called by that author *Philomedes longicornis*, but which is identical with the previously-described *Cypridina interpuncta*, Baird.

The females of this genus differ, to a certain extent, both in form of shell and internal structure, from the males, and are seldom or never met with except on the bottom; the males, on the contrary, being active swimmers, are often taken abundantly in the surface-net. Professor G. O. Sars, noticing that he never obtained any egg-bearing females of *Philomedes longicornis*, has expressed an opinion that *Cypridina globosa* (*brenda*) is the true female of that animal. I have already, in the Proceedings of the Zoological Society, April 4, 1871, stated my reasons for dissenting from that view, and have traced, as I think, with sufficient clearness, the true sexual relations of several reputed distinct species. Into this question I need not, therefore, here enter at greater length.

Cypridina olivacea, Dana, Professor Sars thinks fairly referable to the genus *Philomedes*. I am disposed, however, to think that this species may more properly be assigned to the genus *Asterope*. One very fine new species, *Philomedes wyville-thomsoni* (mihi), doubtless belonging to the genus *Philomedes*, is described below, and I have ventured to refer Professor Dana's *Cypridina gibbosa* to the same group. These, with a European species already described by myself (*Philomedes folini*), comprise all the known members of the genus.

1. *Philomedes gibbosa* (Dana), (Pl. XXXIX. figs. 12–17).

Philomedes gibbosa, Dana, Crust., United States' Exploring Expedition, p. 1295, pl. xci. fig. 4, *a–c*.

Shell membranaceous, pale yellowish-brown, seen from the side (fig. 12), elongated, much higher in front than behind, height equal to more than half the length; beak consisting only of a small acuminate process situated about the middle of the anterior margin, below which is a very shallow curved notch; anterior extremity broad and obliquely truncated, rather concave above, and convex below the beak, fringed below the middle and at the ventral angle with a series of rather long curved setæ; posterior extremity tapering, narrow, forming a rather upturned beak-like process; dorsal margin rather boldly arched, ventral gently convex; seen from above, oblong-ovate, widest in the middle, tapering and compressed towards the posterior extremity; anterior extremity obtusely, posterior very acutely pointed, width equal to half the length. Anterior antennæ (fig. 14) five-jointed (?), fourth joint bearing a moderately long seta which has near its base, and arranged in a pectinate manner, a series of six marginal setæ; the last joint is very small, and has five apical setæ, two long and three short. Secondary branch of posterior antenna (fig. 15) rudimentary, consisting only of three short setæ. Length, 1-20th of an inch (1·3 mm.).

Taken in the surface-net, Zebu Harbour, Philippine Islands.

[Pl. XXXIX. figs. 12–17. 12 Carapace of male seen from right side, 13 the same from above (magnified 50 diameters), 14 anterior antenna (*a*, *a* eyes), 15 secondary branch of lower antenna, 16 mandibular foot, 17 first maxilla.]

2. *Philomedes wyville-thomsoni*, n. sp. (Pl. XXXVI. fig. 1, *a–c*).

Shell stout and calcareous; seen from the side, broadly subovate, greatest height situated in the middle and equal to fully two-thirds of the length; notch shallow, beak rounded off and obtuse; anterior extremity above the notch broad and obtusely angulated, gently curved below, posterior produced in the middle into a short, wide and obtusely-rounded prominence; dorsal margin well and evenly arched; ventral somewhat flattened in the middle but curved upwards at the ends; seen from above, the shell is of irregularly oval shape with obtuse extremities; the lateral margins are curved and somewhat irregularly sinuous in front of the middle where they sink abruptly forming two projecting lateral wings, thence they continue with a gentle curve backwards and are twice deeply sinuated near the hinder extremity; the greatest width is in the middle and is nearly equal to the height; end-view extremely irregular in outline, showing two conspicuous lateral prominences and several lesser humps and sinuations. Surface of the shell sculptured with numerous large, deep and closely-set angular cavities; the centre of the valves elevated; running nearly parallel with the dorsal and ventral margins, but considerably inside of these are two rounded but very prominent and thick ridges, separated from each other, however, by a distinct interval at the extremities. Length, $\frac{1}{4}$th of an inch (5·2 mm.).

This very fine species, of which one specimen only was obtained, was dredged in a depth of 38 fathoms, off the entrance to Port Philip, South Australia, on a sandy bottom (Station 161). In order to preserve entire so interesting a specimen, the animal has not been submitted to dissection, but the general appearance of the species recalls so vividly that of *Philomedes folini* (described by me in the Zoological Proceedings, *loc. cit.*) that I cannot hesitate to refer it to the same genus. I have much pleasure in dedicating it, as being perhaps the finest of the Ostracoda taken during the Challenger Expedition, to my friend Professor Sir C. Wyville Thomson.

[Pl. XXXVI. fig. 1, *a–c*. *a* Carapace seen from the left side, *b* from below, *c* from front. All magnified 14 diameters.]

Asterope, Philippi.

One or two specimens, in an imperfect condition, but probably belonging to this genus were found in a dredging from Station 33, off Bermudas, in a depth of 435 fathoms.

Family II. Conchœciadæ.

Sub-family Halocyprinæ, Dana.

Shell very thin and flexible, usually neither calcareous nor horny, but almost membranaceous; more or less distinctly notched and emarginate on the anterior surface (as in the Cypridinidæ) for the protrusion of the posterior antennæ. Eyes wanting. Anterior antennæ in the female small, indistinctly jointed, and bearing near the apex a brush of ciliated auditory setæ; in the male, much larger and distinctly jointed; between the antennæ a long tentacle directed forwards, and bearing at the apex a club-shaped dilatation. Posterior antennæ almost like those of *Cypridina;* basal portion large and stout; natatory branch beset with long, plumose setæ, and having a smaller secondary appendage, which in the male is prehensile. Mandibles distinct, toothed at the apex, provided with a large pediform, four-jointed palp, the basal joint of which is very large, extending downwards as far as the apex of the mandible, and, like it, armed with numerous terminal teeth; last three joints slender, and bearing numerous setæ. Two pairs of pediform maxillæ, the first[1] composed of three lobes, of which the two basal

[1] Dana appears to consider this as forming two distinct maxillæ, the two basal lobes constituting the first, the two last the second maxilla.

are dilated and shortly setiferous on their inner margins, the last lobe (or palp) elongated, two-jointed, setiferous, and bearing at the apex three or four slender claws; a branchial plate attached to the base of the maxillæ; second pair geniculated, three or four-jointed, the basal joint produced into an angular setiferous lobe, the apical portion biarticulate, slender, bearing numerous marginal setæ, and three or four slender apical claws. Two pairs of feet; first pair elongated, slender, the two basal joints dilated, and bearing a branchial lamina, the apical portion more slender, and having three or four long terminal setæ; in the male this limb is larger, and has three long, equal terminal setæ; second pair of feet rudimentary, two-jointed, and bearing two unequal apical setæ. Post-abdomen composed of two short, marginally-clawed flat laminæ.

Though closely related to the Cypridinidæ, the Conchœciadæ are clearly separated from the former group by several well-marked characters. The remarkable organ found between the anterior antennæ, called by Dana "spiculum," by Sars "frontal tentacle," is, perhaps, as regards function, an organ of touch. A structure agreeing with this in general character is figured by Grube as occurring in *Cypridina oblonga*, but no other author appears to have noticed anything similar amongst the Cypridinidæ. In Grube's figure two of these organs are shown, whereas in the Conchœciadæ one only is present, situated in the median line. The apparent duplication of the mandible by the abnormal development of the basal joint of the palp is another very extraordinary family mark. The second pair of feet is very small, so as readily to escape observation, and is indeed left without notice by Dana, Lubbock, and Claus.

The animals belonging to this family appear to be generally of pelagic and natatory habit, though Sars' specimens were obtained by dredging in depths of 200 to 300 fathoms. They abound more especially in the tropical seas, few surface-net gatherings made in those regions being without some representatives of the family of which *Halocypris atlantica*, Lubbock, seems to be by far the most abundant and most widely distributed. In the Challenger dredgings I have not recognised any trace whatever of their shells; this, together with a consideration of their structure, which specially fits them for a natatory life, the females being (unlike those of the Cypridinidæ) little less adapted for this mode of existence than the males, leads me to believe their life on the sea bottom to be an exceptional occurrence. Seeing the immense numbers of *Halocypris* which evidently swarm in some parts of the ocean, one might perhaps expect to find their empty shells in plenty at the bottom, but their subsidence in any great numbers would probably be prevented by the abundance of predaceous animals, of whose food these little creatures doubtless form an essential part, and by the excessive lightness and delicacy of their shell-structure which would render subsidence so long a process as probably to ensure the solution or decomposition of the shell before its full accomplishment.

After a careful comparison of Dana's descriptions and drawings of the two genera, *Conchœcia* and *Halocypris*, I am unable to find any differences sufficient, in my opinion, to form grounds of generic distinction. These descriptions, owing, doubtless, to paucity of material at the command of the author, are scarcely detailed enough to serve as standards of comparison now that our knowledge of allied forms has been so greatly extended. On the other hand, the very minute and careful description of the genus *Conchœcia*, given by G. O. Sars as the result of the dissection of numerous specimens, leaves nothing to be wished for so far as that genus is concerned. Nor can I find any material difference between the anatomy of *Conchœcia* as described by Sars and that of *Halocypris*, as shown by my own drawings in the plates of this monograph. It can scarcely be doubted that the species taken during the cruise of the Challenger belong to Dana's genus *Halocypris*; but whether Sars is correct in referring his Norwegian specimens to *Conchœcia* rather than to *Halocypris*, is, I think, questionable. In the structure of the mandible, where, according to Dana, one of the most important differences lies, Sars' specimens seem to me to be more in agreement with the latter genus. But if, on the contrary, the Norwegian specimens be rightly assigned to *Conchœcia*, then, as I can see no reason why they may not with equal propriety come under *Halocypris*, it follows that one of the two generic names must lapse. Adopting this view, and seeing that *Halocypris* is already perhaps the better known name, I have here used it to designate the genus.

Halocypris, Dana (1853).

Halocypris, *Conchœcia*, Dana; *Halocypris*, Claus, Lubbock; *Conchœcia*, G. O. Sars.

Valves usually elongated, and produced in front into a distinct beak-like process, with an underlying notch; surface of the shell more or less delicately striated in a concentric or reticulated manner. Anterior antennæ in the female small, indistinctly jointed, and bearing at the apex four or five setæ, of which three or four are small, and one very long; in the male the antennæ is much larger, four-jointed, and mobile, bearing four apical setæ, one of which is very small, the other three very long, equal, transversely ringed, and densely ciliated, one of the three bearing a series of marginal appendages. Posterior antennæ very large and stout, the basal portion elongated, triangular, and about half as long as the shell of the animal; natatory branch seven or eight-jointed, the first joint occupying about two-thirds of the entire length of the branch; secondary branch biarticulate, the first joint greatly dilated, second very small, bearing in the female a few long subequal setæ, in the male a strongly falcate claw, from the base of which spring a few not very long unequal setæ. Mandibles armed at the free extremity with a single strong tooth, and along the crescentic margin with one or more series of much smaller teeth; palp very stout, four-jointed, the basal joint excessively stout, produced downwards as far as the extremity of the mandible, and divided at the apex into a series of several small teeth. First pair of maxillæ composed of two incisive lobes, which are strongly toothed on the free margins, and a stout two-jointed palp, the first and largest joint of which bears several long setæ on each margin, the last joint armed with several unequal curved claws; a small branchial plate is attached to the base of the limb.[1] First pair of feet in the female five-jointed, slender, and bearing at the base a narrow semicircular and somewhat lobate branchial palp, the last joint provided with three subequal long and slender terminal claws; in the male the limb is much stronger, and bears three long, curved, and densely ciliated terminal setæ. Second pair of feet rudimentary, two-jointed, bearing two unequal apical setæ, one of which is of moderate length, the other several times the length of the entire limb. Postabdominal laminæ short and wide, rounded, and armed with numerous curved marginal claws, decreasing regularly in length from the apex. Eyes wanting. Copulative organ of the male double, not very complex in structure, consisting apparently of a compressed tubular organ, divided into two terminal, slightly-toothed, and setiferous lips, and enclosing an efferent duct.

Three species of *Halocypris* have been recognised amongst the proceeds of the Challenger tow-net gatherings. Of these *Halocypris atlantica*, Lubbock, is by far the most abundant; *Halocypris brevirostris*, Dana, also occurred not unfrequently; and another species, apparently undescribed, *Halocypris imbricata* (mihi), was met with only seldom.

1. *Halocypris atlantica*, Lubbock (Pl. XL. figs. 1–15, and Pl. XLI. figs. 11, 12).

Halocypris atlantica, Lubbock, Trans. Entom. Soc., vol. iv., 1856, p. 28, pl. xii. figs. 1–8.
(?) *Halocypris*, sp. Claus, Ueber die Geschlechtsdifferenzen von *Halocypris* (Zeitschr. f. Wissensch. Zool., Bd. xv., 4 Heft, 1865).

Carapace of the female (Pl. XL. figs. 1, 2), seen from the side, oblong, rather higher behind than in front;[2] anterior extremity produced at the dorsal angle into a subacute, hood-shaped beak, below which is a deep notch, whence the margin rounds off into a full curve continuous with that of ventral surface, the posterior extremity is rounded off below at its junction with the ventral margin, indented above the middle, and produced upwards so as to join the dorsal margin almost at a right angle; the dorsal margin in its general direction is straight, but shows more or less sinuation; ventral margin gently convex; the height of the shell is equal to more than half its length. Seen from above, the outline is subovate, or tending to the shape of a hexagon with rounded angles, about twice as long as broad; lateral margins subparallel, converging to an acuminate point behind, but in front forming a broadly rounded or subtruncate anterior extremity. Surface of the shell marked with numerous closely-set, irregularly-concentric striæ, the

[1] Sars makes no mention of a branchial plate in connection with the first maxilla, but assigns one to the second maxilla, and a single branchial filament to the mandible palp. These are the most important points of divergence between the observations of Sars on *Conchœcia*, and those here given on *Halocypris*.

[2] The shape, as remarked by Sir John Lubbock, is not unlike that of the capital letter D.

intervals of which are often finely punctate. The shell of the male (Pl. XLI. fig. 11) is smaller, broader in proportion to its length, and the anterior rostriform process is short and obtuse. The margins of the valves at the posterior ventral angle show often a series of minute, irregular serratures (Pl. XL. fig. 3). The setæ of the anterior antennæ in the female (fig. 6) are one long and three short, in the male (fig. 5), one short and three long, the latter being annulated and densely setose; one of the three bears also a series of very delicate marginal loop-like appendages (fig. 5, *a*). The secondary branch of the posterior antennæ has the basal joint very much dilated and bearing two short setæ, while the last joint in the female (fig. 7) has five or six long subequal, densely-ciliated setæ, and in the male (fig. 8) a strongly hooked claw and three setæ, two of which are long and one short. Length, 1-15th of an inch (1·6 mm.).

The following is a list of the localities of the tow-net gatherings in which *Halocypris atlantica* was found; in some of these cases it was scarce, but in others very abundant:—

Lat. 50° 1′ S., long. 123° 4′ E., . . .	Station 158
„ 47° 25′ S., „ 130° 12′ E., . . .	„ 159
Abi to Cape York (Pacific).	
Lat. 35° 11′ N., long. 139° 28′ E., . . .	„ 232
„ 35° 41′ N., „ 157° 42′ E., . . .	„ 241
„ 36° 32′ S., „ 132° 52′ W., . . .	„ 287
„ 42° 43′ S., „ 82° 11′ W., . . .	„ 302
„ 45° 31′ S., „ 78° 9′ W.	
„ 46° 53′ S., „ 75° 11′ W., . . .	„ 304
„ 42° 32′ S., „ 56° 27′ W., . . .	„ 318
„ 12° 16′ S., „ 13° 44′ W., . . .	„ 341
„ 3° 10′ N., „ 11° 51′ W., . . .	„ 348
„ 36° 44′ S., „ 46° 16′ W., . . .	„ 325

Following these references on the map, the very wide distribution of this species becomes at once apparent, the points indicated being spread over the Pacific Ocean from 10° south of the Australian continent to the latitude of Japan in the north, and to Patagonia in the east, while in the Atlantic it occurs from the latitude of Patagonia southward to that of Sierra Leone in the north, this last being also the district in which Sir John Lubbock's type-specimens were taken. If Dr Claus' Messina specimens be taken to belong to the same species, its range will, of course, extend to the Mediterranean.

[Pl. XL. figs. 1–15. 1 Carapace of female seen from left side, 2 from above (both magnified 35 diameters), 3 portion of margin of shell more highly magnified, 4 anterior antennæ of male with tentacle, 5 one of the same more highly magnified, 5*a* portion of central seta showing marginal loops, 6 anterior antenna of female, 7 posterior antenna of female, 8 secondary branch of posterior antenna of male, 9 mandible and palp, 10 first maxilla, 11 second maxilla, 12 first foot of female, 13 first foot of male, 14 second foot, 15 postabdominal laminæ. Pl. XLI. figs. 11, 12. 11 Carapace of male seen from left side, 12 copulative organ and postabdomen of male.]

2. *Halocypris brevirostris*, Dana (Pl. XXXIX. figs. 1–11).

Halocypris brevirostris, Dana, Crustacea of United States' Exploring Expedition, p. 1303, pl. xci. fig. 9, *a–c*.

Carapace, in general shape, very similar to the preceding species, but much shorter, more tumid, and having a much more convex ventral surface, with a less prominent rostrum. Shell of the female (Pl. XXXIX. figs. 1–3) seen from the side, highest in the middle, the height equal to nearly three-fourths of the length; rostrum short, broad obtusely rounded and often fringed with four or five short, broad teeth, notch wide and shallow; ventral margin boldly and evenly convex, forming one continuous curve from the notch to the postero-dorsal angle, both ventral angles well rounded; dorsal margin nearly straight, but sinuated both in front of and behind the middle, and forming an obtuse angle at its junction with the posterior extremity; seen from above the outline is broadly ovate, greatest width equal to two-thirds of the length, and situated in the middle, extremities subacuminate; seen from the front, broadly lanceolate, widest above the middle, the width being a little less than the height; dorsal margin broad, with well rounded angles, compressed below the middle, and subacuminate at the ventral edge. The shell of the male (figs. 4, 5) is smaller, less convex ventrally, when seen from above is much less tumid, and has the greatest width situated behind the middle. The shell in both sexes is perfectly smooth, without any, or only a very faint trace of striation, and is usually much firmer in texture than in the preceding or following species. The anterior antenna (fig. 6) bears five obtusely-pointed and untapering setæ, one of which is much longer than the rest, and annulose; the secondary branch of the posterior antenna in the female (fig. 7) bears five blunt and rather rigid setiform appendages, two of which are longer than the rest; in the male (fig. 8) there is a terminal hook and a fascicle of setiform filaments, in length similar to those of the female, but the longest is dilated at the apex, and filled with a granular stroma. The other limbs almost exactly as in *Halocypris atlantica*. Length, 1-16th of an inch (1·55 mm.).

Halocypris brevirostris was noticed in the following tow-net gatherings :—

Lat. 47° 25′ S., long. 130° 12′ E., . . .	Station 159
Abi to Cape York (Pacific).	
Lat. 35° 11′ N., long. 139° 28′ E., . . .	„ 232
„ 35° 41′ N., „ 157° 42′ E., . . .	„ 241
„ 36° 32′ S., „ 112° 52′ W., . . .	„ 287
„ 42° 43′ S., „ 82° 11′ W., . . .	„ 302
„ 45° 31′ S., „ 78° 9′ W., . . .	„ 303
„ 37° 45′ S., „ 33° 0′ W., . . .	„ 330
„ 12° 16′ S., „ 13° 44′ W., . . .	„ 341
St Vincent, Cape Verde.	

The range of this species appears to be almost exactly identical with that of *Halocypris atlantica,* but it is perhaps not quite so abundant, many of the bottles in which the latter species occurred being destitute of *Halocypris brevirostris.* The almost entire absence of striation, and the subglobose contour of this species, suffice to distinguish it at once from *Halocypris atlantica.*

[Pl. XXXIX. figs. 1–11. 1 Carapace of female seen from left side, 2 the same seen from above, 3 seen from front, 4 carapace of male seen from left side, 5 seen from above, 6 anterior antenna of male and female, 7 secondary branch of posterior female antenna, 8 secondary branch of posterior antenna of male, 9 mandible and palp, 10 foot of first pair of female, 11 one lamina of postabdomen. Figs. 1–5, magnified 25 diameters.] It should be noted that the front view of the shell given in figure 3 is, through an oversight, not shown in the customary position, the ventral (narrow) edge being placed upwards.

3. *Halocypris imbricata,* n. sp. (Pl. XLI. figs. 1–10, and Pl. XLII. figs. 1–8).

Shell compressed, elongated, lower in front than behind, and produced in front into one very long, curved, slender rostrum (Pl. XLII. figs. 1, 2), the dorsal margin also extended into a long spine, which is directed straight backwards, the spine being double, the half belonging to the left valve much smaller than that of the right; the hinder ventral angle of each valve is likewise produced into a wide, sharply-pointed triangular appendage, directed nearly straight backwards; the anterior angles are rounded off, but are fringed with minute teeth, which are arranged in several successive series (fig. 3), each series composed of four or five teeth, increasing regularly in length from the first to the last. Seen from the side, the anterior extremity of the shell is narrowed and rounded, the long, slender rostrum projecting, however, very far beyond it; the dorsal margin is deeply indented in the middle, slightly convex in front, and a little sinuated towards the posterior extremity; the posterior extremity is produced dorsally into a long spine, below which it is nearly straight, the ventral angle being rounded off, except when it is encroached upon by the pair of triangular spines; ventral margin nearly straight; the texture of the shell is reticulated, the reticulations being arranged in more or less regular transverse rows over a considerable portion of the valves, but a longitudinal striation, especially towards the margins, being also distinctly apparent; in the ventral spinous processes, as well as near the margins of other parts of the shell the areolæ are distinctly imbricated, and might fairly be called scales (fig. 4). The anterior antennæ of the female (Pl. XLI. fig. 1) has four very short granulated appendages, and one long, annulose setæ; in the male (fig. 2) there are two short club-shaped appendages and three long annulose setæ, one of which (fig. 2, *a*) bears on its central portion a fringing armature of about forty closely-set delicate hair-like spines arranged in a pectinate manner, the whole series beginning and ending quite abruptly. The secondary branch of the posterior antenna in the female (Pl. XLII. fig. 5) has two long and two short ringed setæ; in the male (Pl. XLI. fig. 3) an angularly-curved hook and five setæ, two long and three short. In other respects the animal does not appear to present any special differentiations of structure. Its length is 1-16th to 1-11th of an inch (1·55 mm. to 2·3 mm.).

Only three or four examples have been found, and I am by no means sure that the forms which I here refer to the male and female of the same species may not prove to be specifically distinct. The following are the localities in which the species was taken:— lat. 35° 11′ N., long. 137° 8′ E; lat. 35° 41′ N., long. 167° 42′ E.; lat. 36° 44′ S., long. 46° 16′ W., tow-net at trawl; depth 2650 fathoms.

[Pl. XLI. figs. 1–10. 1 Anterior antenna and tentacle of female, 2 anterior antenna of male, 2*a* portion of central seta more highly magnified, 3 secondary branch of posterior antenna of male, 4 mandible and palp, 5 first maxilla, 6 second maxilla, 7 first foot of male, 8 postabdomen, 9 dorsal angle and spine of male, 10 anterior ventral angle of male. Pl. XLII. figs. 1–8. 1 Female with valves laid open and seen from below, 2 the same seen from side (magnified 20 diameters), 3 portion of anterior margin of shell, 4 posterior angle and spine more highly magnified, 5 secondary branch of posterior female antenna, 6 second maxilla, 7 first foot of female, 8 branchial appendage of first foot.

Section CLADOCOPA.

Family Polycopidæ, G. O. Sars.

Valves subequal, thin, not notched in front. Anterior and posterior antennæ both natatory, terminated by long setæ, and having the basal portion large, stout, and muscular; the anterior pair simple, not geniculate; posterior two-branched, both branches natatory. Mandibles distinct, strongly toothed below; palp short, neither pediform nor clawed. Two pairs only of posterior limbs, scarcely pediform, the first natatory, the second branchial. Abdomen terminated by two short numerously-clawed laminæ. Eyes wanting. No heart. Intestine forming a simple sac.

Polycope, G. O. Sars.

Valves rounded, ventricose, corneo-calcareous. Forehead having no tentacle, but in its place two ciliated setæ. Anterior antennæ three-jointed, last joint short, terminal setæ long and slender; terminal rami of posterior antennæ unequal, one branch many-jointed and similar in structure to that of *Cypridina*, the other shorter and three-jointed. Lower extremity of mandibles strongly inflexed, armed with a few small acute teeth; palp biarticulate, first joint stout, bearing externally a short, bisetose branchial appendage, last joint narrow, beset with long plumose setæ. Incisive portion of the first pair of jaws small, forming a simple setiferous lobe; palp very large, four-jointed, two-branched, second joint bearing a long, narrow, and obsoletely-biarticulate branch, which is terminated by long setæ. Second pair of jaws membranaceous, three-jointed; penultimate joint bearing externally a small branch which terminates in a simple seta, furnished at the base with a large branchial plate. Post-abdominal plates short, posterior margin shortly digitate, and armed between the segments with acuminate claws. Animal swimming actively like the Lynceidæ.

Very few specimens referable to this genus have been observed in the Challenger dredgings. These belong to three species, two of which are undescribed.

1. *Polycope orbicularis*, G. O. Sars.

Polycope orbicularis, G. O. Sars, Oversigt af Norges marine Ostracoder, 1865, p. 122.
Polycope orbicularis, Brady, Monog. Recent Brit. Ostrac. 1868, p. 471, pl. xxxv. figs. 53–57.
Polycope orbicularis, Brady, Crosskey, and Robertson, Monog. Post-Tertiary Entom., p. 219, pl. xii. figs. 22, 23.

Shell of the female, as seen from the side, subcircular, greatest height in the middle, and slightly smaller than the length; anterior margin slightly narrowed and produced, posterior evenly rounded, dorsal and ventral margins boldly convex; outline, as seen from above, ovate, tapering equally to each extremity, greatest width in the middle, and somewhat exceeding half the length. Valves finely punctate, and divided by fine reticulating ribs into numerous polygonal areolæ; colour pale yellow, marked with patches of a darker reddish colour. Basal joint of the anterior antennæ longer than the two others combined, densely hairy on the anterior margin, and provided with a short seta, last joint ending in five long, slender setæ; one branch of the posterior antenna eight-jointed, its last seven joints short and subequal; second branch three-jointed, its first joint longer than the united lengths of the two following, and bearing eight long, partially-ciliated setæ. Mandibles divided at the apex into five teeth, the outermost of which is much the longest; palp shorter than the mandible itself, its last joint equal in length to the basal joint, and bearing seven ciliated setæ. Secondary branch of the anterior maxillæ reaching a little beyond the apex of the palp, and terminating in about eight very long and slender setæ. Branchial plate of the posterior maxillæ narrow, elliptical, bearing sixteen ciliated marginal setæ. Post-abdominal plates armed with six finely-ciliated claws, decreasing gradually in length backwards; behind them two short setæ. Posterior margin of the abdomen bearing three branches of short hairs. Male unknown. Length, 1-85th of an inch (·3 mm.).

Though specimens which may fairly be referred to this species have been met with in several of the Challenger dredgings, none of them are good or well developed, and they have therefore not been figured, while, as regards some of them, doubts may perhaps be entertained as to their specific identity. The species is well known in the seas of Northern Europe, especially in those of Great Britain and Norway; I have seen specimens also from Spitzbergen; and it occurs somewhat sparingly in the Post-Tertiary deposits of

Scotland. A species, perhaps distinct from *orbicularis*, occurs in the Mediterranean. The foregoing description, owing to the unserviceable nature of the Challenger specimens has been drawn up entirely from British and Norwegian specimens,—largely from the published description of G. O. Sars. Amongst the Challenger dredgings *Polycope orbicularis*, or some very nearly allied, form has been found as follows:—In mud, brought up by the anchor in Vigo Bay, from a depth of 11 fathoms; off the Cape of Good Hope (?), 150 fathoms (Station 142); Christmas Harbour, Kerguelen Island, 120 fathoms (?); Torres' Straits, lat. 11° 35′ S., long. 144° 3′ E., 155 fathoms, sand (Station 185).

2. *Polycope cingulata*, n. sp. (Pl. XXXV. fig. 7, *a–d*).

Carapace, seen from the side, subcircular, length not much exceeding the height, which is greatest in the middle; the anterior extremity (?) is broader than the posterior; and, except the middle of the dorsum, which is flattened and nearly straight, the rest of the margin forms one continuous and almost circular curve; seen from above, the outline is ovate, widest in the middle, the width being equal to two-thirds of the length, lateral margins evenly curved, extremities wide, obtuse, and nearly equal; the end-view is subovate, widest in the middle, lateral margins regularly convex; apex broad and deeply emarginate in the middle, ventral margin broadly keeled. The valves are surrounded, except on the dorsal aspect, by a broad, thickened flange or encircling keel, the surface of the shell is perfectly smooth, and marked all over with very minute and closely-set punctures. Length, 1-43d of an inch (·575 mm.).

I have, unfortunately, no record of the locality in which the one specimen of *Polycope cingulata* was found.

[Pl. XXXV. fig. 7, *a–d*. *a* Carapace seen left side, *b* from above, *c* from below, *d* from front. All magnified 60 diameters.]

3. *Polycope* (?) *favus*, n. sp. (Pl. XXXVI. fig. 4, *a*, *b*).

Valves seen laterally irregularly subquadrate, equal in height and length; anterior margin wide, truncated, not rounded, posterior produced in the middle, where it forms a rounded obtuse angle; dorsal margin straight, ventral very slightly convex. The shell is bordered throughout by a thickened lip, somewhat as in the preceding species, and the surface is marked by numerous large, deep, and irregular angular pits; there are also two short, blunt teeth near the postero-ventral angle. Length, 1-55th of an inch (·46 mm.).

One or two valves, belonging, doubtless, to some undescribed species, and perhaps referable to this genus, were dredged in Torres' Straits (Station 185); lat. 10° 35′ S., long. 144° 3′ E., 155 fathoms. I propose to call these provisionally *Polycope favus*.

[Pl. XXXVI. fig. 4, *a*, *b*. *a* Left valve, seen from side, *b* the same from above. Magnified 40 diameters.]

Section PLATYCOPA.

Family CYTHERELLIDÆ, G. O. Sars.

Valves unequal, very thick and calcareous, not notched in front. Antennæ very large, the anterior many-jointed and geniculated at the base; posterior broad and flattened, two-branched like the feet of the Copepoda. Mandibles very small, with a large pectinato-setose palp. Three pairs of hinder limbs, scarcely pediform; the two anterior pairs branchial, the others rudimentary. Abdomen terminating in two very small, narrow, and spiniferous laminæ. Ova and embryos borne beneath the shell of the female.

Cytherella, Jones (1849).

Cytherella (sub-genus), Jones, Entom. of Cretaceous Formation (1849), G. O. Sars (1865), G. S. Brady (1865).

Valves elongated, flattened, thick and hard, very unequal; the right much larger than the left, overlapping throughout the whole circumference, and presenting round the entire inner margin a distinct groove, into which the valve of the opposite side is received. Muscle-spots arranged in a curved pinnate series on an oblong, obliquely placed depression near the centre of the shell, the depression appearing internally as an elevation. Spots from twelve to sixteen in number, linear oblong in shape, and increasing in size toward the ventral margin. Anterior antennæ very large, shortly setose or spiniferous, seven-jointed, the first two joints larger than the rest, and forming between them a distinct geniculation; posterior antennæ composed of a large, broad, biarticulate, and geniculate basal portion, from which arise two flattened unequal branches, one biarticulate, the other triarticulate, both beset with very numerous long setæ. Labrum large, sublobose, giving out in front a short subtriangular process. Mandibles very weak, strongly inflexed at the lower extremity, which is obliquely truncate, and set in a pectinate manner with slender teeth; palp large and elongated, almost straight, bearing on its inner side very numerous long, pectinately-arranged setæ, which stretch backwards as in the feet of the Sididæ. First pair of jaws bearing at the base a very large branchial plate, which is beset with numerous ciliated marginal setæ; incisive portion divided into three setiferous lobes; palp very large, scarcely articulated; the posterior margin slightly lobated, inner margin pectinately setose, like the mandibular palp, but smaller. Second pair of jaws membranaceous, bearing, like the preceding pair, a branchial plate, but smaller and narrower; distal portion subovate, beset with a few ciliated setæ, and in the male furnished with a very large and strong hatchet-shaped appendage adapted for prehension. Third pair of jaws, in the female, rudimentary, forming a simple setiferous lobe; in the male, strong, distinctly jointed, and subcheliform. Abdomen beset behind with several bundles of long setæ for supporting the ova. Postabdominal laminæ narrow, slightly dilated at the apex, and armed before and behind with several marginal setæ or spines. Copulative organs of the male very large and narrow.

The foregoing descriptions of family and genus are borrowed from the work of G. O. Sars on the Norwegian marine Ostracoda. I have myself had no opportunity of seeing the recent animal, all the specimens that have come under my notice having been empty shells. It is at once apparent from the definition of the genus that we have here an animal presenting a type of structure quite different from that of the preceding families, in the conformation of the posterior antennæ approaching the Copopoda, and in that of the mandible-palps and first pair of jaws showing a likeness to the Sididæ. The mode of life of the animal and the manner in which the various limbs are used have not yet been observed.

Many species of fossil *Cytherellæ* have been described, ranging from the Cretaceous (doubtfully from the Carboniferous) to the Tertiary formations; and judging from our present knowledge of the genus, we should be disposed to say that it had attained its greatest development in the Cretaceous epoch, and is perhaps now dying out. But much further observation is required before this can be affirmed with certainty.

The characters of the shells are such as to render generic reference usually a very easy matter. The very unequal valves with the peripheral groove on the right side, the usually distinct cuneate form of the shell, and the pinnately-arranged muscle spots, are marks not to be found in any other group. Many detached valves of *Cytherellæ* were noticed in various dredgings, which it has been impossible to determine specifically.

1. *Cytherella polita*, G. S. Brady (Pl. XLIII. fig. 5, *a–c*, and Pl. XLIV. fig. 1, *a–g*).

Cytherella polita, Brady, Les Fonds de la Mer, p. 161, pl. xix. figs. 5–7.

Shell of the female, as seen from the side, subelliptical, height equal to about two-thirds of the length; extremities nearly equal and well rounded, dorsal margin forming a regular flattened arch, ventral nearly straight; seen from above, the outline is ovate-cuneate, widest near the hinder extremity, obtusely pointed in front, broadly rounded behind, width equal to half the length; end-view broadly oval. Surface of the shell perfectly smooth and polished. Length, 1-31st of an inch (·78 mm.).

The form shown in figures *e–g* is doubtless the male of this species, the points in which it differs from figures *a–d* being just those which are usually characteristic of the sexes.

The type-specimens of *Cytherella polita* were found at Port-au-Prince, West Indies. Those found in the Challenger dredgings are from the following localities:—Wellington Harbour, New Zealand, in tow-net at trawl; mouth of Rio de la Plata, 13 fathoms, mud (Station 321).

[Pl. XLIII. fig. 5, *a–c*. *a* Carapace of male (Wellington specimen) seen from left side, *b* from below, *c* from front. Pl. XLIV. fig. 1, *a–g*. *a* Female (La Plata) seen from left side, *b* from above, *c* from below, *d* from front; *e* male (La Plata) seen from left side, *f* from below, *g* from front. All magnified 40 diameters.]

2. *Cytherella lata*, n. sp. (Pl. XLIV. fig. 5, *a–e*).

Shell, seen from the side, subelliptical, higher in front than behind, greatest height situated near the middle, and equal to two-thirds of the length, extremities well and evenly rounded, the posterior the narrower of the two, dorsal margin boldly arched, ventral slightly convex; seen from above, the outline is regularly ovate. Surface of the shell perfectly smooth. Length, 1-16th of an inch (1·55 mm.).

Figure *c* represents in all probability the left valve of the species, the right valve of which is shown at *a* and *b*. Figures *d* and *e* differ considerably from the rest, but perhaps not more than is consistent with the supposition that they belong to the young of the same species.

The specimens—all of them detached valves—which I refer to this species were dredged as follows:—off Culebra Island, West Indies, 390 fathoms, mud (Station 24); off Azores, lat. 38° 37′ N., long. 28° 30′ W., 450 fathoms, sand (Station 75); off Pernambuco, lat. 8° 37′ S., long. 34° 28′ W., 675 fathoms, mud (Station 120); Torres' Straits, lat. 11° 35′ S., long. 144° 3′ E., 155 fathoms, sand (Station 185); off Ki Islands, 580 fathoms, lat. 5° 26′ S., long. 133° 19′ S., mud (Station 191*a*).

[Pl. XLIV. fig. 5, *a–e*. *a* Right valve seen from outside, *b* from above; *c* left valve from outside; *d* right valve of young (Ki Islands) seen from outside, *e* from above. Magnified 40 diameters.]

3. *Cytherella dromedaria*, n. sp. (Pl. XLIII. fig. 6, *a*, *b*).

Valves, seen laterally, elongated, subovate, rather higher in front than behind, greatest height situated behind the middle, and equal to rather more than half the length; extremities evenly rounded, dorsal margin gently arched and raised behind the middle into a gibbous prominence, ventral margin slightly convex; seen from above, the outline is regularly ovate, widest near the posterior extremity. Surface of the shell perfectly smooth. Length, 1-26th of an inch (·98 mm.).

Except the gibbous enlargement of the dorsal margin, there is no very marked distinctive character apparent in the single valve upon which this species is founded, yet it seems impossible to refer it to any hitherto known form. It was dredged in Simon's Bay, South Africa, in a depth of 15 to 20 fathoms (Station 140).

[Pl. LXIII. fig. 6, *a*, *b*. *a* Left valve seen from the side, *b* from above. Magnified 50 diameters.]

4. *Cytherella pulchra*, G. S. Brady (Pl. XLIV. fig. 3, *a*, *b*).

Cytherella pulchra, Brady, Trans. Zool. Soc. (1865), vol. v. p. 361, pl. lvii. fig. 1, *a–d*.

Valves oblong, subelliptical, nearly equal in height throughout, height equal to more than half the length, rounded evenly in front and obliquely behind, dorsal margin nearly straight, ventral straight or slightly convex; seen from above, the outline is compressed, ovate, widest somewhat behind the middle. Shell-surface smooth. Length, 1-32d of an inch (·77 mm.).

Valves referable, as I think, to this species, were found in dredgings from off Bermudas, 435 fathoms, mud (Station 33); from Port Jackson, Australia, 2 to 10 fathoms; from lat. 39° 32′ S., long. 171° 48′ E., 150 fathoms, grey ooze (Station 167); and from off Ascension Island, 420 fathoms (Station 344). The type specimens were from an Australian dredging.

[Pl. XLIV. fig. 3, *a*, *b*. *a* Valve seen from outside, *b* from above.]

5. *Cytherella truncata*, G. S. Brady (Pl. XXXVI. fig. 3, *a–d*).

Cytherella truncata, Brady, Les Fonds de la Mer, p. 154, pl. xix. figs. 3, 4.

Carapace, as seen from the side, oblong, subelliptical, height nearly equal throughout, and corresponding to about half the length; extremities nearly equal, rounded, dorsal margin straight, ventral slightly concave and obscurely angular at its junction with the posterior margin; seen from above, the outline is compressed, ovate, more than twice as long as broad, widest behind the middle, anterior extremity subacuminate, posterior subtruncate and slightly mucronate in the middle; end view ovate, pointed above and below, widest in the middle. Surface of the shell smooth, and unsculptured. Length, 1-30th of an inch (·85 mm.).

The specimens described in Les Fonds de la Mer were found at Colon-Aspinwall. Those obtained during the Challenger Expedition are from Torres' Straits, 155 fathoms, sand (Station 185).

[Pl. XXXVI. fig. 3, *a–d*. *a* Shell seen from left side, *b* from above, *c* from below, *d* from front. Magnified 40 diameters.]

6. *Cytherella punctata*, G. S. Brady (Pl. XXXVI. fig. 6, *a*, *b*, and Pl. XLIV. fig. 4, *a–g*).

Cytherella punctata, Brady, Trans. Zool. Soc., vol. v. (1865), p. 362, pl. lvii. fig. 2, *a*, *b*.

Carapace oblong, compressed; seen from the side, reniform, of equal height before and behind, extremities well and evenly rounded, dorsal margin nearly straight in the middle, and gently curved towards the ends, ventral deeply sinuated; height equal to at least half the length; seen from above, compressed, ovate, widest behind the middle, the width equal to somewhat more than a third of the length; extremities sharply rounded and subequal, the front of the shell being but very little more compressed than the hinder end; end view ovate, widest in the middle, pointed above and below, width equal to about two-thirds of the height. The surface of the shell is even, and covered with small and rather closely-set impressed circular puncta. Length, 1-30th of an inch (·85 mm.).

The specimens represented in figures *e–g* (from Station 167) may perhaps be referred to the young of this species; it is, at any rate, undoubtedly identical with the types described in the Zoological Transactions (*loc. cit.*) which were found in sponge-sand, probably from the Levant. Should this supposition be upset by future observations, the larger forms (figures *a–d*) will require to be re-named. The valve shown in Pl. XXXVI. fig. 6, is probably the same species, but ill-grown and distorted.

I have notes of the occurrence of this species in the following localities:—Off Nightingale Island (Tristan d'Acunha), 100 to 150 fathoms, rock and shells (Station 135); (?) Port Jackson, 2 to 10 fathoms; lat. 39° 32′ S., long. 171° 48′ E., 150 fathoms (Station 167); off Ki Islands, 580 fathoms, mud (Station 191*a*); sounding, 160 fathoms (Station 305).

[Pl. XXXVI. fig. 6, *a*, *b*. *a* Left valve seen from side, *b* from above. Pl. XLIV. fig. 4, *a–g*. *a* Adult shell seen from left side, *b* from above, *c* from below, *d* from front; *e* young shell seen from left side, *f* from above, *g* from front. All magnified 40 diameters.]

7. *Cytherella semitalis*, G. S. Brady (Pl. XLIV. fig. 2, *a–e*).

Cytherella semitalis, Brady, Les Fonds de la Mer, tom. i. p. 72, pl. viii. figs. 23, 24.

Carapace compressed, oblong; seen from the side, elliptical, equal in height throughout; extremities well rounded, the posterior somewhat oblique, dorsal and ventral margins straight (or only slightly sinuated) and parallel, height equal to half the length; seen from above, the outline is ovato-cuneate, greatest width near the posterior extremity, and equal to somewhat less than half the length; the extremities are subtruncate, but rounded at the angles, the anterior much narrower than the posterior. The surface of the shell is marked by a broad encircling belt of subangular excavations, somewhat irregularly disposed, but leaving in the centre of each valve a smooth longitudinal patch or track quite free from sculpturing; this patch usually encroaches at some points in a transverse direction upon the sculptured belt, and in some cases the shell bears traces also of irregular transverse grooving. Length, 1-45th of an inch (·54 mm.).

The types of this very well-marked species were found in a sounding from the north of Java. The Challenger specimens were found in dredgings from Booby Island, lat. 10° 36′ S., long. 141° 55′ E., 6 to 8 fathoms (Station 187); lat. 9° 59′ S., long. 137° 50′ E., 28 fathoms, mud (Station 189); Humboldt Bay, Papua, 37 fathoms; Nares' Harbour, Admiralty Islands, 16 fathoms. All these stations, it will be seen, belong to the Malayan or Melanesian Province.

[Pl. LXIV. fig. 2, *a–c*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front; *e* old shell (variety) from left side. All magnified 50 diameters.]

8. *Cytherella venusta*, n. sp. (Pl. XLIII. fig. 4, *a–d*).

Carapace oblong, cuneiform; seen from the side, somewhat obliquely quadrangular, height equal to half the length; extremities nearly equal, the anterior scarcely rounded, somewhat oblique, and obscurely angulated at its junction with the dorsal margin; posterior obliquely subtruncate; dorsal margin almost straight for the anterior half of its course, then sloping gently backwards, ventral very slightly sinuated; seen from above, the shell is oblong-cuneate, widest at the hinder end, the width at that joint being considerably less than half the length; the posterior extremity is truncated, and has a broad mucronate prominence in the middle, the lateral margins converging very gradually towards the front, which is obtusely rounded and has a couple of minute teeth, one on each valve; end view regularly ovate. The surface of the shell is smooth, but marked with a very delicately impressed reticulated pattern. Length, 1-37th of an inch (·7 mm.).

This is a very elegant and distinct species, well characterised by its distinctly cuneate shape and reticulated surface. Several specimens of it occurred in a dredging from 40 fathoms depth off the reefs at Honolulu.

[Pl. XLIII. fig. 4, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. Magnified 60 diameters.]

9. *Cytherella cribrosa*, n. sp. (Pl. XXVI. fig. 5, *a–d*).

Carapace oblong, rather tumid; seen from the side, subquadrate, somewhat higher in front than behind, height equal to more than half the length; anterior extremity broadly rounded, posterior slightly rounded, obliquely subtruncate, and obscurely angular in the middle; dorsal margin nearly straight, gently sloping backwards, ventral straight or slightly convex; seen from above the outline is cuneiform, broadest at the posterior extremity, where the width is equal to nearly half the length; anterior extremity broadly rounded; lateral margins nearly straight, ending behind in an obtuse angle, thence converging abruptly to the posterior extremity; end view broadly ovate. Surface of the shell destitute of ridges or undulations, but marked with numerous rather large oblong excavations. Length, 1-52d of an inch (·49 mm.).

Found only off Nuknalofa, Tongatabu, 18 fathoms (Station 172).

[Pl. XXVI. fig 5, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. All magnified 60 diameters.]

10. *Cytherella cavernosa*, G. S. Brady (Pl. XXXVI. fig. 5, *a–d*).

Cytherella cavernosa, Brady, Les Fonds de la Mer, p. 65, pl. viii. figs. 13, 24.

Carapace compressed, cuneiform; seen from the side quadrangular, equal in height throughout; height equal to nearly two-thirds of the length; anterior extremity somewhat flattened, rounded off at the angles, posterior subtruncate, abruptly rounded at the angles and sinuated in the middle, dorsal and ventral margins parallel, the former nearly straight, the latter slightly sinuated; seen from above elongated cuneate, widest behind; anterior extremity obtusely pointed, bimucronate, posterior truncated, slightly mucronate in the middle, width equal to rather more than one-third of the length; end-view irregular, ovate, much higher than broad. The surface of the valves is marked by irregularly-disposed flexuous rounded ridges, the two principal ones running nearly parallel to each other for about three-fourths of the length of the shell from its anterior margin, one near the middle, the other between it and the ventral margin; there are also several smaller ridges running transversely across the longitudinal ridges towards the posterior and upper margins of the shell, the interspaces being marked with closely-set minute punctures. Length, 1-34th of an inch (·75 mm.).

The type specimens of *Cytherella cavernosa* were from Java; those got during the Challenger Expedition were dredged off East Moncœur Island, Bass' Strait, in 38 to 40 fathoms (Station 162), and off Booby Island, lat. 10° 36′ S., long. 141° 55′ E.; 6 to 8 fathoms (Station 187).

[Pl. XXXVI. fig. 5, *a–d*. *a* Carapace seen from left side, *b* from above, *c* from below, *d* from front. All magnified 40 diameters.]

11. *Cytherella cingulata*, G. S. Brady (Pl. XLIII. fig. 1, *a–g*, and fig. 2, *a–d*).

Cytherella cingulata, Brady, Les Fonds de la Mer, tom. i. p. 159, pl. xvii. figs. 24, 25.

Carapace oblong, irregularly cuneiform; seen from the side subquadrangular, equal in height before and behind, anterior extremity well rounded, posterior rounded and somewhat produced in the middle, obtusely angulated at its junction with the dorsal and ventral margins; dorsal margin straight, or nearly so, ventral rather deeply sinuated in the middle; seen from above, the outline is irregularly cuneiform, widest at the posterior extremity where the width (in the female) equals nearly half the length; the anterior extremity is wide, subtruncate, the inner edges of the valves projecting in a bimucronate manner; posterior extremity truncated and rounded, crenulated; the lateral margins are doubly sinuated, with a central boss-like prominence; end-view quadrangular, height (in the female) not much greater than the width, angles rounded. Surface of the shell more or less rugose and pitted, the edges of the valves much thickened and raised into a broad rounded ridge which runs round, and just within, the anterior, superior and inferior margins and terminates behind in a prominent rectangular elevation. The proportions of the male carapace (fig. 2, *a–d*) are much more slender than those of the female. Length, 1-40th of an inch (·65 mm.).

The type specimens described in Les Fonds de la Mer were dredged at Hong Kong; those described in the present monograph are from lat. 9° 49′ S., long. 137° 50′ E., 28 fathoms, mud (Station 189); and from Hong Kong Harbour, 7 fathoms, mud; Port Jackson, 2 to 10 fathoms; off Booby Island, 6 to 8 fathoms.

[Pl. XLIII. fig. 1, *a–g*. *a* Carapace of female seen from left side, *b* from above, *c* from below, *d* from front; *e* young shell seen from left side, *f* from above, *g* from front; fig. 2, *a–d*, *a* shell of male seen from left side, *b* from above, *c* from below, *d* from front. All magnified 60 diameters.]

12. *Cytherella irregularis*, n. sp. (Pl. XLIII. fig. 3, *a–c*).

Valves as seen from the side subquadrangular, scarcely higher in front than behind, height equal to nearly two-thirds of the length, anterior extremity well rounded, posterior flattened, obliquely truncate, dorsal margin slightly excavated, ventral somewhat convex along its whole course; seen from above the lateral margins are nearly straight, ending in an obtusely angular fashion before and behind and thence tapering abruptly to the extremities. The shell-surface is undulated, having a large irregular elevated central patch which is filled with small oblong puncta arranged in obscurely concentric series. Length, 1-50th of an inch (·5 mm.).

One or two detached valves of this species were noticed in a dredging from 435 fathoms off Bermudas (Station 33).

[Pl. XLIII. fig. 3, *a–c*. *a* Left valve seen from outside, *b* from above, *c* from front. All magnified 60 diameters.]

13. *Cytherella latimarginata*, n. sp. (Pl. XXVI. fig. 7, *a–d*).

Carapace compressed, oblong; seen from the side, subovate, scarcely higher in front than behind, height equal to about half the length; extremities well rounded, dorsal margin slightly convex, ventral somewhat sinuated in the middle; seen from above, the outline is subcuneiform, but only very little broader behind than in front, the greatest width being equal to fully one-third of the length; the lateral margins are subparallel, with a long central protuberance, terminating abruptly at each extremity, and thence converging at an obtuse angle towards the median line of the shell; end-view irregularly ovate. The surface of the shell is irregularly undulated, the margins raised into a broad rounded lip, which forms an encircling fillet, except at the anterior margin, where it is partially absent. Length, 1-50th of an inch (·5 mm.).

Two or three specimens only of this species were found in a dredging from Torres' Strait, 155 fathoms, sandy bottom. The shells figured in the plate represent, probably,—judging from the difference of size,—different stages of growth, the essential characters of all being the same. The sloping dorsal margin of the smaller example, if it be really the young, is only an illustration of what is well known to be a juvenile character in *Cypris* and other Ostracoda of both marine and fresh water habitat.

[Pl. XXVI. fig. 7, *a–d*. *a* Left valve of full-grown form seen from the side, *b* shell of young form seen from left side, *c* from below, *d* from front. All magnified 60 diameters.]

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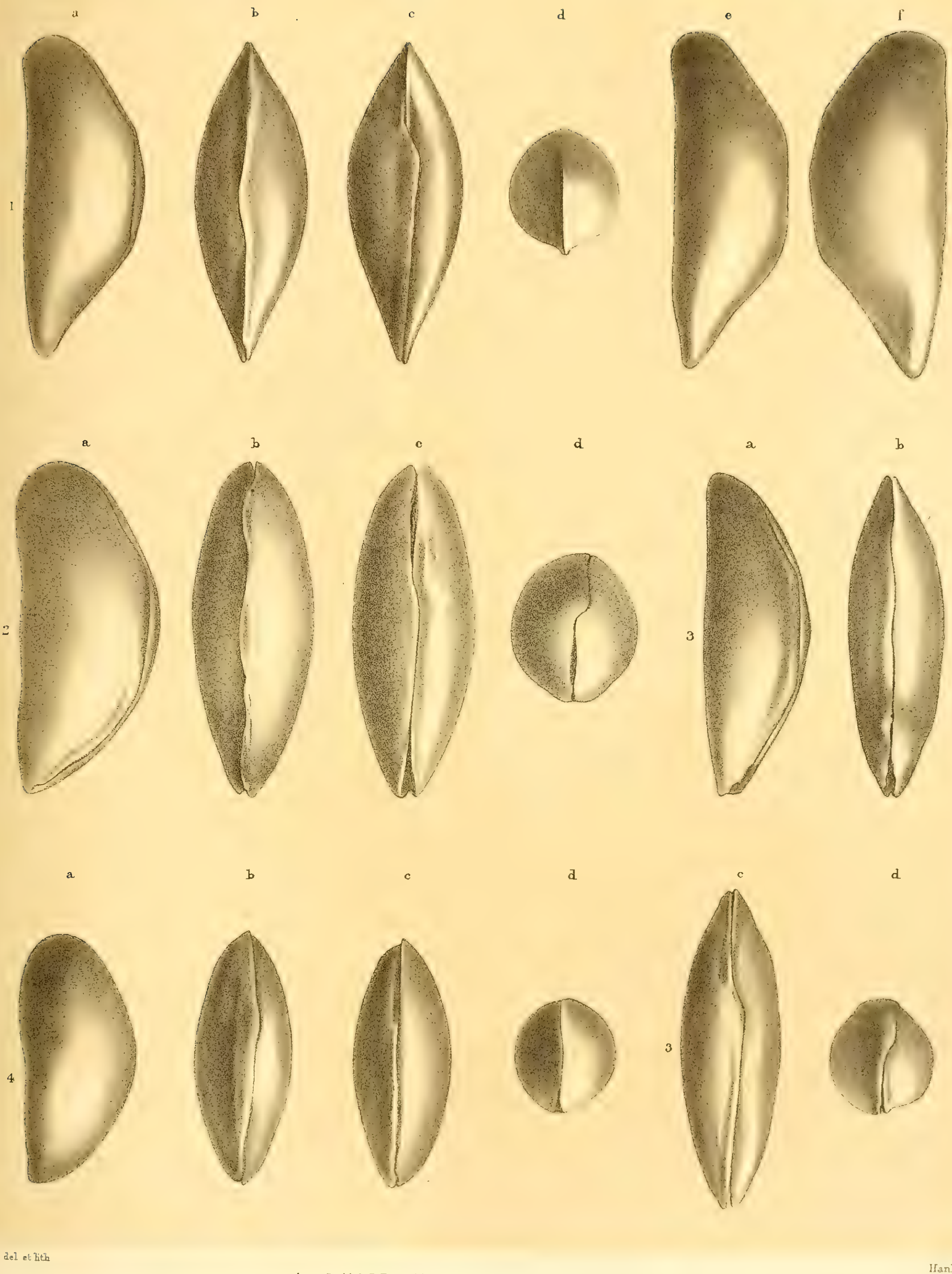

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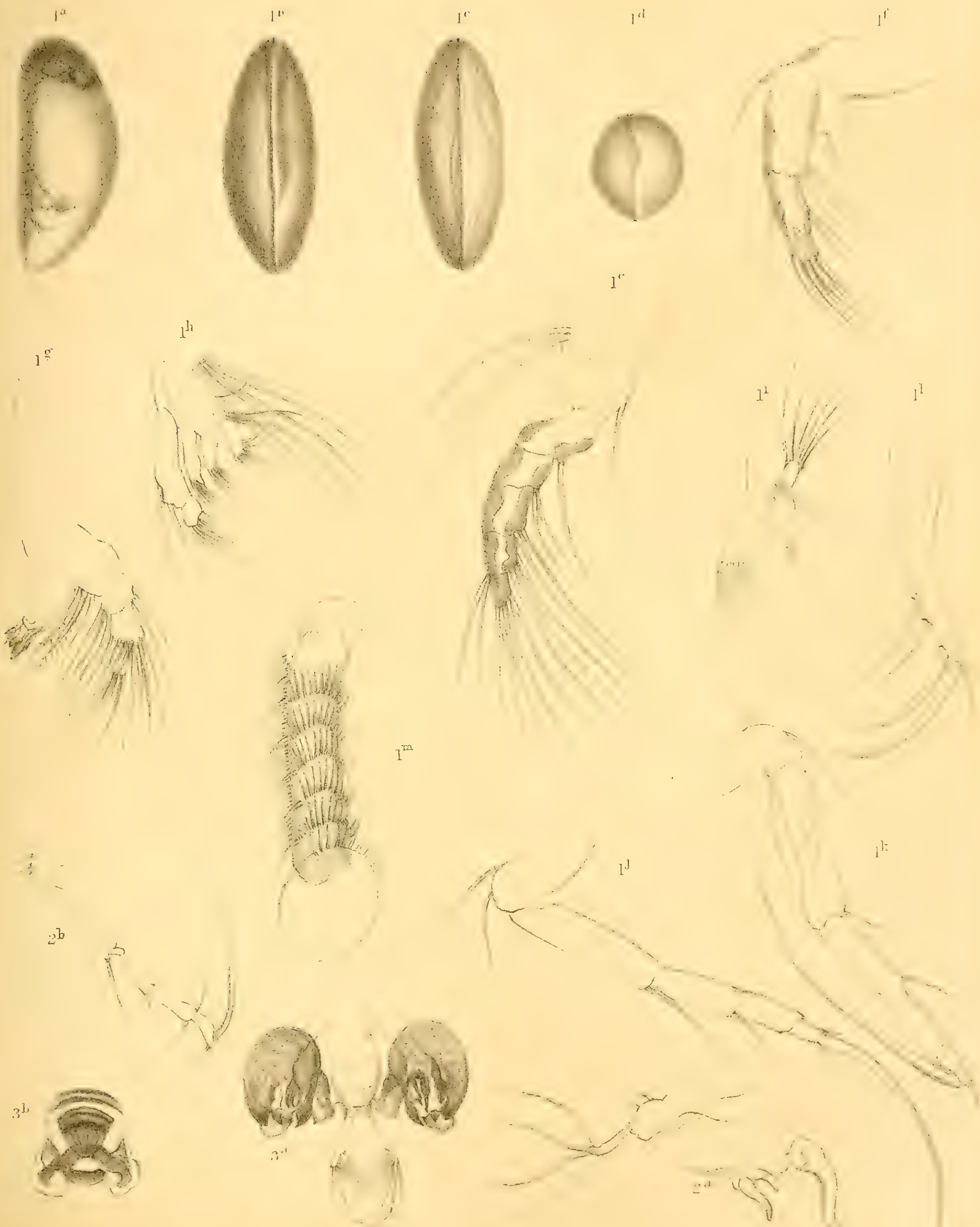

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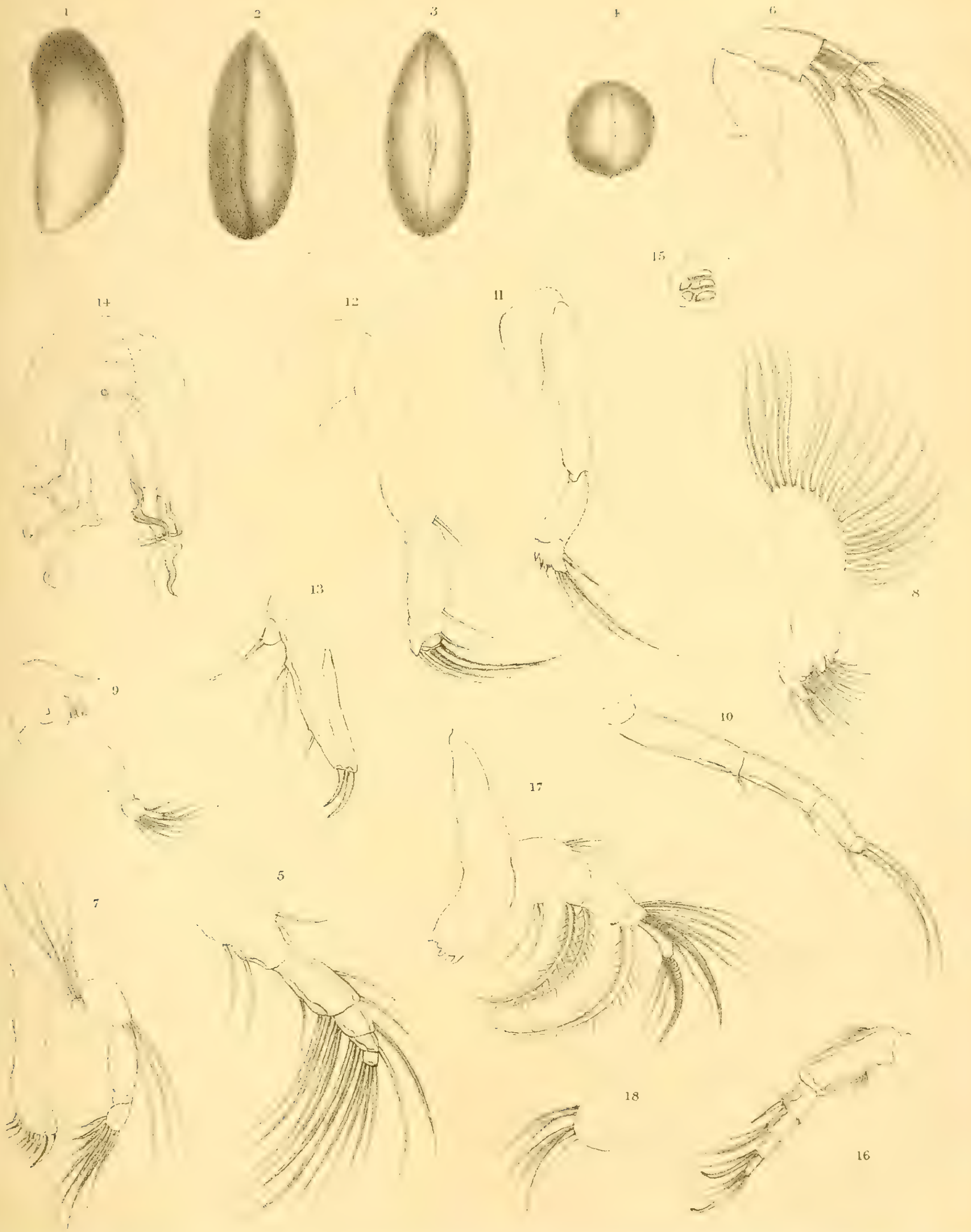

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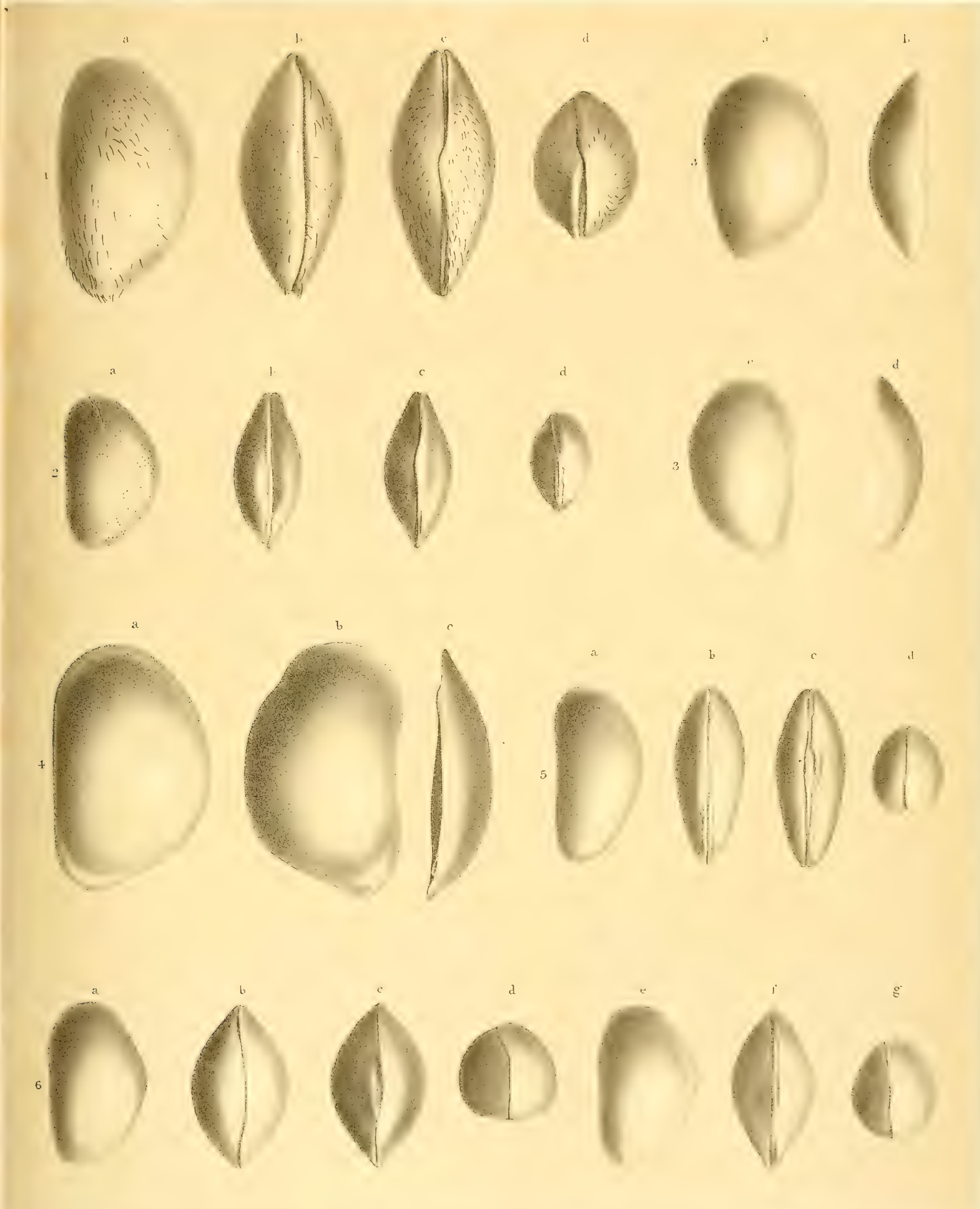

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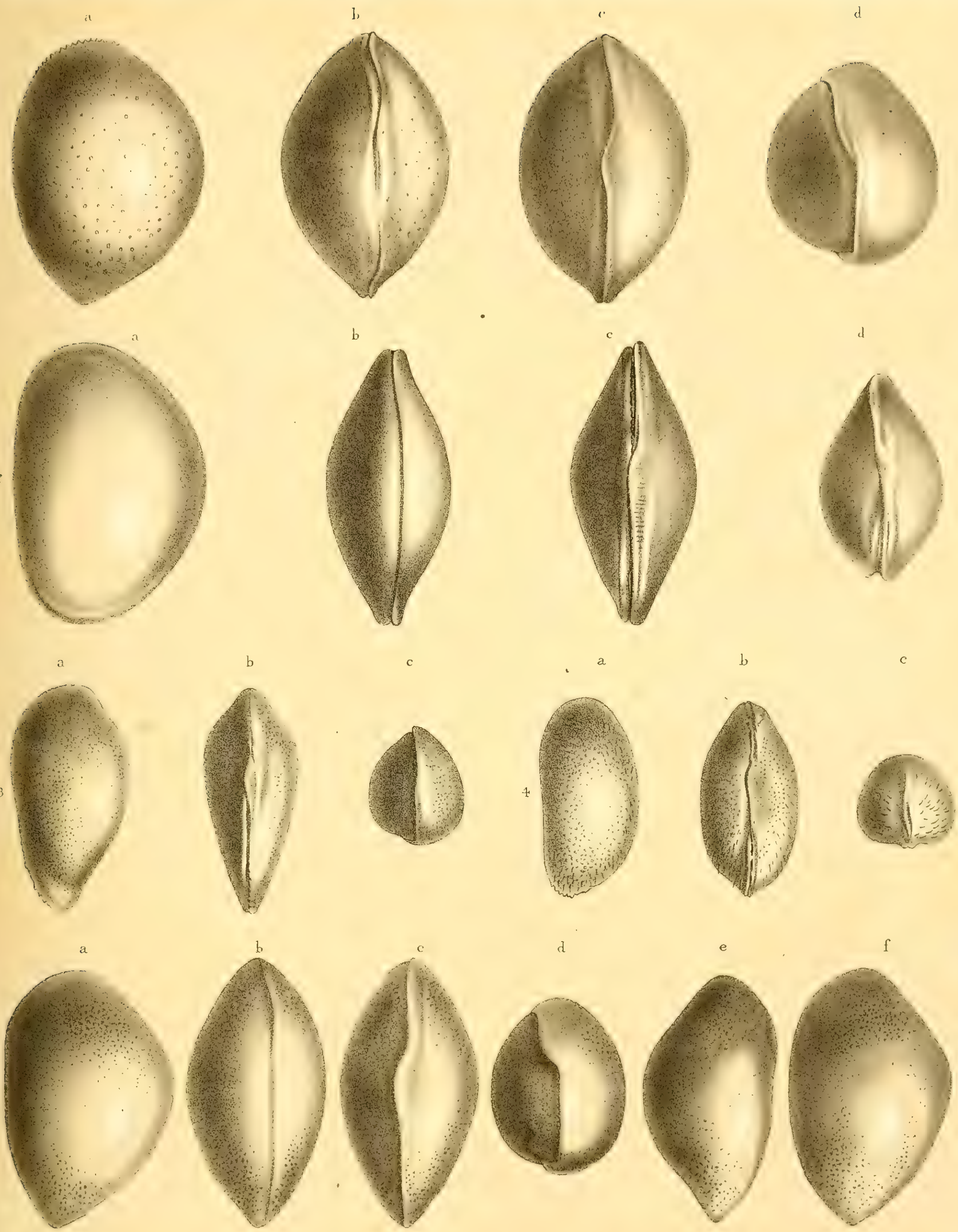

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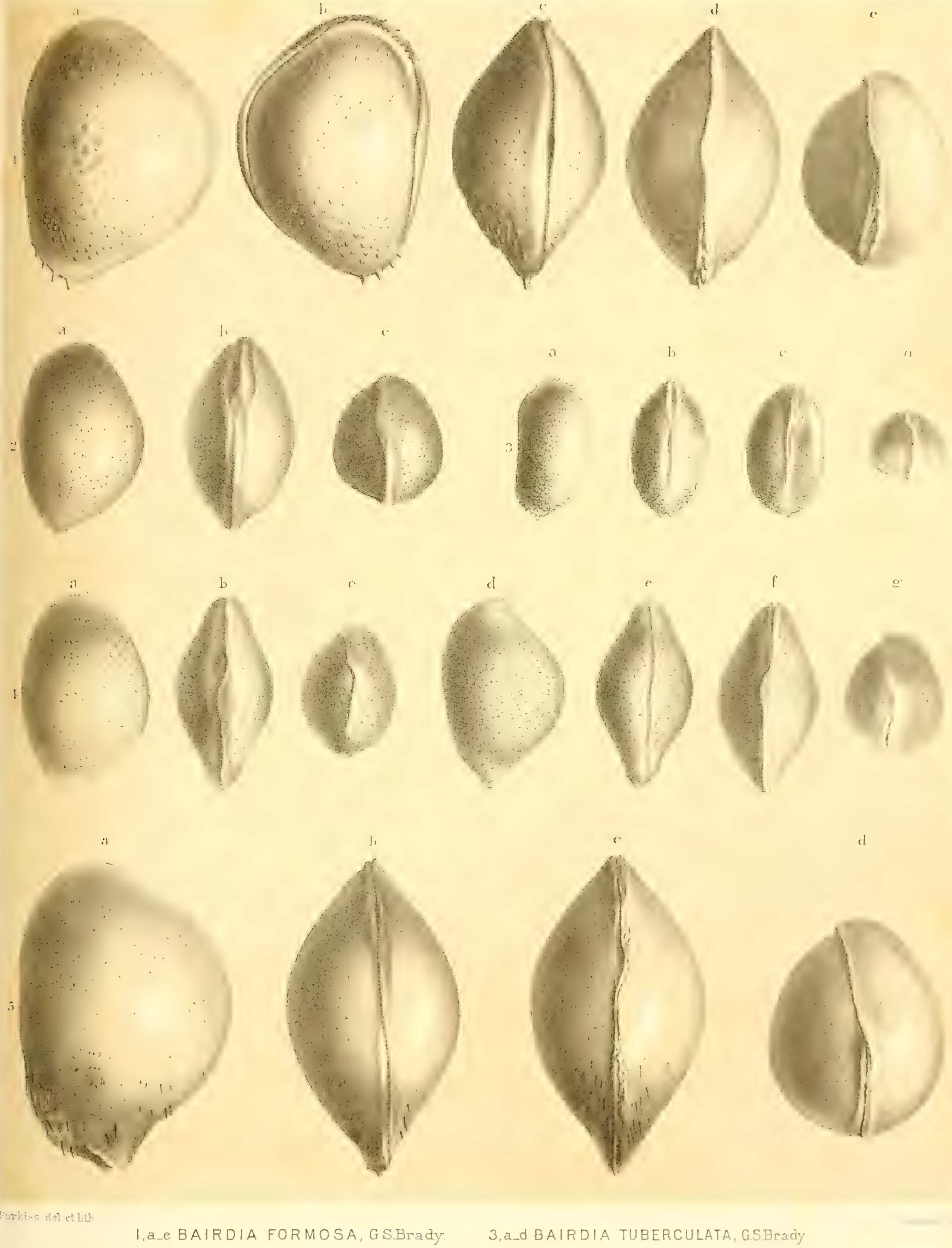

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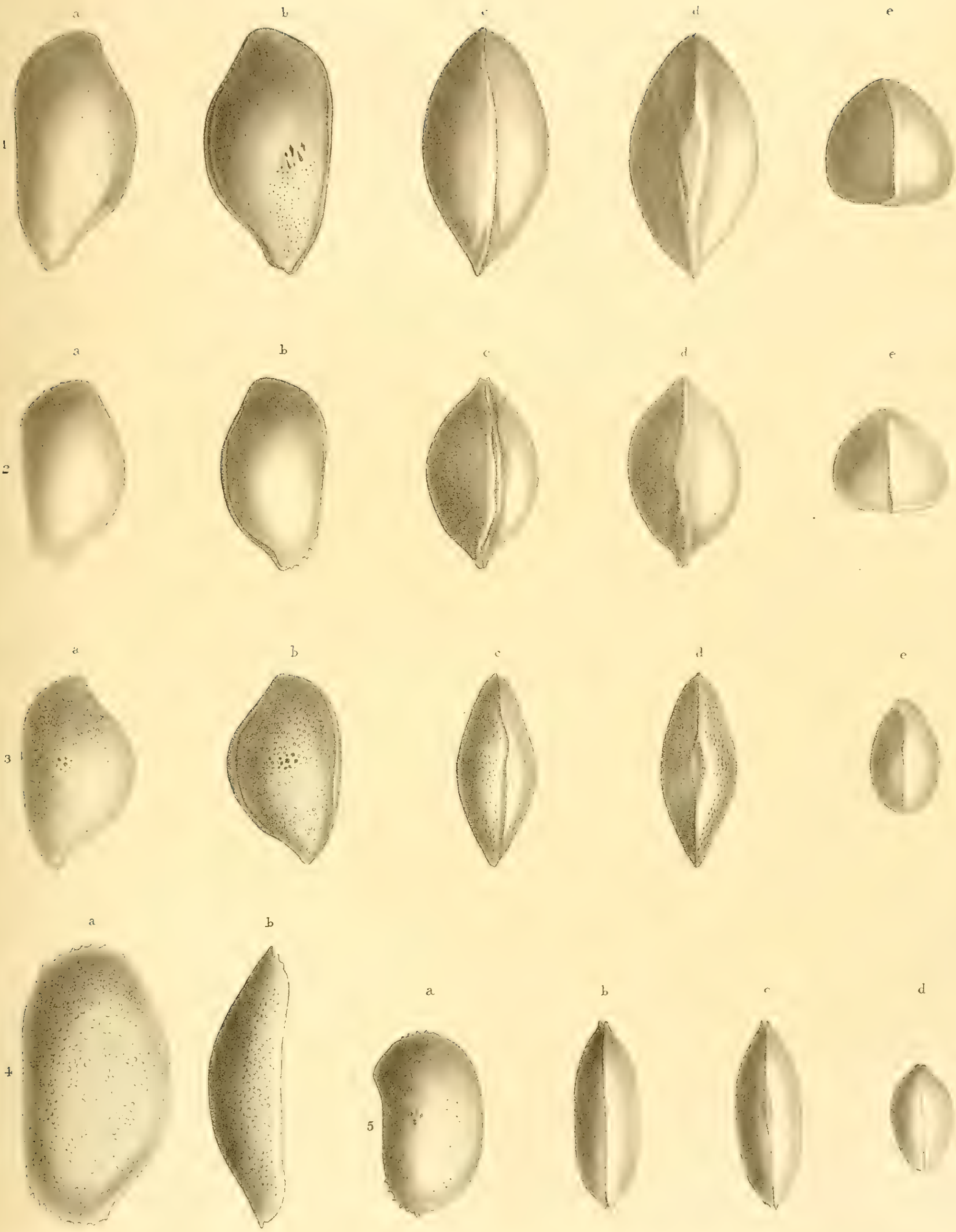

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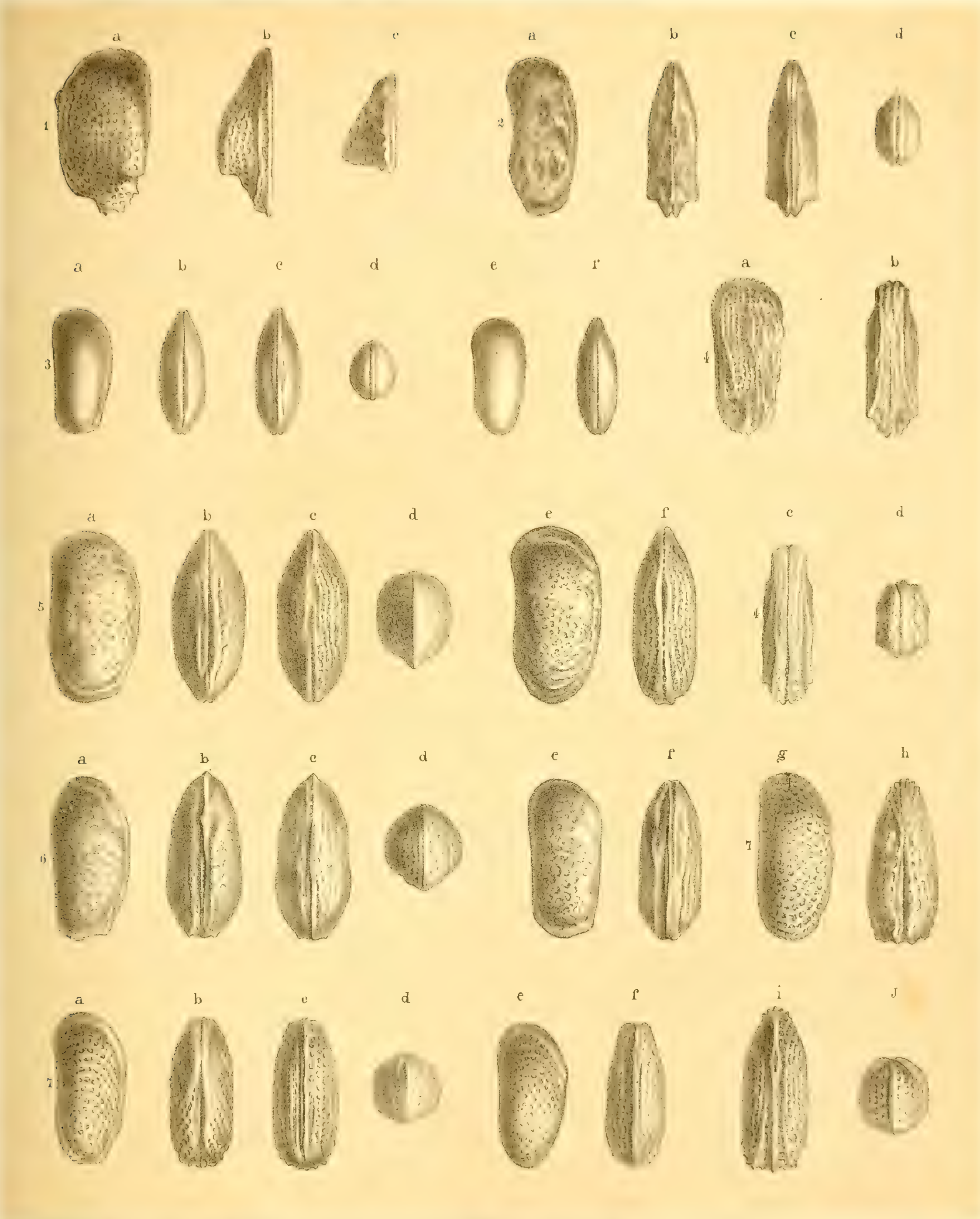

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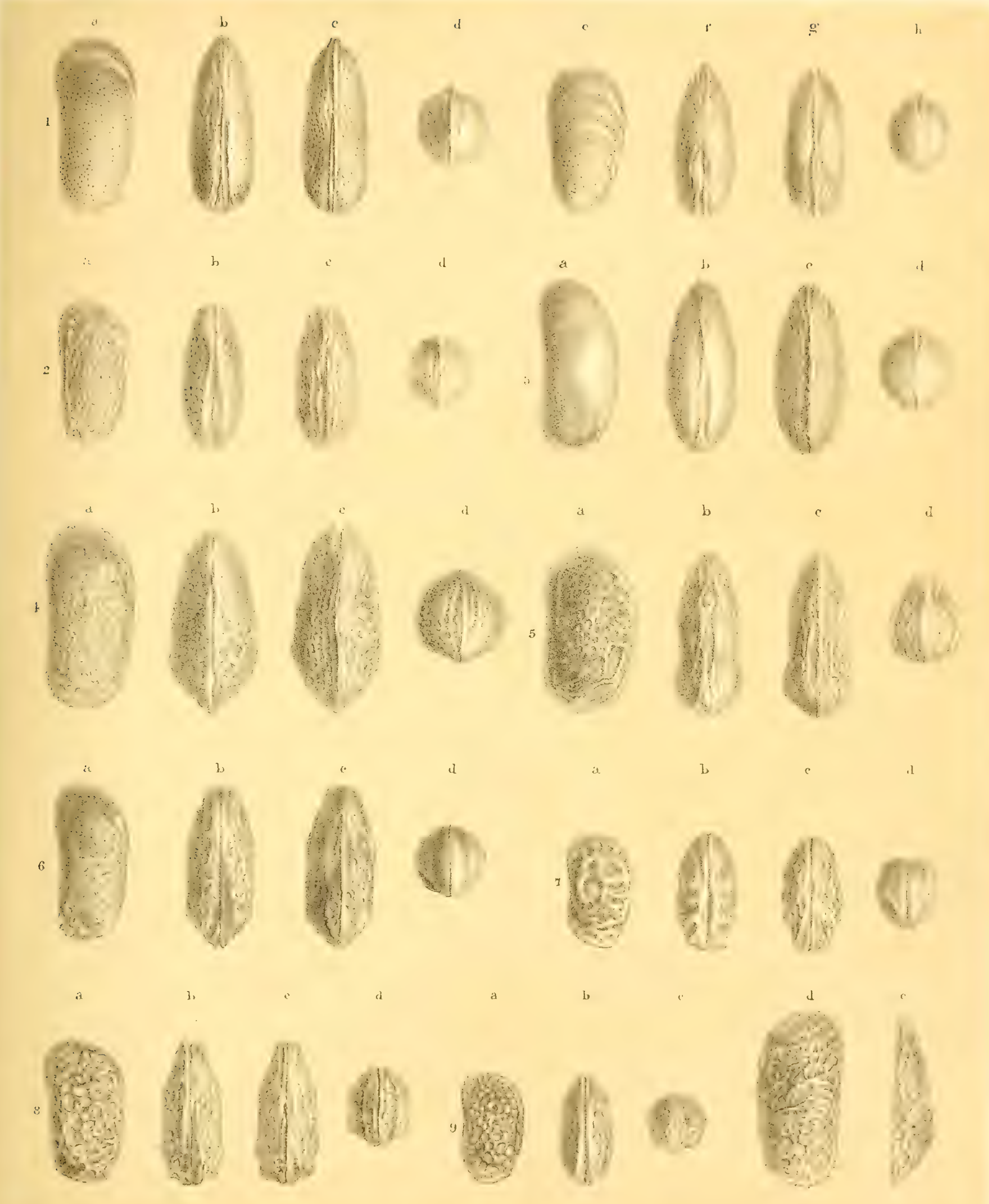

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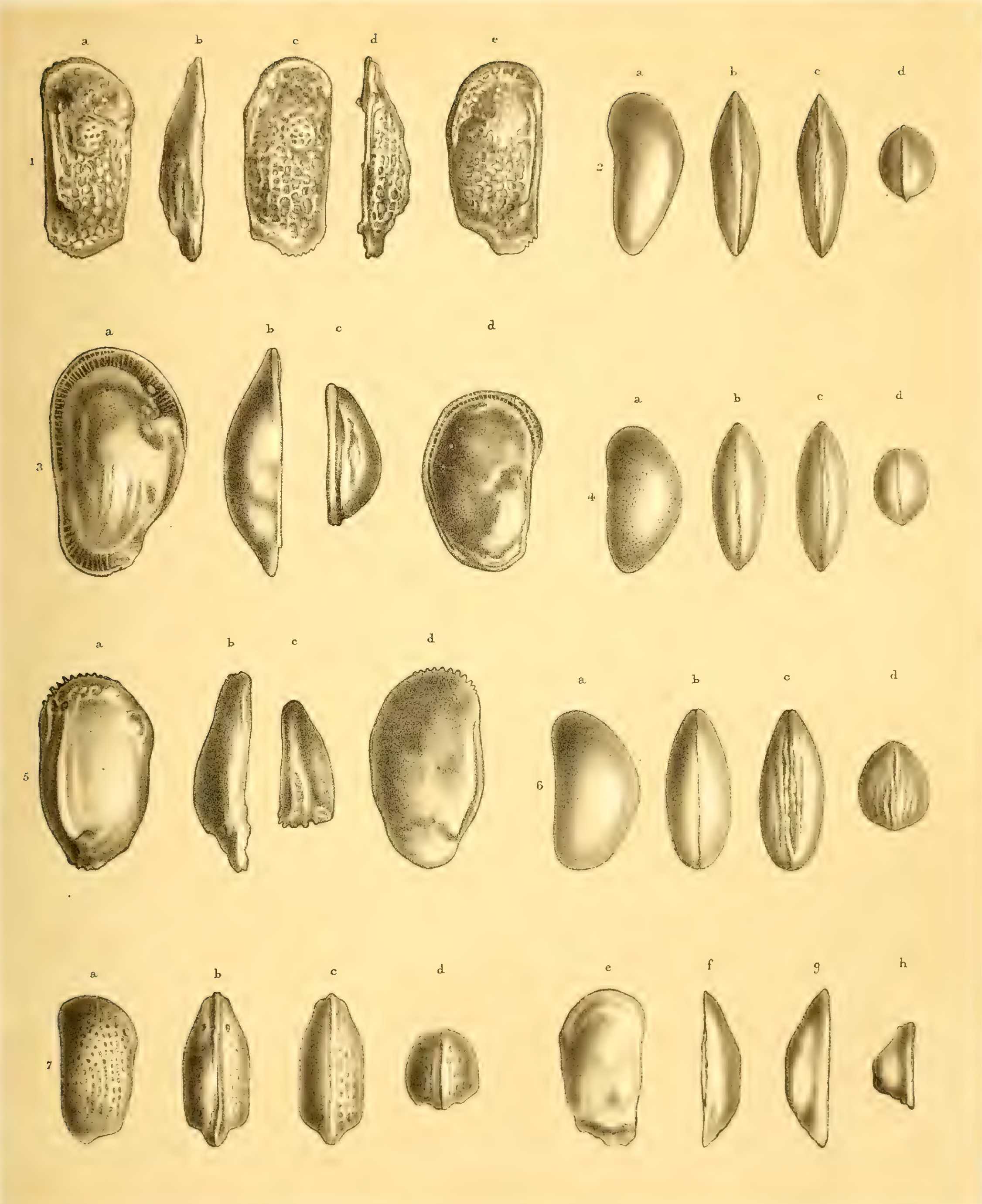

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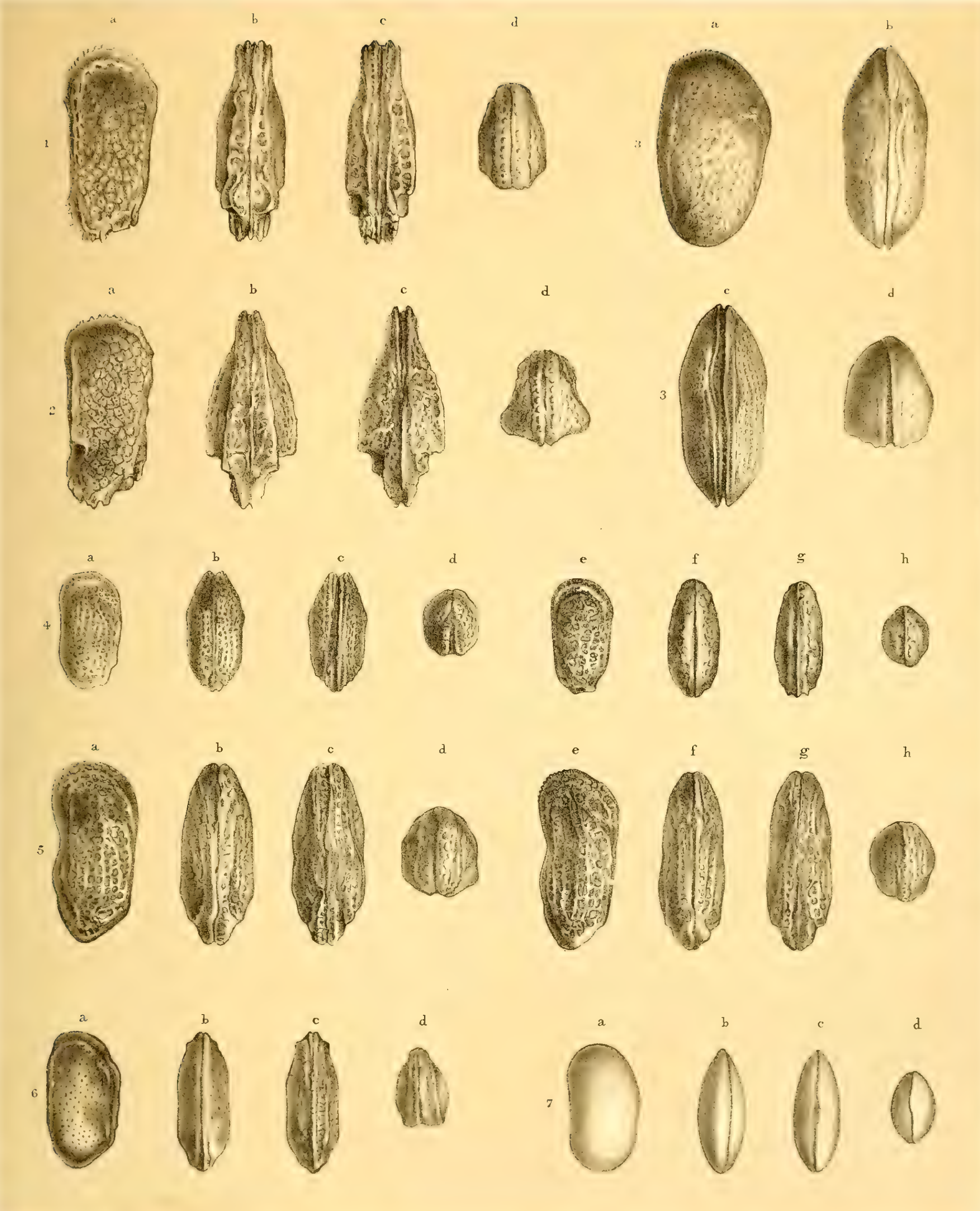

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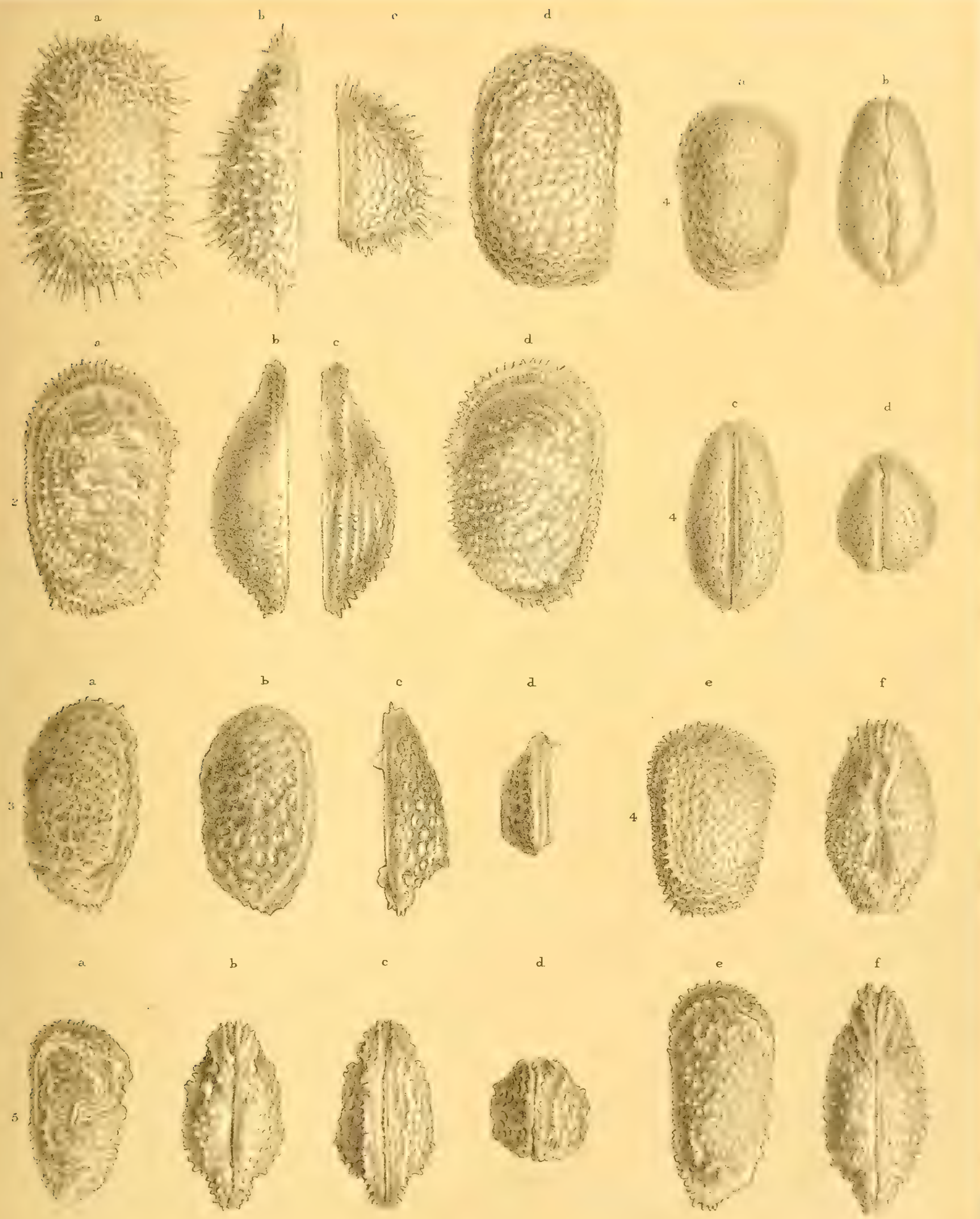

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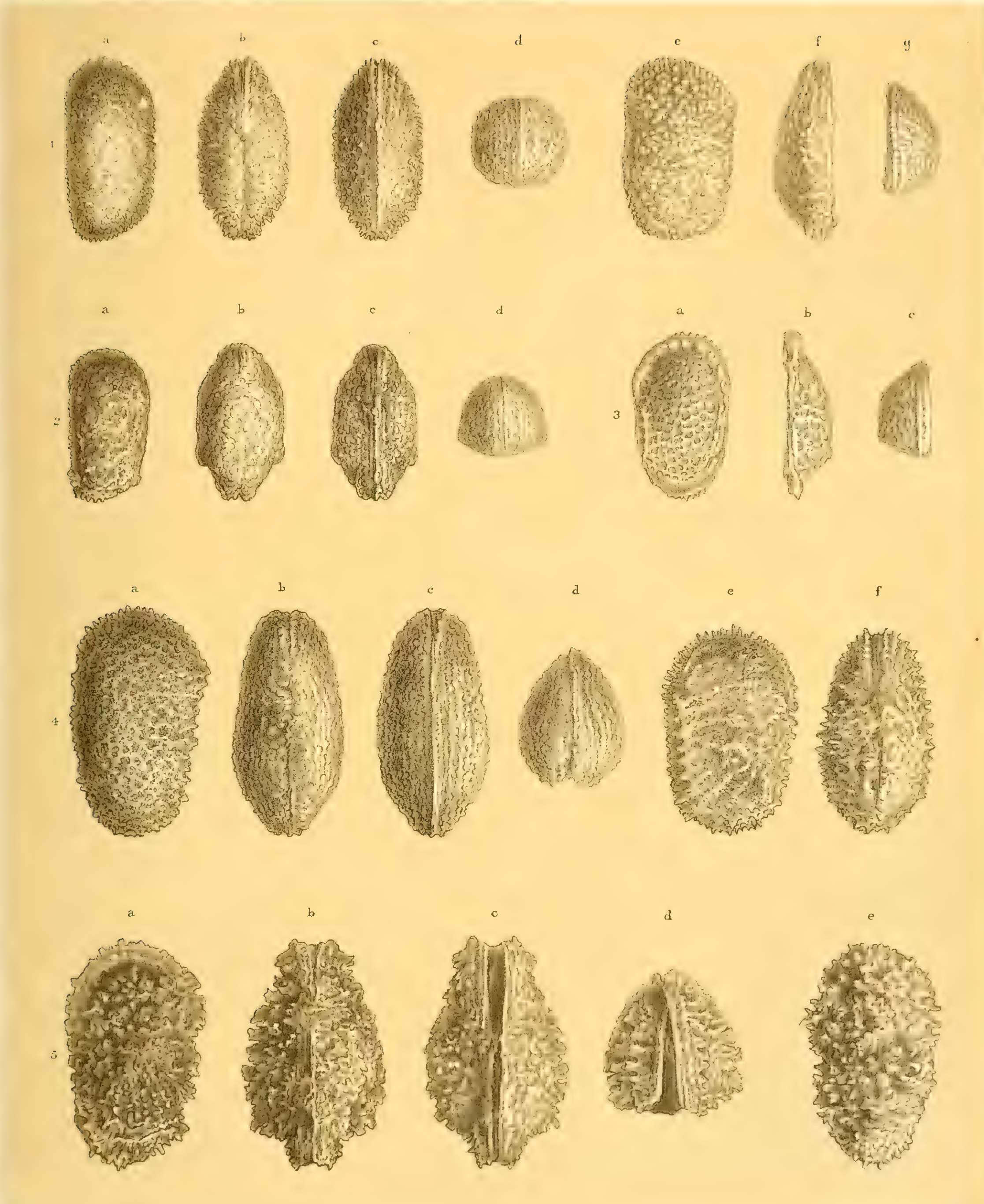
4 a–f „ DASYDERMA, Sp. nov
5 a–f CYTHERE SCABROCUNEATA, Sp. nov



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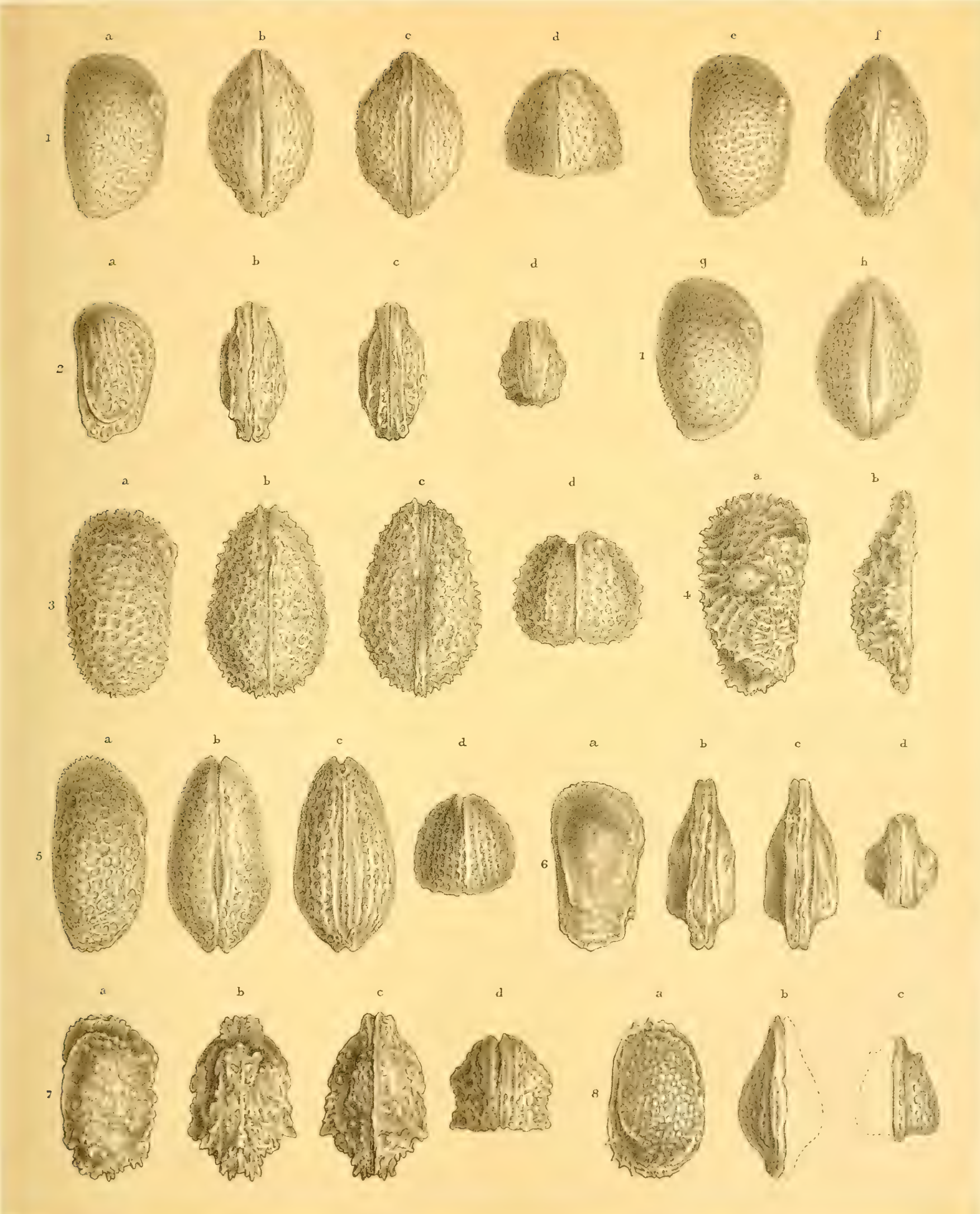

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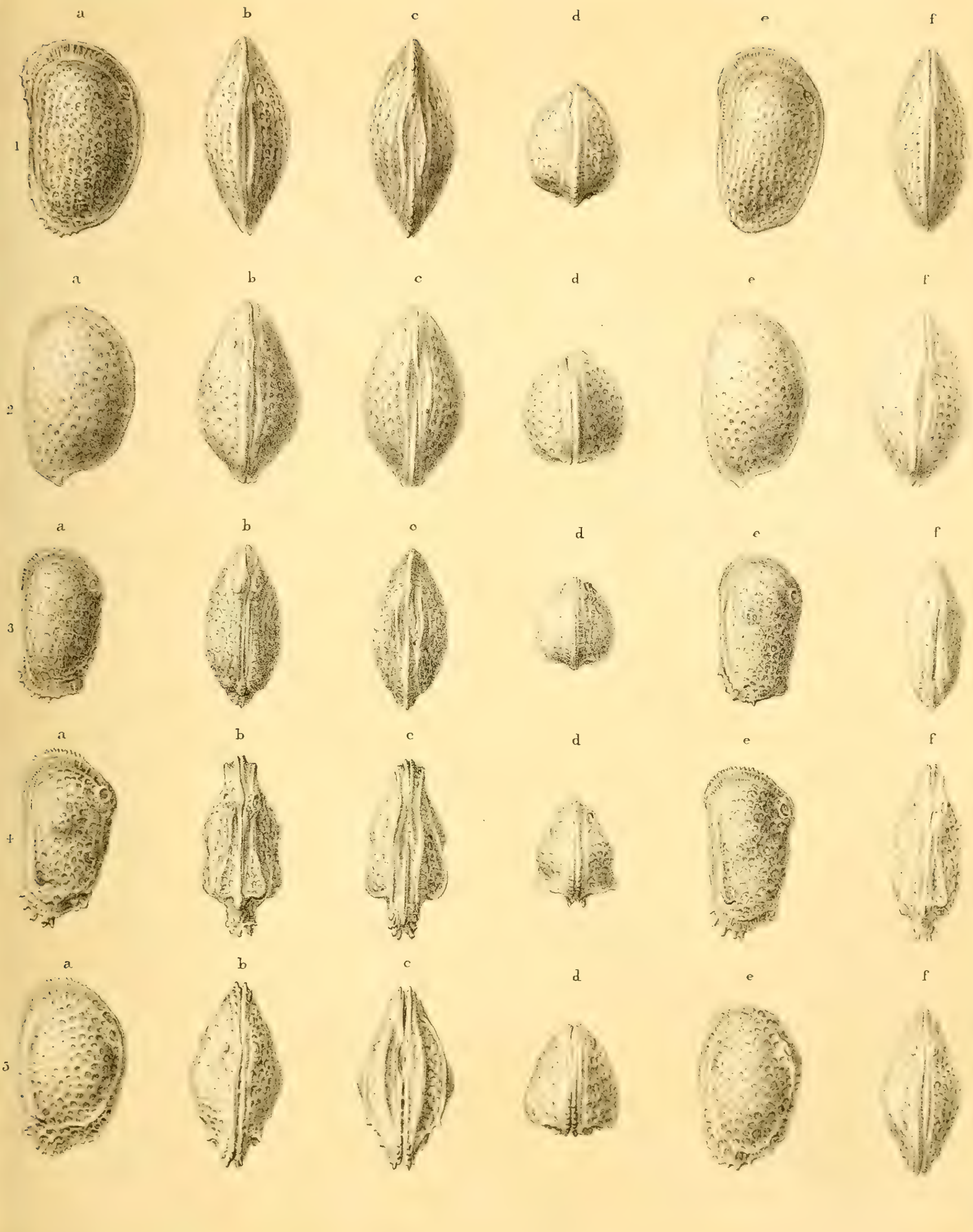

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6 a–h. " STIMPSONI, G.S. Brady.
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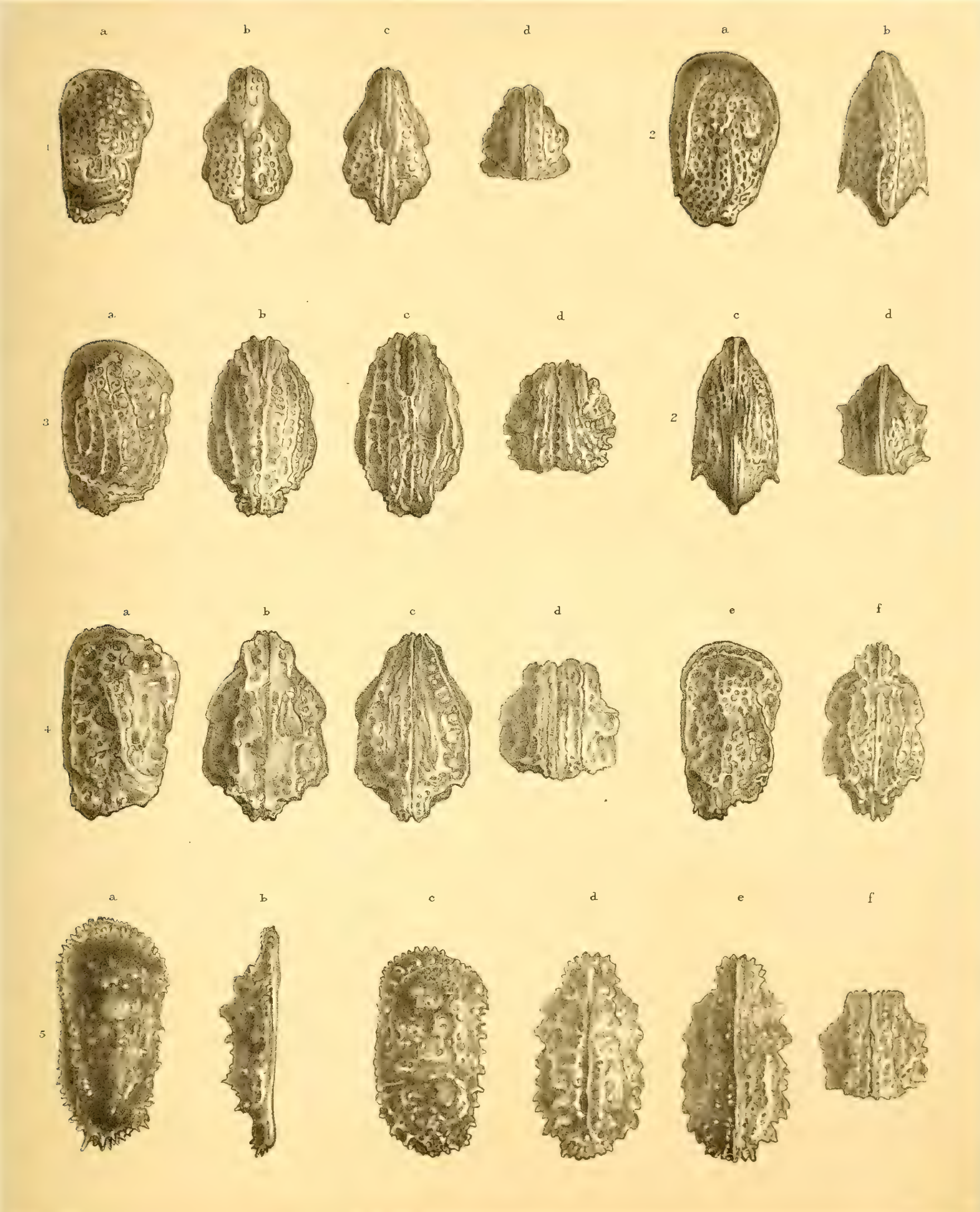

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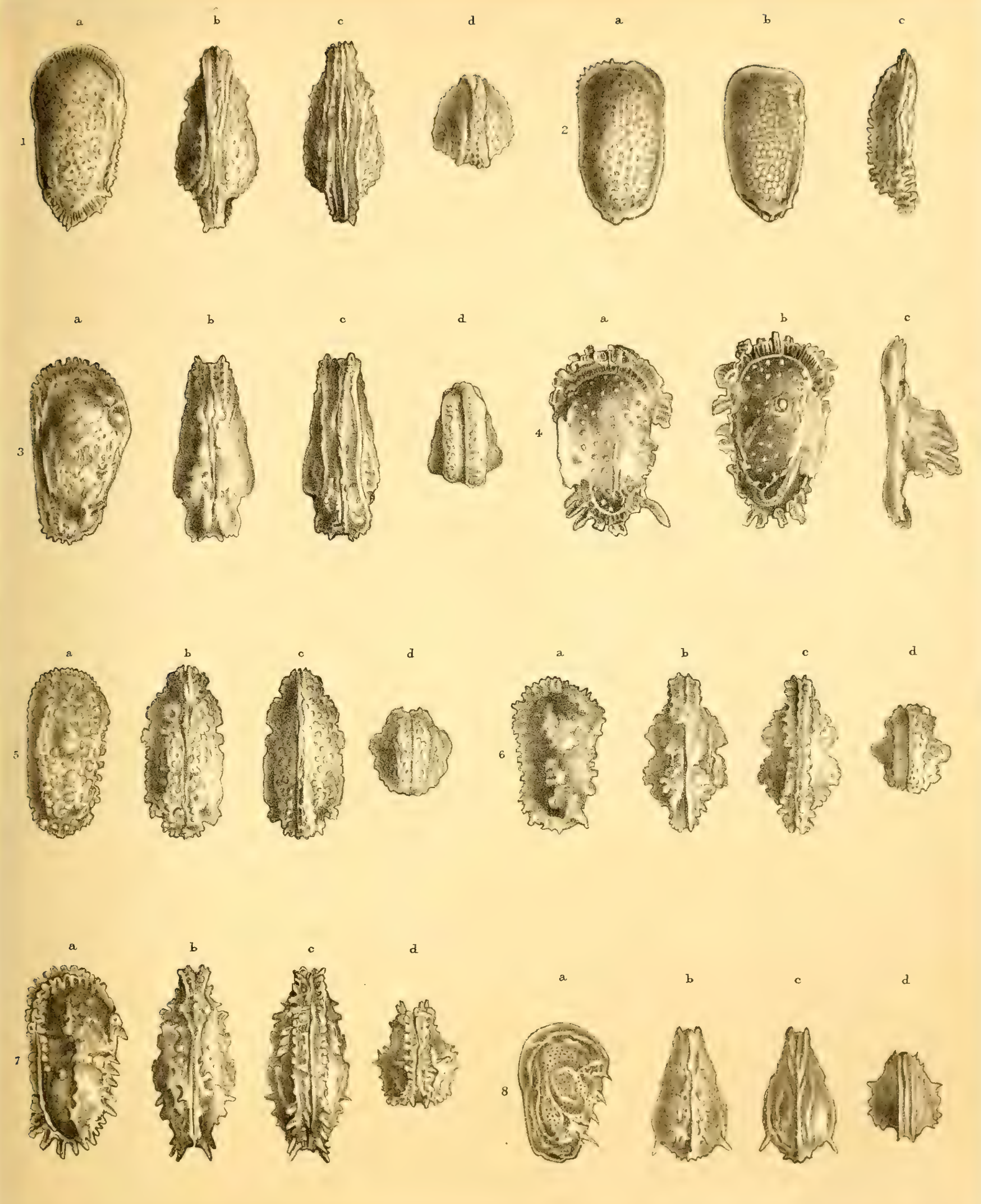

W. Purkiss lith.   Hanhart imp.

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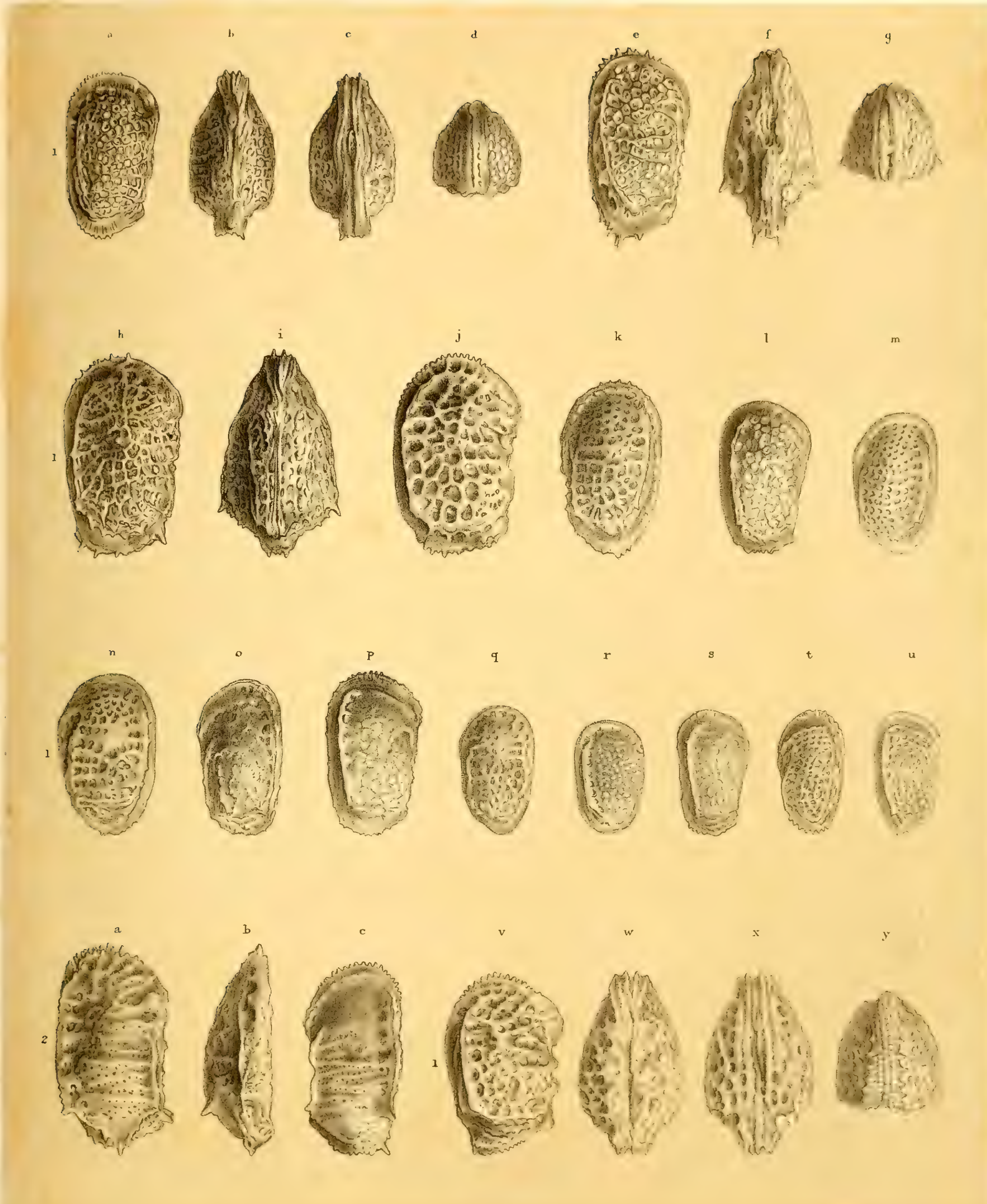
7 a–d „ CLAVIGERA, Sp. nov.
8 a–d „ SQUABIDENTATA, Sp. nov.



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2 a–g CYTHERE DARWINII, G.S.Brady.

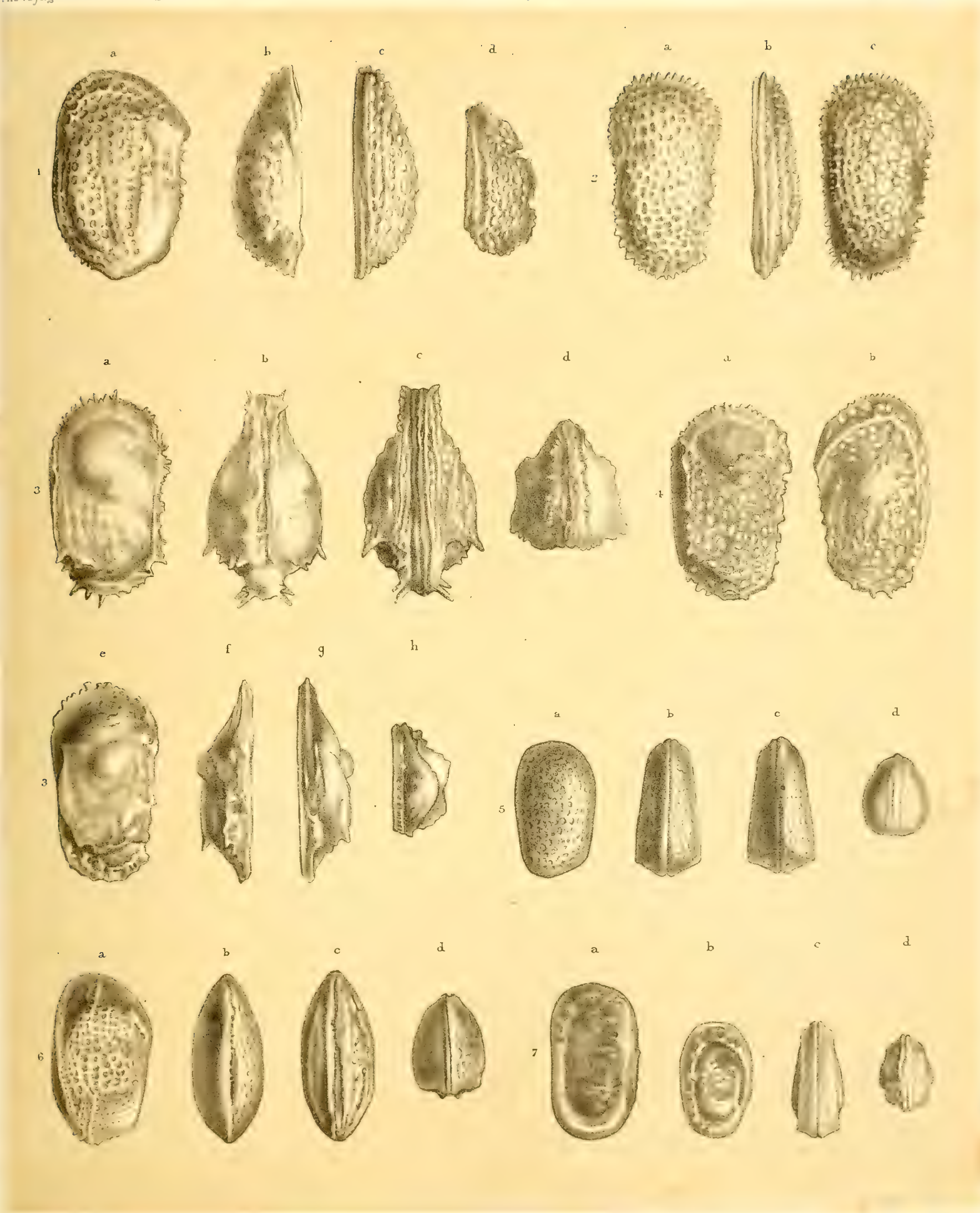
3 a–d " EUPLECTELLA, G.S.Brady.

4 a–d " QUADRIACULEATA, Sp. nov.

5 a–d CYTHERE PAPUENSIS, Sp. nov.

6 a–d " ADUNCA, G.S.Brady.

7 a–g " GOUJONI, G.S.Brady.



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3 a–h „ SUHMII, Sp. nov.

4 a.b. „ NORMANI, G.S. Brady.

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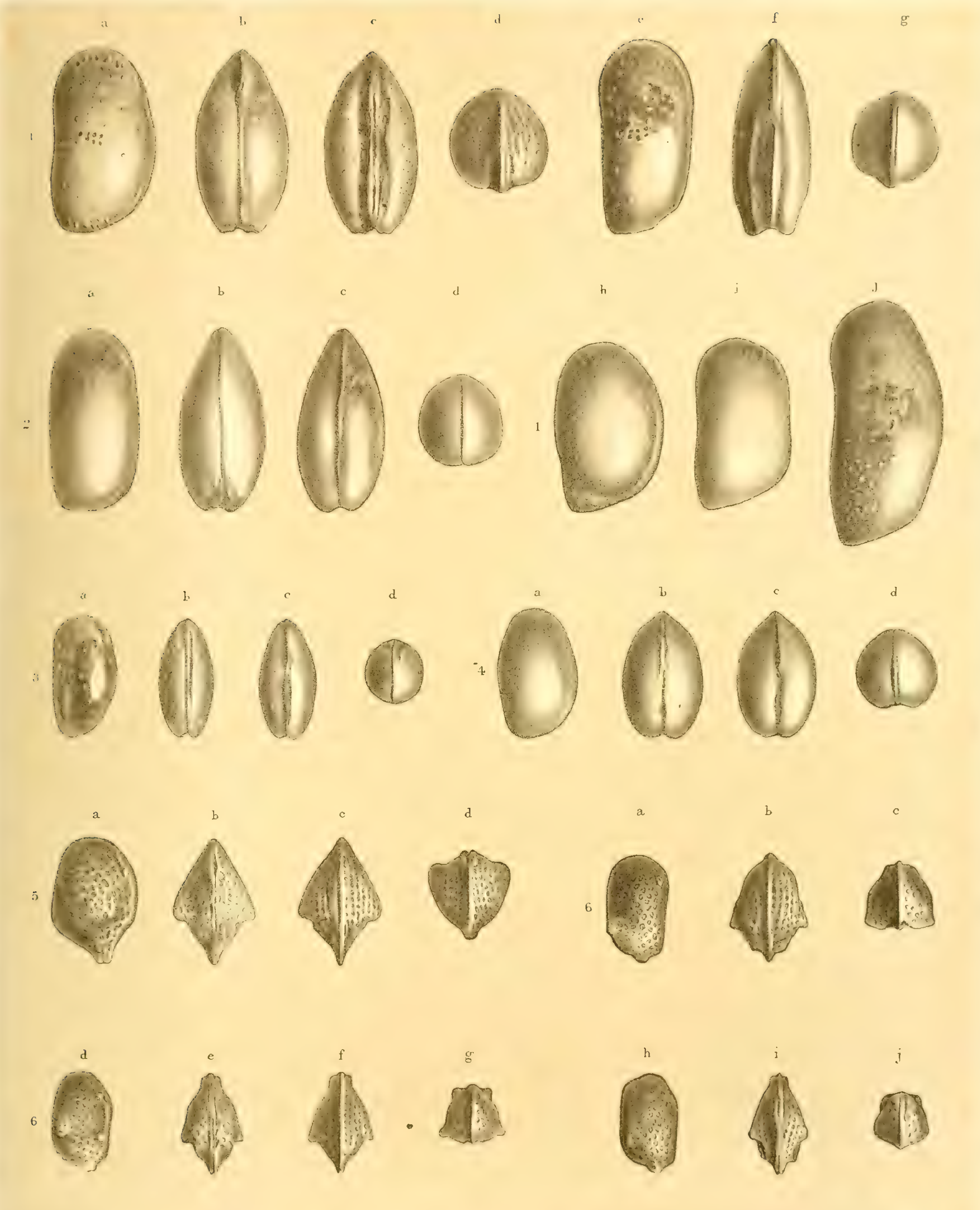

W Purkiss del et lith

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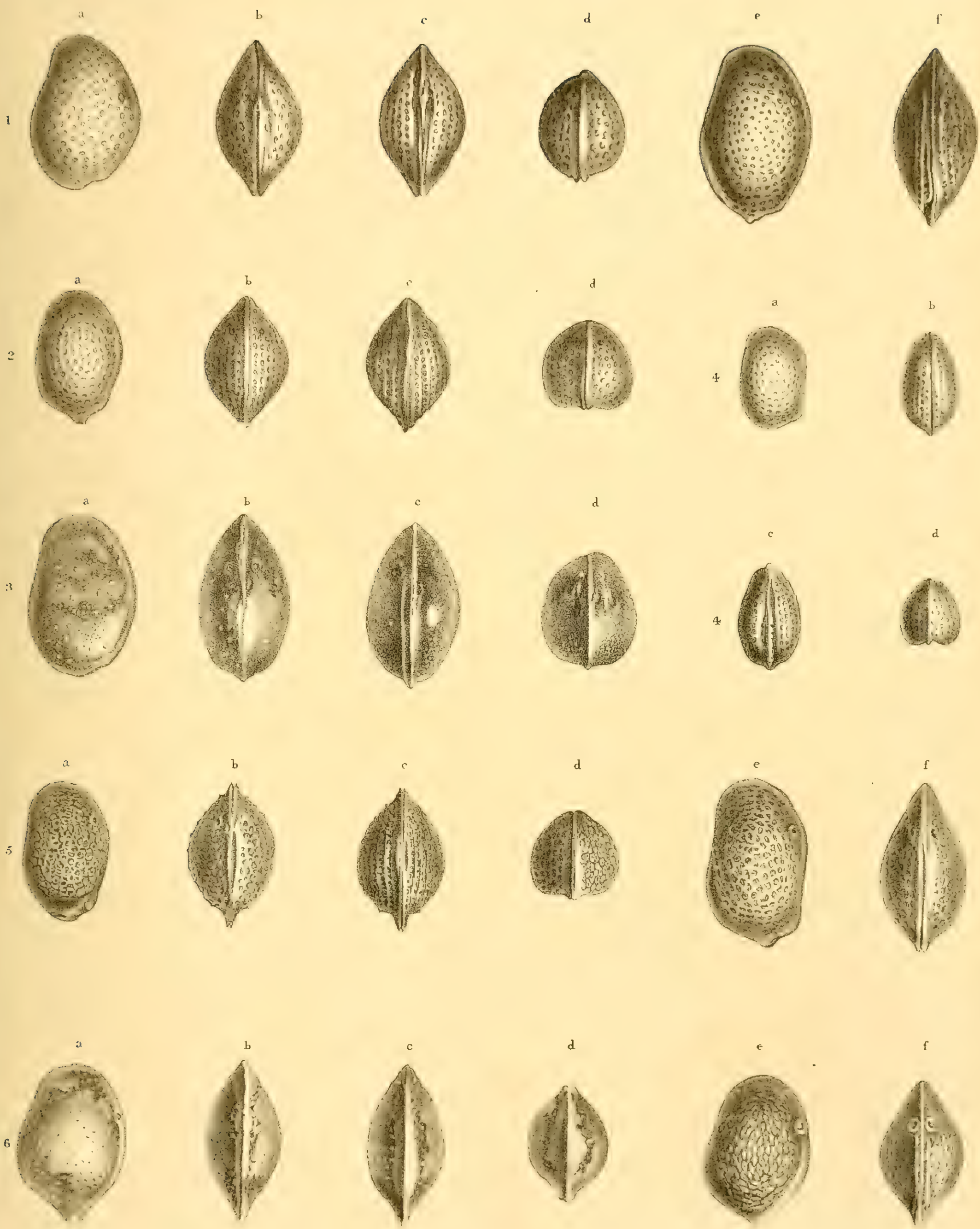

Purkiss del. et lith.

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6, a–d " VARIOLATA G.S.Brady
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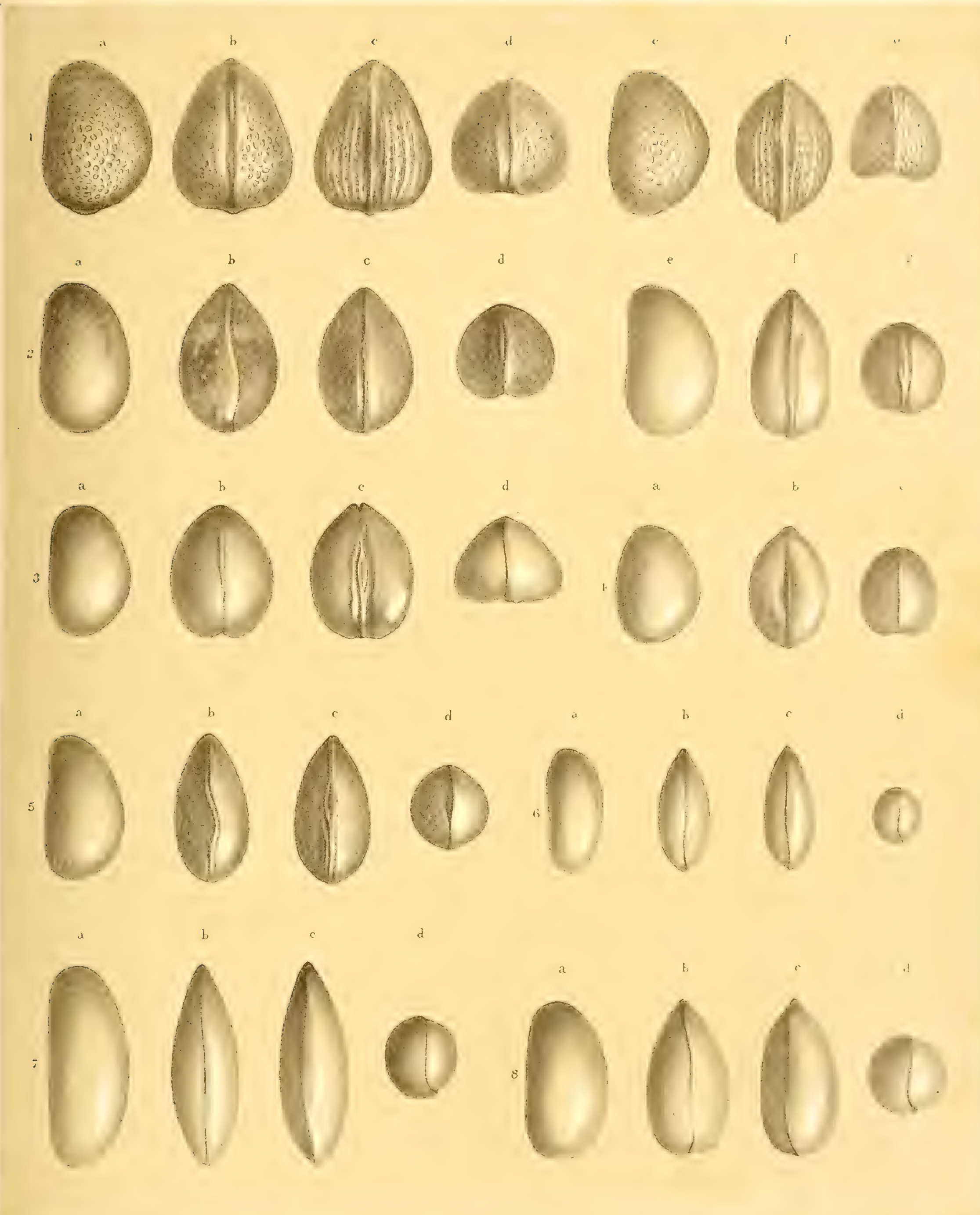

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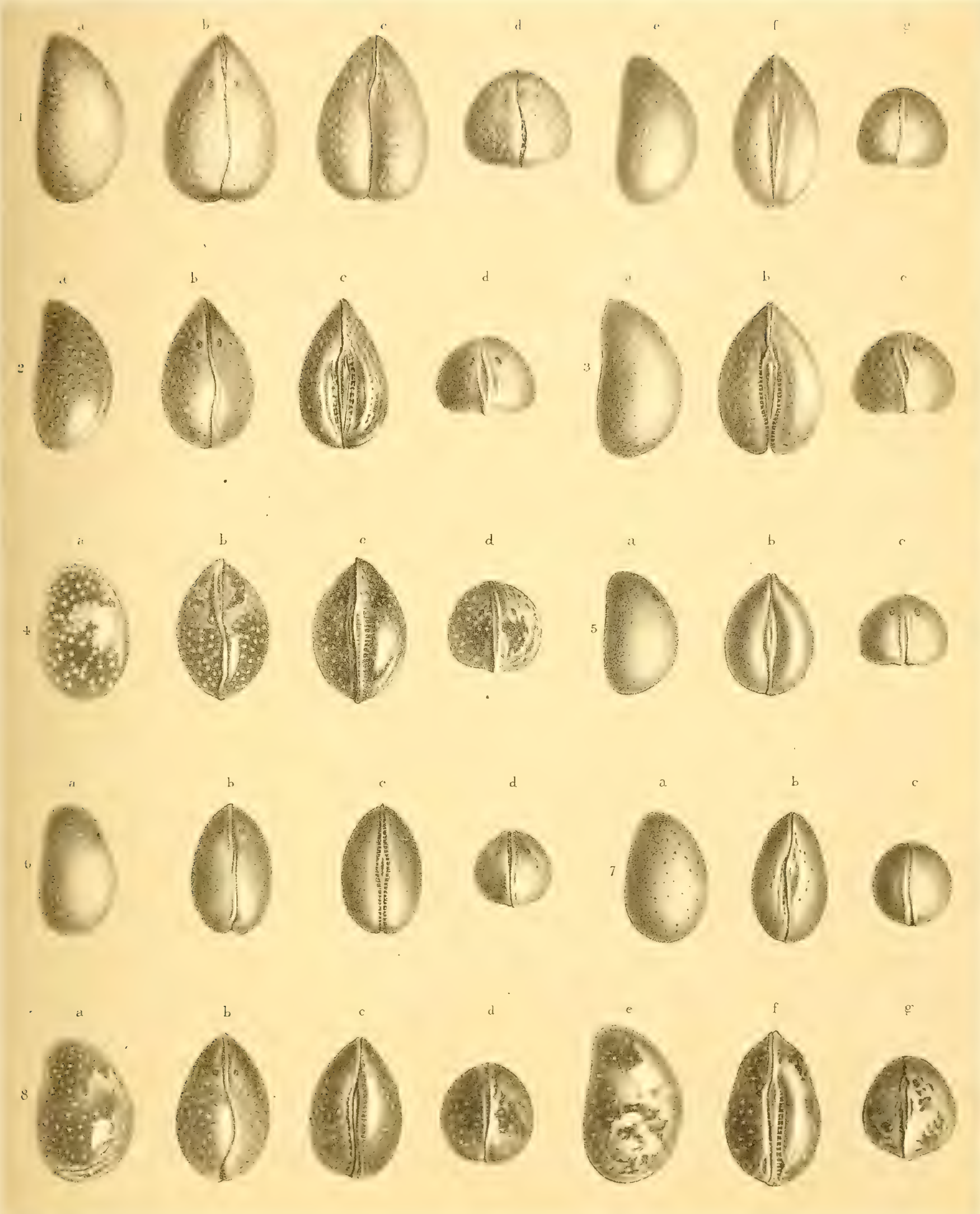

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8, a–d. " CLAUSII, Sp. nov.
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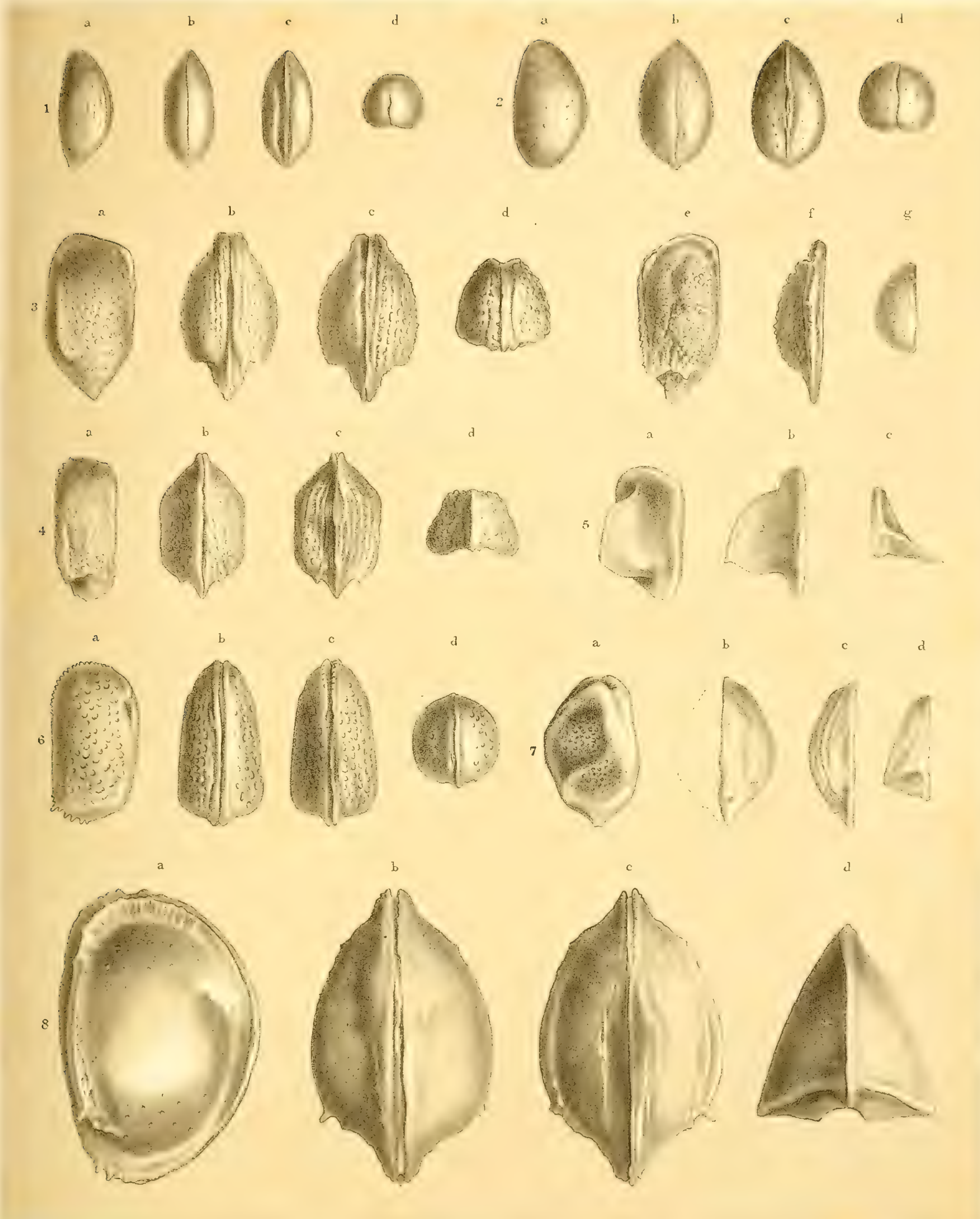

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7, a–d. CYTHEROPTERON PATAGONIENSE, Sp. nov.
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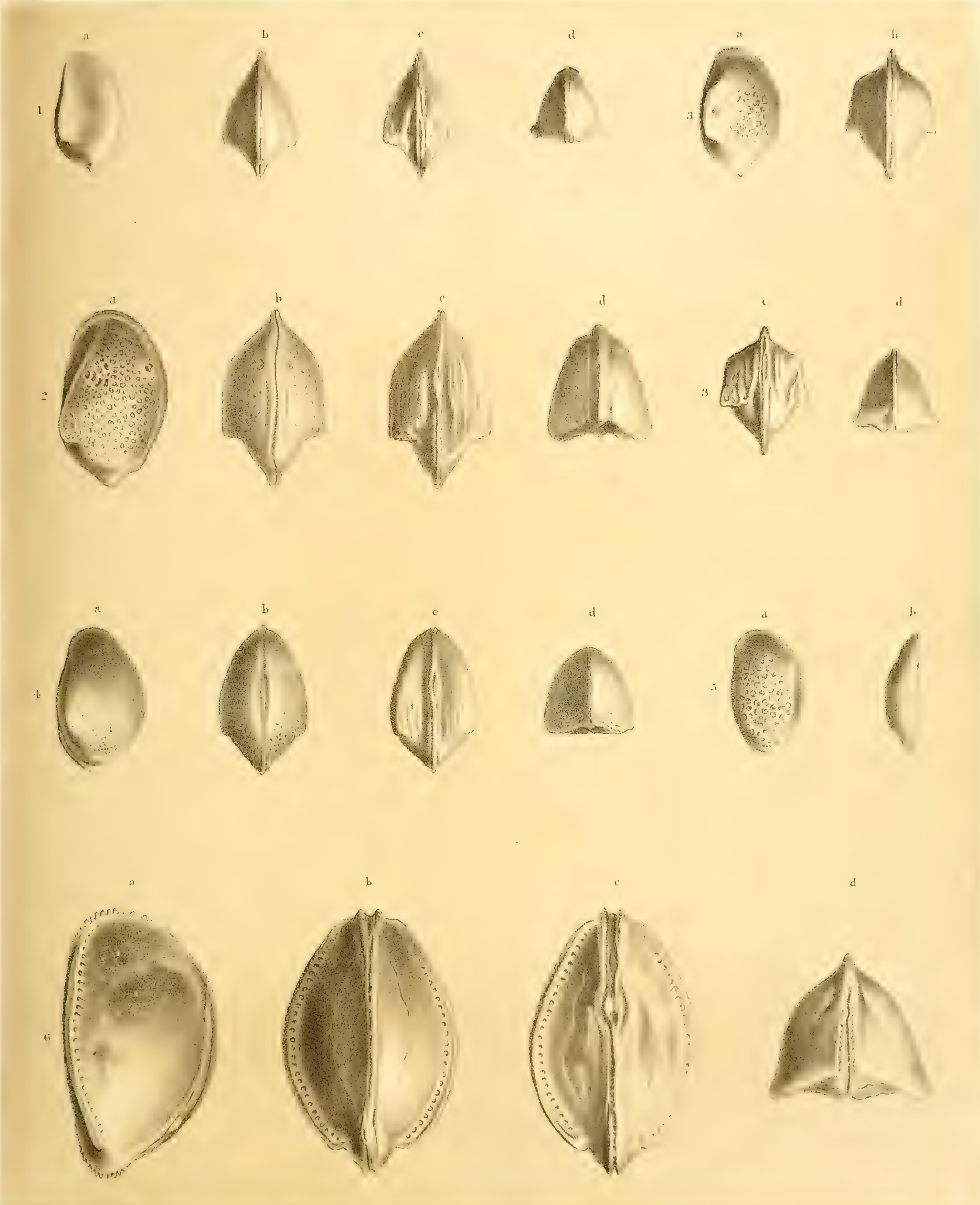

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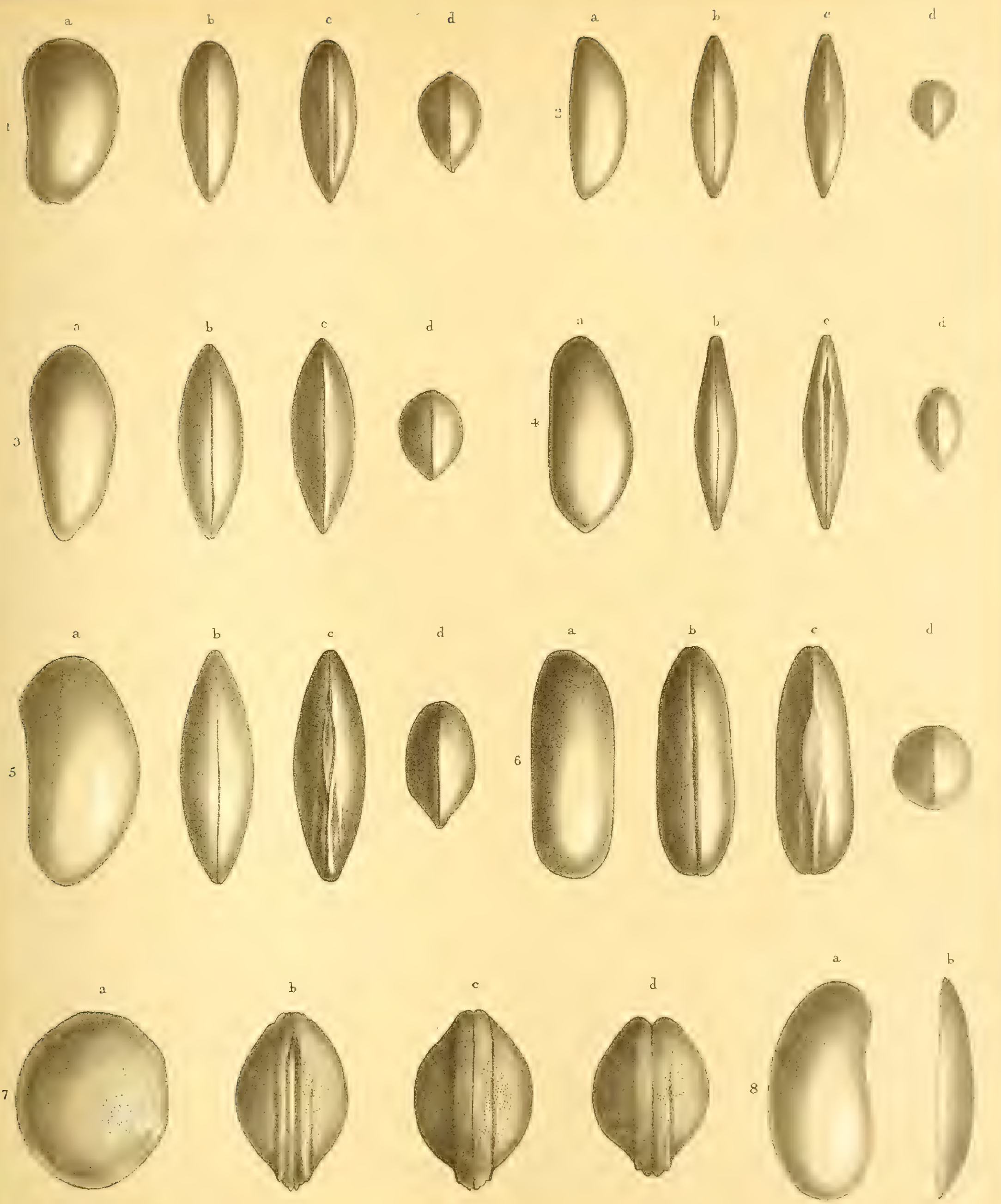
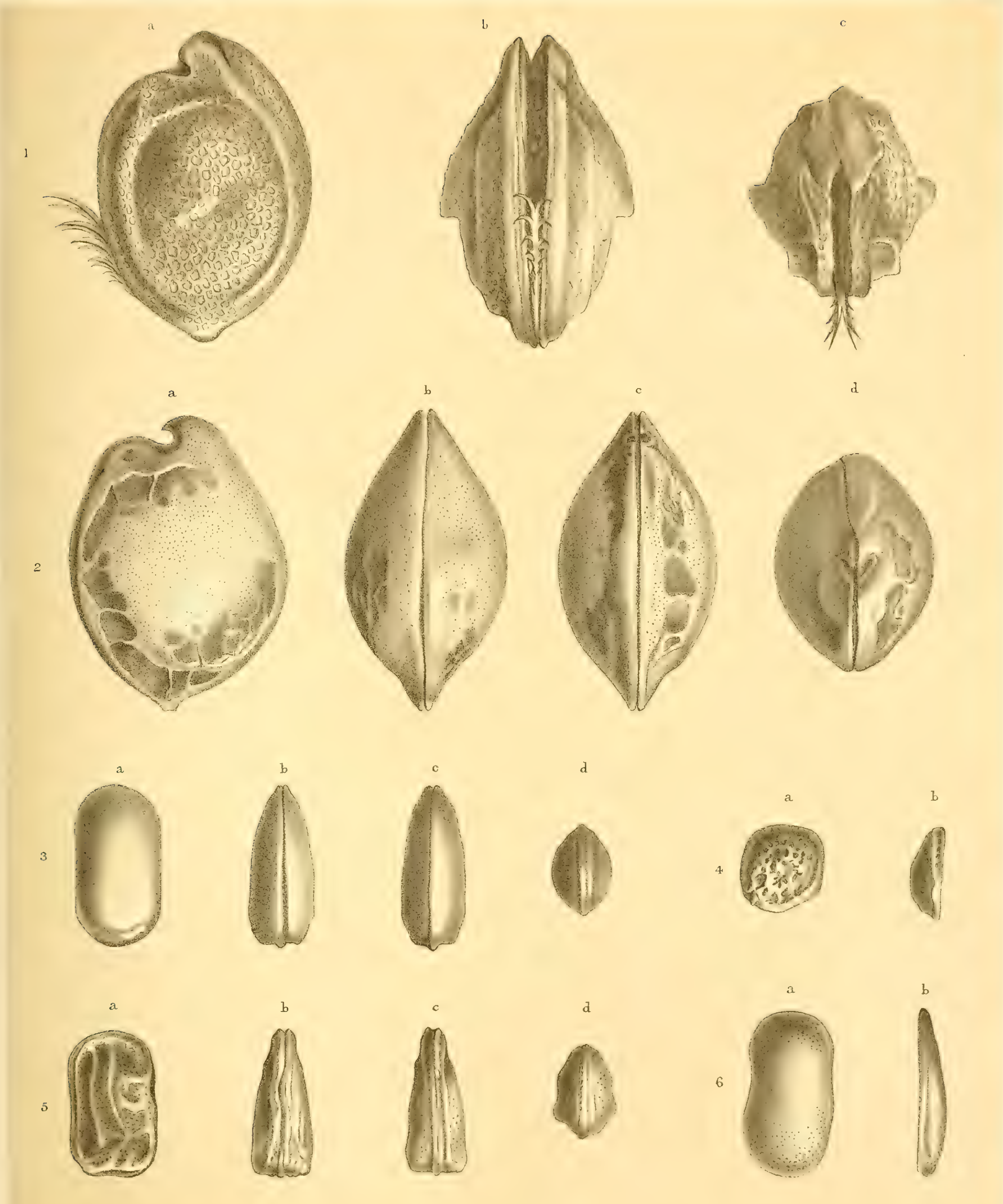
5 a–b " ANGUSTUM, Sp.nov.
6 a–d " FENESTRATUM, Sp.nov.



Purkiss del et lith.

Hanhart imp

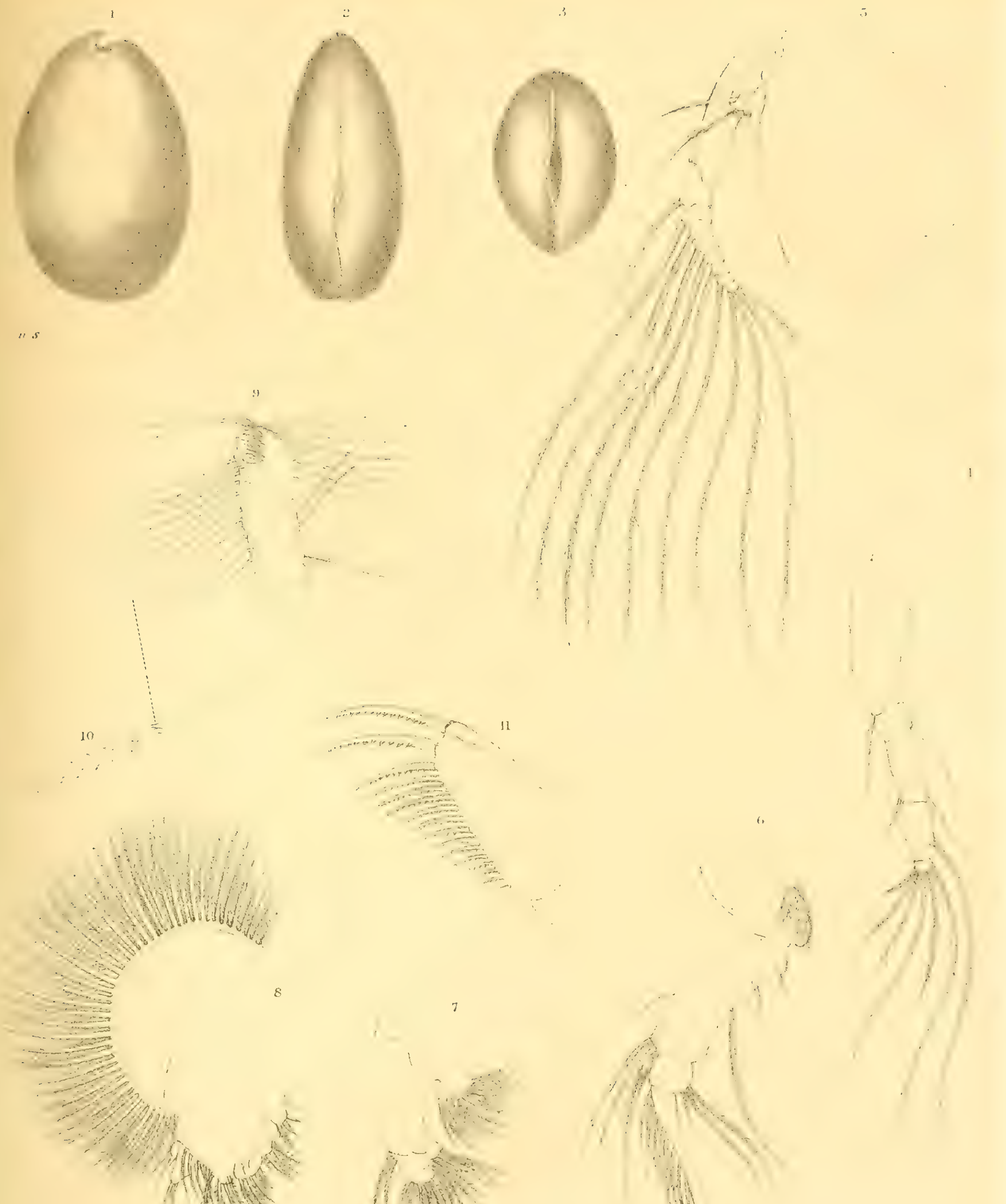
1, a–d. PARADOXOSTOMA ABBREVIATUM, G.O.Sars.
2, a–d. XIPHICHILUS ARCUATUS, Sp.nov.
3, a–d. PARADOXOSTOMA ENSIFORME? G.S.Brady.
4, a–d. XIPHICHILUS COMPLANATUS, Sp.nov.
5, a–d. BYTHOCYPRIS ?, COMPRESSA, Sp.nov.
6, a–d. CYTHERIDEIS LÆVATA, Sp.nov.
7, a–d. POLYCOPE CINGULATA, Sp.nov.
8, a–b. SCLEROCHILUS CONTORTUS, (Norman)



Purkiss del. et lith.

Hanhart imp.

1, a–c. PHILOMEDES WYVILLE-THOMSONI, Sp. nov.
2, a–d. CYPRIDINA DANÆ, Sp. nov.
3, a–d. CYTHERELLA TRUNCATA, G.S. Brady.
4, a–b. POLYCOPE FAVUS, Sp. nov.
5, a–d. CYTHERELLA CAVERNOSA, G.S. Brady.
6, a b. " PUNCTATA, G.S. Brady.

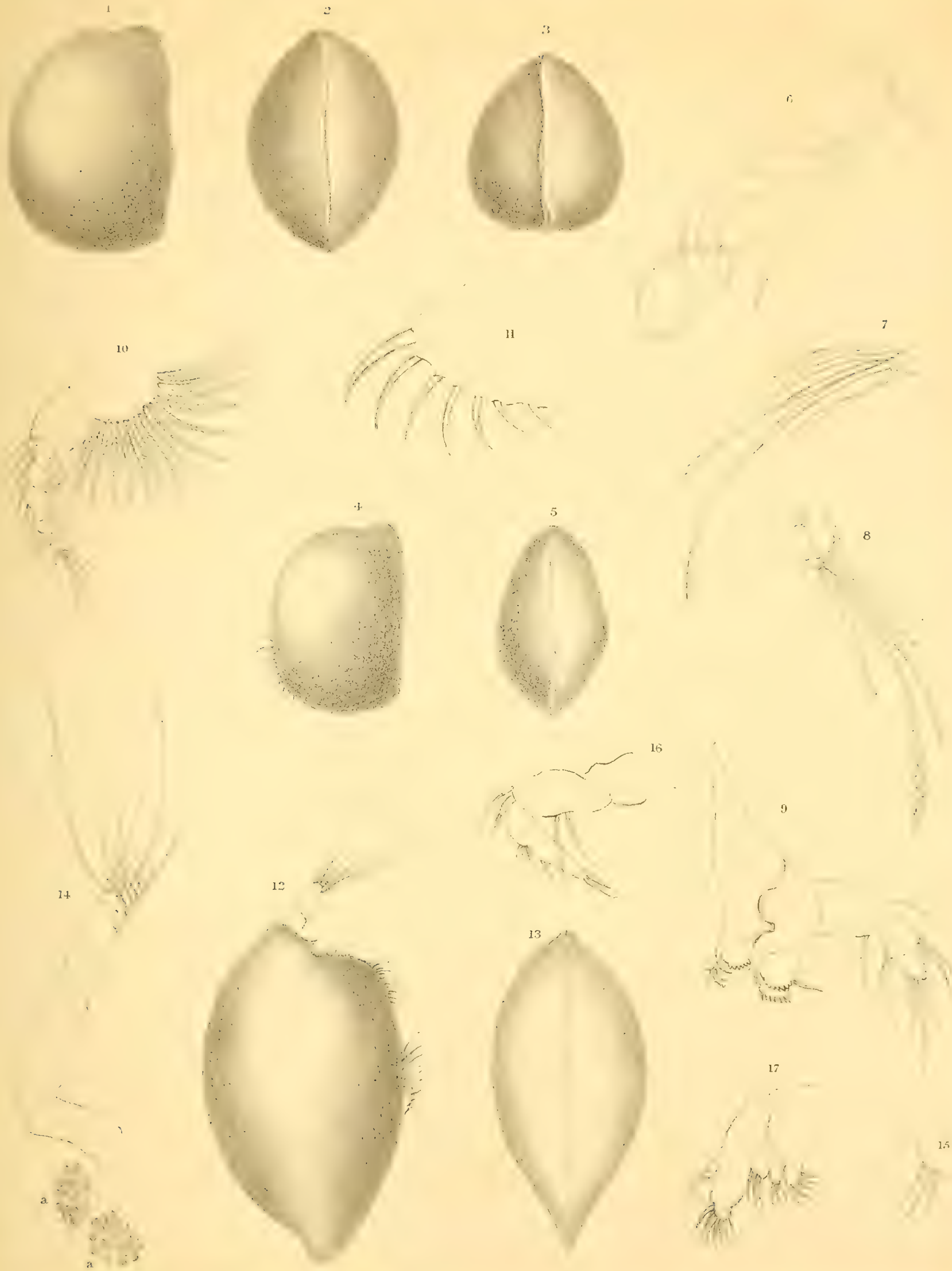


G.S.B. del et lith

Hanhart imp

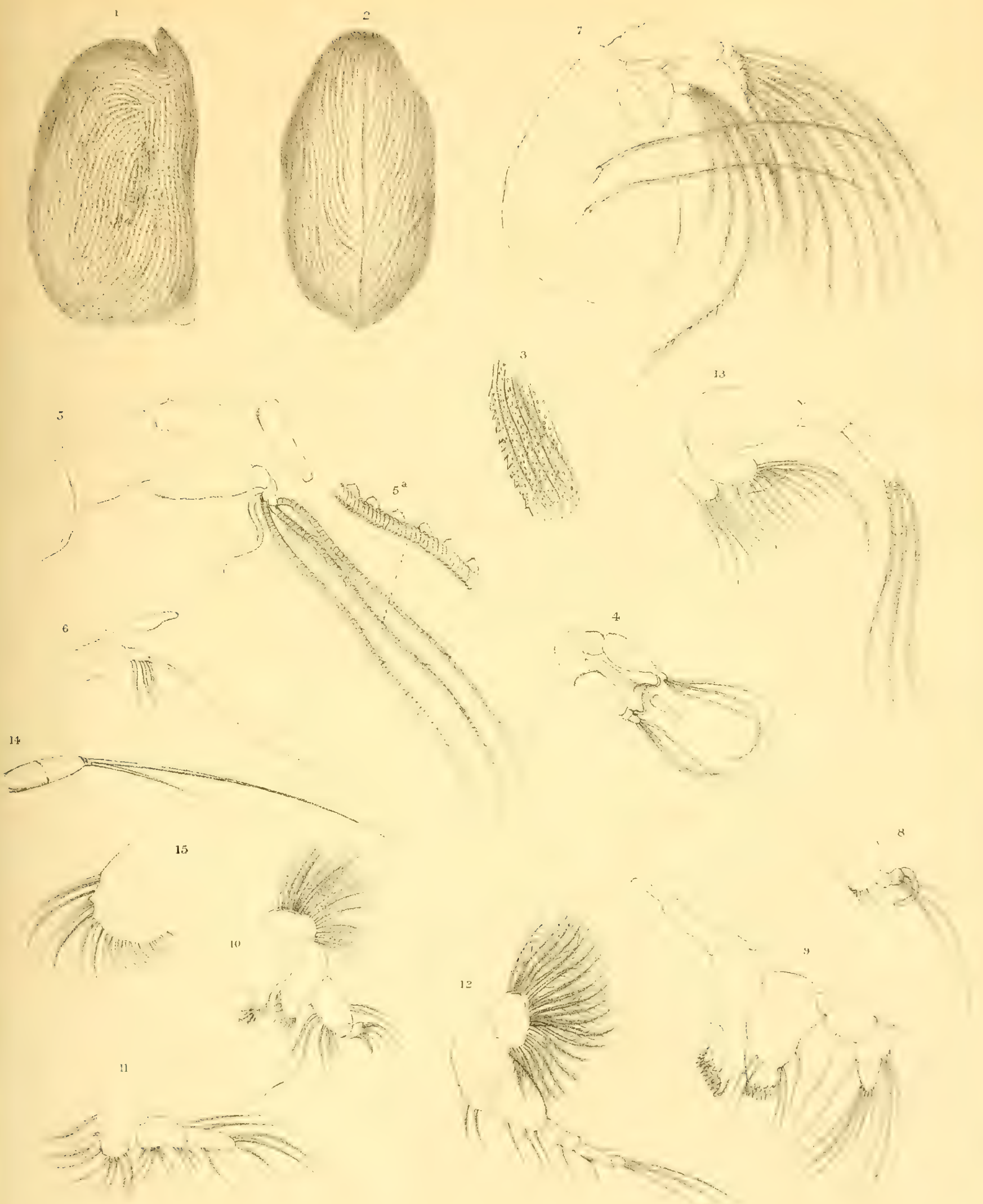
CYPRIDINA GRACILIS, Sp nov.

CROSSOPHORUS IMPERATOR, nov. gen. & Sp.



Hanhart imp.

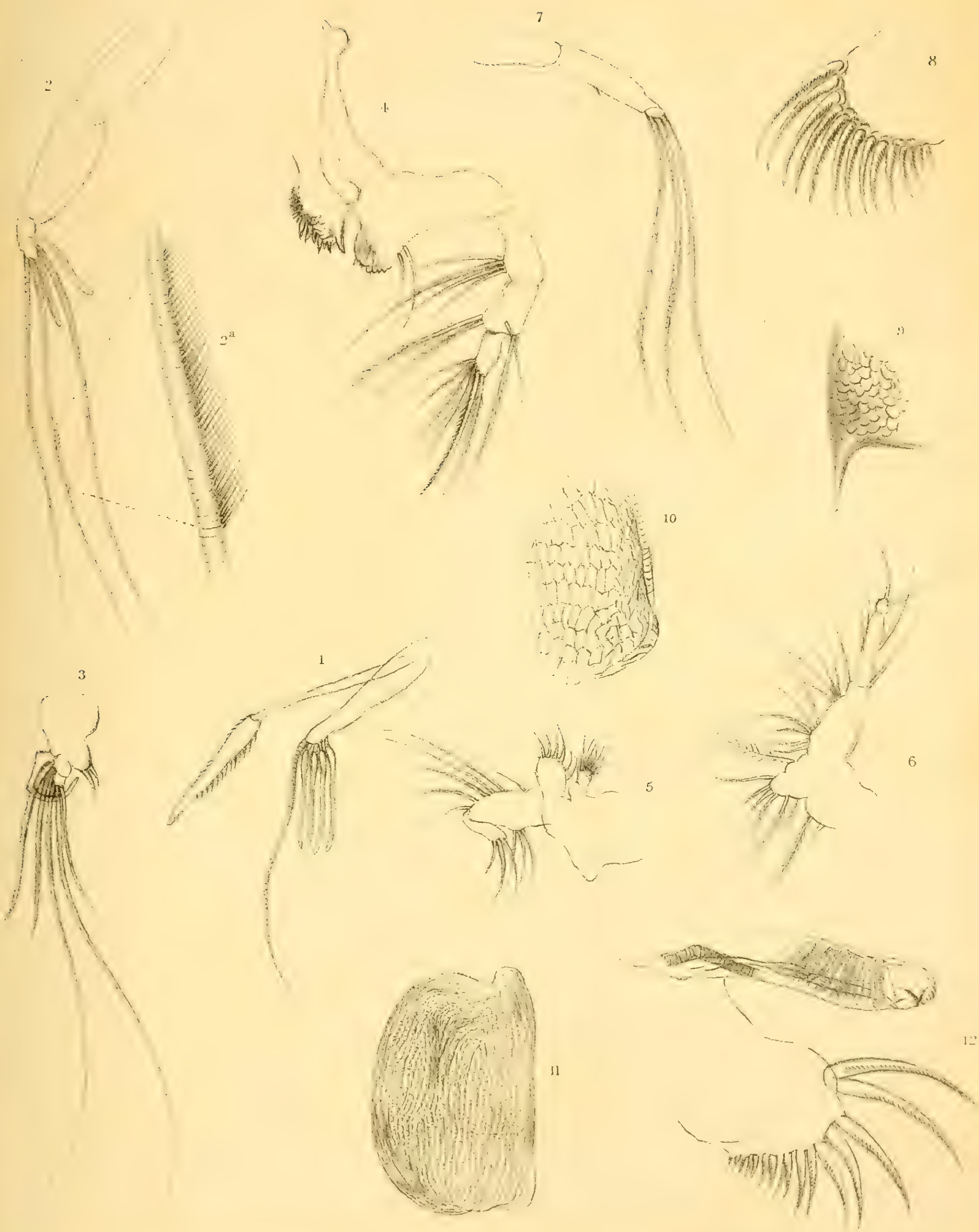
1_11. HALOCYPRIS BREVIROSTRIS, Dana.
12_17. PHILOMEDES GIBBOSA, (Dana).



GSB del et lith

Hanhart imp.

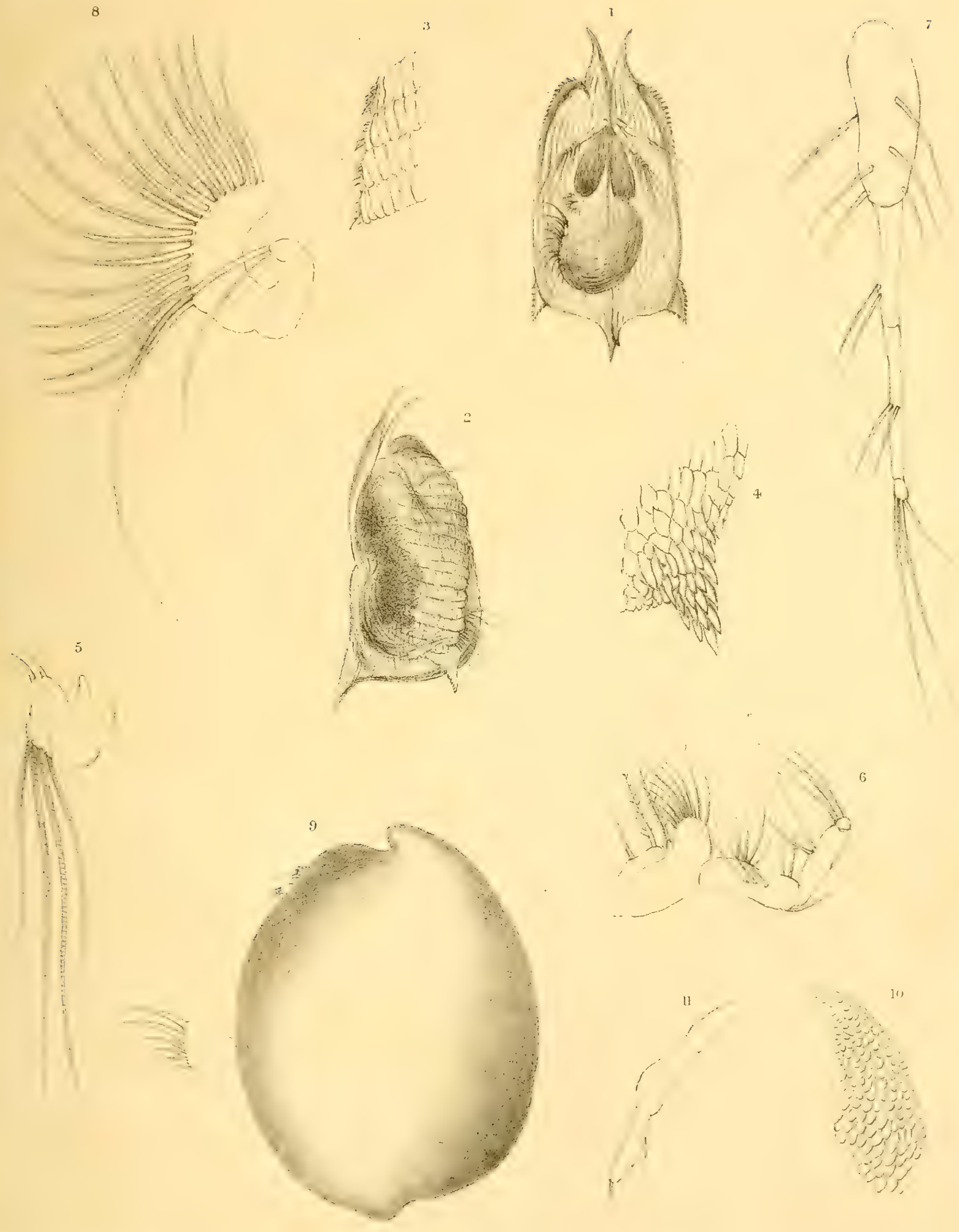
HALOCYPRIS ATLANTICA, Lubbock.



G.S.B. del. et lith.

Hanhart imp.

1_10. HALOCYPRIS IMBRICATA, ♂ & ♀, Sp nov.
11, 12. " ATLANTICA, ♂ Lubbock.



G.S.B. del. et lith.

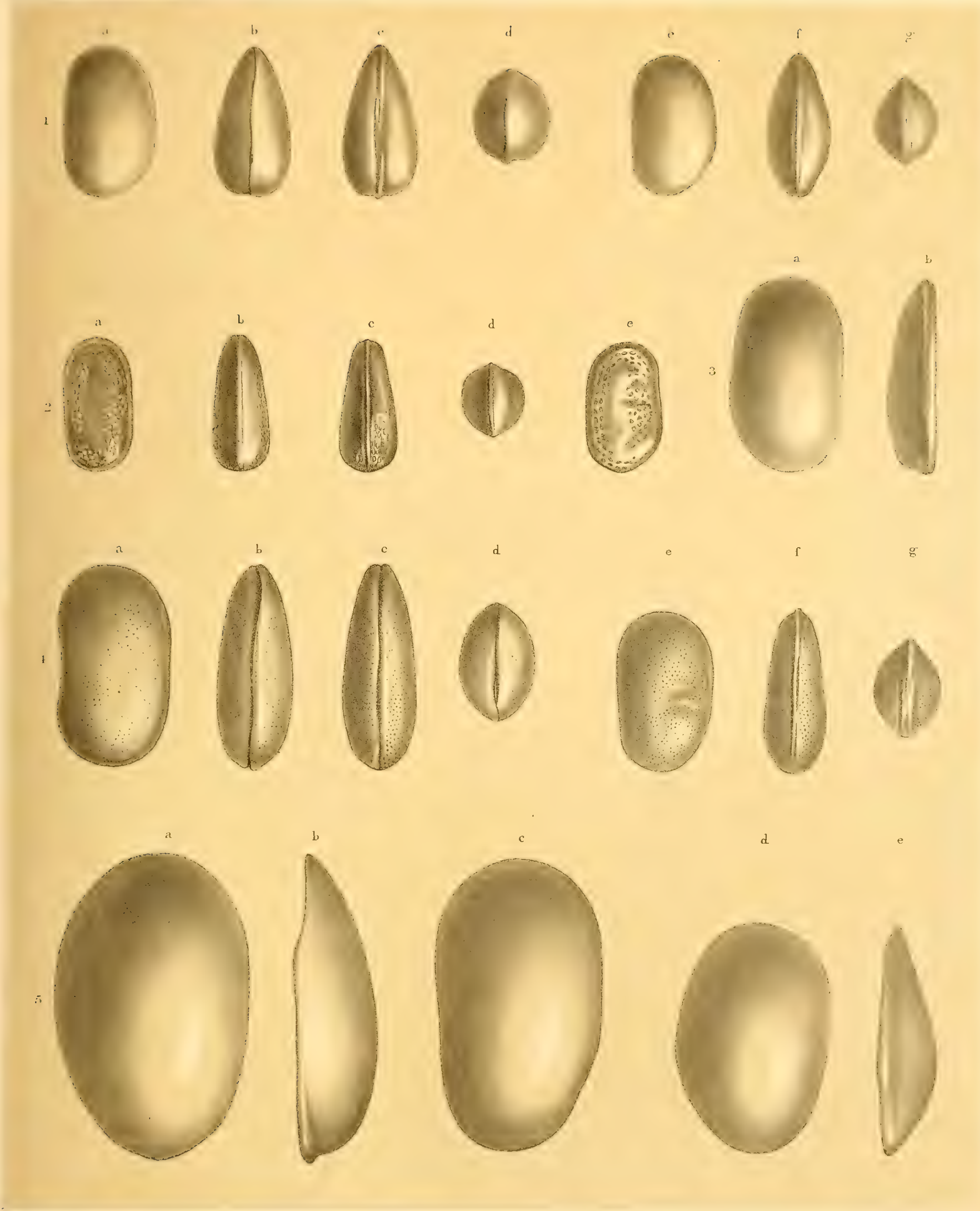
Hanhart imp.

I_8. HALOCYPRIS IMBRICATA, ♀ Sp. nov.
9_II. CYPRIDINA FORMOSA?, Dana.

Purkiss del et lith.

Hanhart imp

1, a–g. CYTHERELLA CINGULATA, G.S.Brady.
2, a–d. " " " " .
3, a–c. " IRREGULARIS, Sp. nov.
4, a–d. CYTHERELLA VENUSTA, Sp. nov
5, a–c. " POLITA, G.S.Brady.
6, a, b. " DROMEDARIA, Sp. nov
7, a–d. CYTHERE SERRATULA, Sp. nov



Purkiss del. et lith.

Hanhart imp.

1. a–g. CYTHERELLA POLITA, G.S.Brady.
2. a–e. " SEMITALIS, G.S.Brady.
3. a–b. " PULCHRA, G.S.Brady.
4. a–g. " PUNCTATA, G.S.Brady.
5. a–e. " LATA, Sp. nov.

THE

VOYAGE OF H.M.S. CHALLENGER.

ZOOLOGY.

REPORT on the BONES OF CETACEA collected during the Voyage of H.M.S. Challenger in the years 1873-1876. By WILLIAM TURNER, M.B. (Lond.), F.R.SS. L. and E., Professor of Anatomy in the University of Edinburgh.

PROFESSOR SIR C. WYVILLE THOMSON having entrusted to me for purposes of description the bones of the CETACEA collected during the voyage of H.M.S. Challenger, I have to report as follows :—

The specimens which were placed in my hands for examination were—

A. The skull, without the lower jaw, of an adult *Mesoplodon layardi.* This specimen is now in the Oxford Museum, and I am indebted to Professor Rolleston for the opportunity of examining it.

B. The end of the rostrum, with the corresponding part of the lower jaw, and the two mandibular teeth of *Mesoplodon layardi,* also in the Oxford Museum.

C. The skull and a large part of the skeleton of an immature Cetacean, evidently a young *Mesoplodon layardi.*

D. A skull with lower jaw from the Colonial Museum, Wellington, New Zealand, marked *Epiodon chathamiensis,* but which I regard as a specimen of *Ziphius cavirostris.*

E. Atlas, axis, and 3d and 4th cervical vertebræ of Humpback whale of New Zealand, from the Colonial Museum, Wellington.

F. Cervical vertebræ of Right whale of New Zealand, from the Colonial Museum, Wellington.

G. Numerous ear-bones and some fragments of other bones brought up by the dredge from the floor of the ocean.

Mesoplodon layardi (Gray), (Pls. I.–III.).

Specimens *A* and *B* were collected in November 1873 at the Cape of Good Hope by Mr H. N. Moseley, F.R.S., one of the naturalists of the Expedition, and specimen *C* was obtained by the same gentleman at the Falkland Islands in 1875. Mr Moseley has with great courtesy placed at my disposal his notes on these specimens.

Specimen A.—" The skull of *Mesoplodon layardi* was obtained from John M'Kellar, Esq., of Cape Point. The animal came ashore at that place about 1865. Mr M'Kellar reports that it was about 18 feet long, black on the back, white on the belly, and with a conspicuous line of demarcation on the side between the black and white colours. The animal yielded a large quantity of oil, which was of a very superior quality, selling for more than twice the price of ordinary whale oil. It had long tusks in the lower jaw, and Mr M'Kellar thinks that he gave this bone with the teeth to Mr Layard, so that it is probable that this is the specimen to which Mr Layard's tooth belongs. The skull had lain exposed for eight years on the beach, and was found with the beak stuck in the sand, the skull having been put up as a target for rifle practice.[1] The fused cervical vertebræ, and one or two dorsal vertebræ, were lying with the skull, but the remainder of the skeleton was not to be found."

Specimen B.—The animal to which the rostrum and lower jaw with teeth belonged " was captured by the men in the employ of Mr Alexander Michael Black of Simon's Town, Cape Colony, who presented the specimens to the Oxford Museum. The animal came ashore at Walwick Bay in 1869. It was from 16 to 18 feet in length, and yielded 80 gallons of oil.[2] The entire head was brought to Simon's Bay as a curiosity, but it smelt so badly that the snout was sawn off with difficulty, owing to the density of the bone, and the head was pitched overboard."

Specimen C, which I have recognised to be a young example of *Mesoplodon layardi,* " was obtained at the head of Port Sussex, on the west coast of East Falkland Island. The animal ran ashore late in 1875. It was measured by Mr John Bonner, and found to be exactly 14 feet in length. It had a greyish-white colour below, but was black above. The oil was especially clear and good. The paddles were cut off, along with masses of blubber, and dragged to a distance. Mr Bonner gave me the head, which he had separated from the trunk as a curiosity." Mr Moseley carried the head and bones of the trunk on a pack horse from Port Sussex to Stanley,[3] where the Challenger was lying, but the paddles were not recovered. A similar whale was said by Mr Bonner to have come ashore at the peninsula known as Lafonia in 1866.

[1] See also Notes by a Naturalist on the Challenger. By H. N. Moseley, F.R.S., London, 1879. In these Notes, obviously by a misprint, the animal is said to be only " about 10 feet in length."

[2] See also Moseley's Notes above cited, p. 158.

[3] See Notes, p. 559.

The specimens already put on record which have been referred to the *Mesoplodon layardi* are as follows :—

1. A skull, with lower jaw, from the Cape of Good Hope, presented by Mr E. L. Layard to the British Museum. The skull was described and figured by Dr Gray,[1] and more fully described and with better figures by Professor Owen.[2]

2. A single tooth from another specimen in the possession of Mr E. L. Layard.[3] It is possible that this is the tooth already referred to as obtained from the skull of specimen *A* collected by Mr Moseley.

3. A lower jaw, with teeth, from the Chatham Islands, in the Colonial Museum, Wellington, New Zealand, described and figured by Dr Hector as *Dolichodon layardii*.[4]

4. A skeleton in the Sydney Museum, obtained at Little Bay, near Sydney, and named by Mr Krefft successively *Mesoplodon longirostris* and *güntheri*, and by Dr J. E. Gray *Callidon güntheri*.[5]

5. Skeleton from Saltwater Creek, now in the Canterbury Museum, New Zealand, described by Dr von Haast as *Mesoplodon floweri*.[6] From a comparison of a photograph of its skull with the skull of the *Mesoplodon layardi* in the British Museum, neither Professor Flower[7] nor M. van Beneden could recognise any specific differences between the crania, so that they regard them as of the same species.

The geographical range, therefore, of Layard's *Mesoplodon* is very extensive. From the Cape of Good Hope, where it was first discovered, at least three crania, including those collected by the Challenger, have been procured. Other specimens have been obtained, far to the eastward, from the Chatham Islands, New Zealand, and Australia, whilst the discovery of the skeleton of a specimen at the Falkland Islands has extended its habitat considerably to the west. All the localities in which it has been obtained are in the Southern hemisphere, either in the South Atlantic or South Pacific, and there is no knowledge of this Cetacean ever having been seen to the north of the equator.

The Skull.—That the adult skull *A*, and the lower jaw, beak, and teeth *B*, from the Cape of Good Hope were specimens of *Mesoplodon layardi* was unquestionable, as they agreed in characters with specimens of this animal already described and figured. The skull of the

[1] Proc. Zool. Soc., 1865, p. 358; and Catalogue of Seals and Whales, p. 353, where it is named *Ziphius layardii* (*Dolichodon*).

[2] Memoirs of the Palæontographical Society, 1870, in Monograph on the British Fossil Cetacea from the Red Crag. Owen's figures have been reproduced, though reversed in the copying, in pl. xxvii. figs. 1–3, *a*, of Van Beneden and Gervais' Ostéographie des Cétacés.

[3] Referred to by Professor Flower in his Memoir on the Recent Ziphioid Whales, Trans. Zool. Soc., vol. viii. p. 211.

[4] Trans. New Zealand Institute, vol. v. p. 166, pl. iii. Dr Gray in vol. vi. of these Transactions proposes to call this specimen *Dolichodon traversii*.

[5] Annals and Magazine Natural History, 1871, vol. vii. p. 368. Dr Gray had only a photograph and sketch of the tooth for examination.

[6] Notes on *Mesoplodon floweri*, Proc. Zool. Soc. London, June 6, 1876; and Trans. New Zealand Institute, vol. ix. p. 442, 1877.

[7] Remarks by Prof. Flower upon Dr von Haast's Communication on *Mesoplodon floweri*, Proc. Zool. Soc. London, June 6, 1876.

younger animal *C*, from the Falkland Islands, was also, after a careful comparison with the adult skull, regarded as an immature example of the same *Mesoplodon*, and not as a new species. For although it differed from the adult in some important characters, such as the absence of a mesorostral bone, and of a maxillary buttress, whilst the teeth were embedded in their sockets, yet these are differences which are perfectly explicable on the ground of the immaturity of the specimen, which may have been, perhaps, also of the female sex. That the specimen was immature, was satisfactorily shown by the open condition of the cranial sutures, the lightness, porosity, and indeed fragility of the cranial bones, and the non-ossification with the vertebral bodies of their plate-like epiphyses. I may also mention that my friend Professor Flower, who has also examined the skull, coincided in the opinion that it was an immature *Mesoplodon layardi.*

As the characters of the skull of the adult *Mesoplodon layardi* have been described with more or less fulness of detail by one or other of the naturalists already referred to, it seems unnecessary that I should give a detailed description of specimen *A*. But as no account has yet appeared of so immature a skull as that from the Falkland Islands, it is advisable that it should be described, and the most satisfactory way of recording its characters will be to write a comparative account of the younger and adult crania. In the course of this description I shall pursue almost the same order as that observed in the account which I gave a few years ago of the skull of *Mesoplodon sowerbyi*,[1] so that a ready comparison between the crania of Layard's and Sowerby's whales may be instituted.

In the first place I append a table of the dimensions, expressed in inches, of the crania of these specimens, and along with them I include the measurements of the skull of *Ziphius cavirostris*. The dimensions are taken between the points adopted by Professor Flower in his Memoir on the genus *Mesoplodon*,[2] so that a comparison may be made between these crania and the species *Mesoplodon australis*, *grayi*, and *hectori*, described by him.

	Adult *Mesoplodon layardi.*	Young *Mesoplodon layardi.*	*Mesoplodon sowerbyi.*	Shetland *Ziphius cavirostris.*	New Zealand *Ziphius cavirostris.*
Extreme length of cranium, ...	$40\frac{1}{2}$	25	$29\frac{1}{2}$	$36\frac{1}{2}$	...
Length of rostrum from apex of præmaxilla to middle of line drawn between antorbital notches, . .	$27\frac{1}{2}$	$14\frac{1}{2}$	$19\frac{1}{4}$	$21\frac{1}{4}$	$22\frac{3}{4}$
From middle of hinder edge of palate, formed by pterygoids, to apex of rostrum, ...	33	19	$22\frac{1}{2}$	$27\frac{1}{2}$	...
Greatest height of cranium from vertex to pterygoids, .	15	$10\frac{7}{8}$	$9\frac{1}{2}$	18	...
Breadth of cranium across middle of superior margin of orbits, ...	$16\frac{1}{8}$	$10\frac{1}{4}$	$11\frac{1}{4}$	20	...

[1] Trans. Roy. Soc. Edin., May 20, 1872, vol. xxvi.

[2] Trans. Zool. Soc. 1877, vol. x.

	Adult *Mesoplodon layardi.*	Young *Mesoplodon layardi.*	*Mesoplodon sowerbyi.*	Shetland *Ziphius cavirostris.*	New Zealand *Ziphius cavirostris.*
Breadth of cranium between zygomatic processes of squamosals,	$17\frac{1}{8}$	$11\frac{1}{8}$	$11\frac{1}{2}$	21	...
Breadth between antorbital notches,	9	$6\frac{3}{4}$	$7\frac{3}{4}$	$15\frac{1}{2}$	...
Breadth of middle of rostrum,	$2\frac{7}{8}$	$1\frac{3}{4}$	2	5	$5\frac{1}{4}$
Breadth of occipital condyles,	$5\frac{1}{4}$	$4\frac{1}{4}$	$4\frac{1}{4}$	$6\frac{7}{8}$	...
Præmaxillæ, greatest width behind anterior nares	$6\frac{3}{4}$	5	5	...	...
Præmaxillæ, least width opposite anterior nares,	$5\frac{1}{8}$	$3\frac{1}{2}$	$4\frac{1}{4}$	...	...
Præmaxillæ, greatest width in front of anterior nares,	5	$3\frac{1}{8}$	4	...	...
Width of anterior nares,	$2\frac{5}{8}$	2	$1\frac{3}{4}$	$4\frac{1}{4}$	$5\frac{3}{8}$
Length of tympanic bone,	...	$1\frac{8}{10}$	...	$2\frac{4}{10}$	...
Greatest breadth of tympanic bone,	...	$1\frac{4}{10}$	...	$1\frac{7}{10}$	...
Mandible, length of ramus,	...	$17\frac{3}{8}$	$18\frac{1}{2}$	$25\frac{1}{2}$	27
" length of symphysis,	$11\frac{3}{4}$	$4\frac{5}{8}$	$9\frac{1}{2}$	7	$7\frac{3}{4}$
" greatest vertical height of ramus,	...	...	$4\frac{1}{2}$	$6\frac{1}{2}$	...

The length of the entire cranium of the younger specimen was $2\frac{1}{2}$ inches less than that of the beak of the adult. The crest at the vertex in both was formed of the nasals, frontal, supra-occipital, and the upper ends of the præmaxillæ and superior maxillæ, but in the younger specimen a thin lamina of each parietal could be traced upwards to the vertex, where the laminæ from opposite sides became fused together (Pl. I. figs. 1, 2).

The beak was about twice as long in the adult as in the young. Its apex in the latter was formed entirely of the two præmaxillæ, but in the adult the anterior end of the mesorostral bone seemed to be fused with the tips of the præmaxillaries, though the absence of sutures prevented the exact determination of their place of union. In the adult, the interval between the præmaxillaries was filled up as far as the base of the beak by the solid mesorostral bone, which, as in Professor Owen's description, "rises as a smooth, dense convex ridge, $1\frac{1}{4}$ inches across at its broadest part, gradually contracting to a breadth of half an inch, when it has traversed one-third of the length of the rostrum." In the younger skull this bone was absent, and an elongated mesorostral furrow, empty in the macerated skull, was seen. This furrow was occupied in the un-macerated state by a bar of cartilage, and the conversion of this cartilage into the dense mesorostral bone is accompanied by the remarkable elongation of the beak, which constitutes one of the most noticable features of difference in the dimensions of the younger and adult crania. As the beak of specimen *B* had been sawn through $20\frac{1}{2}$ inches from the tip, the extremely dense porcellaneous character of the mesorostral bone, and its intimate fusion with the vomer, the superior and præmaxillary bones were seen on the surface of section. Whilst the vomer and præmaxillæ partook of the same porcellaneous character as the mesorostral bone, the superior maxillæ again possessed a much more spongy character. The surface of section through the beak approximated in shape to a heraldic lozenge, the inferior angle of which was rounded (Pl. I. fig. 6). In specimen *B* the mesorostral bone terminated $6\frac{1}{2}$ inches from the tip of the beak, and anterior to it the beak was hollowed into a deep furrow covered over by a dense, fibrous membrane.

In the younger skull, the inner borders of the præmaxillæ were parallel and close together in the anterior half of the beak, but diverged somewhat posteriorly. In both crania these bones ascended behind the base of the beak to form the sides of the anterior nostrils, and to terminate at the vertex in a roughened overhanging ridge. The anterior surface of the ascending part of each bone was concave from above downwards, and the outer and inner borders were concave in the same direction; the concavity of the inner border added to the width of the nostrils, the greatest transverse diameter of which in the younger skull was $2\frac{1}{8}$ inches, in the adult $2\frac{7}{8}$ inches. The præmaxillæ were a-symmetrical at their nasal ends, the right being not only wider, but higher than the left, so that the nasal openings were directed to the left. The a-symmetry was slightly more marked in the adult than in the younger skull. On the anterior surface of each præmaxilla a large foramen was situated a little behind the antorbital notch.

The nasal bones were laterally compressed and placed vertically between the two præmaxillæ. The upper border of the right was, in both crania, broader and more projecting than the left. The mesethmoid nasal septum was inclined obliquely to the left; in the adult its free border was sharp in the greater part of its extent, but below it was prolonged into the mesorostral bone. A deep depression was, however, situated at their place of junction, which indicates, I think, that the mesethmoid and mesorostral bones had originated from separate centres of ossification. In the young skull it was from $\frac{1}{4}$ to $\frac{1}{2}$ inch broad, and had the roughened surface characteristic of a bone to which ossifying cartilage had been attached.

The spout-like vomer formed in the young skull the floor and in part the sides of the mesorostral furrow to within $3\frac{1}{2}$ inches of the tip of the beak, where it terminated in a pointed end; posteriorly, in both crania, it articulated with the sides of the mesethmoid, and, expanding laterally, was jointed with the under surface of the body of the sphenoid. The vomer appeared in the hard palate of the younger skull, as a mesial fusiform bar of bone, nearly 5 inches long, situated between the superior maxilla and præmaxilla of opposite sides. In the adult, the rostral part of the vomer was concealed by the mesorostral bone, except on the palatal surface, where it appeared as a mesial fusiform bar, about 11 inches long. In both crania, the vomer also appeared on the surface as a slender mesial bar between the two pterygoid bones; in the adult, $3\frac{1}{2}$ inches were seen, extending backwards between these bones; but in the young skull, scarcely an inch in length of the vomer appeared, where the pterygoids diverged from each other anteriorly.

Each superior maxilla in the young skull extended to $2\frac{1}{2}$ inches from the tip of the beak where it terminated as a slender bar of bone. In both crania it expanded posteriorly, and, overlapping the frontal bone, ascended to the vertex behind the præmaxilla. The anterior surface of its cranial expansion was concave, and the hollow was somewhat deeper in the adult than in the young specimen. In the young a large single foramen was in the right bone almost on a line with the præmaxillary foramina, but in the left bone were two foramina. In the adult four foramina, one of which was partially subdivided, were in the right bone, but only two in the left. In both skulls a large foramen, directed outwards, opened in the expanded cranial portion, on a line with the middle of the anterior nares. An ectomaxillary ridge was present in both crania, but in neither so prominent as in *Mesoplodon sowerbyi.* In the adult the ectomaxillary groove, and the buttress-like projection of the pterygoid and superior maxilla, closely resembled Owen's description of the original skull in the British Museum. In the younger skull, whilst this groove was marked at the base of the rostrum, it disappeared in the anterior two-thirds, whilst neither the pterygoid nor superior maxilla swelled out to form a "buttress," so that instead of the massive piece of bone seen in the adult swelling out laterally beyond the margin of the ectomaxillary ridge, in the young, but a faint elevation occurred, and the ectomaxillary ridge formed the most prominent feature in the outline of this part of the beak. In both crania, as well as in *Mesoplodon sowerbyi*, the antorbital notch was separated from the base of the ectomaxillary ridge by an intermediate maxillary tubercle.

The palatal surface of the beak flattened anteriorly in the adult, but slightly concave in the younger skull was formed by the præmaxillæ, which passed backwards between the anterior ends of the superior maxillæ, to articulate with the mesial palatal part of the vomer. In the adult, the middle and posterior parts of this surface were much more convex than in the young skull, and the sutures were almost entirely obliterated. In the younger skull, the palatine plates of the two palate bones appeared as narrow triangles between the diverging anterior ends of the two pterygoids, and separated them from the superior maxillæ; but these plates did not articulate with each other mesially as in *Mesoplodon sowerbyi;* for the superior maxillæ were prolonged backwards between them in order to articulate with the interpterygoid part of the vomer which appeared on the surface in this locality. In the adult, the palate plate of the palate bone was absent, so that the pterygoid articulated directly with the superior maxilla. Both in the adult and younger crania the palate bone passed backwards and outwards on the side of the beak, between the pterygoid and superior maxilla, so as to come into proximity with the malar bone.

Each pterygoid was a triangular plate of bone, concave externally, and with its lower border everted so as to constitute the lower boundary of a pterygoid fossa; a deep notch directed upwards and forwards was situated in the base of each plate. The two pterygoids articulated with each other mesially for 4 inches from the base of each plate in the adult skull, but then diverged, and allowed first the vomer, and then the two superior maxillaries to appear between them. In the younger skull, the mesial articulation between the two pterygoids was more complete, for the vomer intervened only at the anterior part.

The posterior nares and the basis cranii had a similar shape and arrangement of bones to what I have elsewhere described in *Mesoplodon sowerbyi*. The occipital surface of the skull also had a similar form, and the jugal process of the ex-occipitals was separated by a cleft from the lateral elevation of the basi-occipital; there was little difference in the configuration of these parts in the young and adult crania. In both an extensively ossified falx was situated in the mesial plane of the cranial cavity.

The general shape of the squamoso-zygomatic part of the temporal resembled that bone in *Mesoplodon sowerbyi*, but the fossa in front of the petro-tympanic bone was not so smooth, and had an irregularly ridged and furrowed surface in both the adult and younger crania. A curved spur-like process descended in the younger skull from the squamous temporal in front of the petro-tympanic and aided in retaining it in place. In the adult skull this process was absent (probably broken off), the tympanic bullæ had been removed and only the left petrous bone was in place. In the younger specimen the mastoid, tympanic, and petrous portions of the temporal were distinctly differentiated: the petrous part was a separate element, but the mastoid and tympanic were fused together. The mastoid articulated behind with both the jugal process of the occipital and the posterior prolongation of the squamosal, by a broad roughened surface, whilst anteriorly it was continued into the the tympanic by a constricted neck. I have carefully compared the tympanic and petrous bones of *Mesoplodon layardi* with the corresponding bones of the *Ziphius cavirostris* from Shetland which I described some years ago.[1] In *Mesoplodon* the inferior surface of the tympanic was one inch in breadth at its posterior end, where it was divided into an outer and an inner lobe by a groove extending forwards from its posterior end, the outer of these lobes was more boss-like and smoother than the inner (Pl. II. fig. 7). In *Ziphius* this surface was not bilobed and possessed a ridge extending in the antero-posterior direction (Pl. II. fig. 9). The outer surface of the tympanic was deeper in *Ziphius* than in *Mesoplodon*, and the groove on this surface was more vertical and elongated in the latter than in the former. The inner surface in *Ziphius*, where it turned into the bulla, was more deeply denticulated that in *Mesoplodon*. The tympanic in *Ziphius* was somewhat larger than in *Mesoplodon*, and the same also was the case with the petrous bones. The longest diameter of the petrous bone in *Ziphius cavirostris* was $2\frac{4}{10}$ inches, of the adult *Mesoplodon layardi* $1\frac{8}{10}$, of the younger specimen the same: the greatest breadth in *Ziphius cavirostris* was $1\frac{4}{10}$, in the adult *Mesoplodon layardi* $1\frac{2}{10}$, and in the younger specimen $1\frac{3}{10}$ inch. The

[1] Trans. Roy. Soc. Edinburgh, 1872, vol. xxvi.

internal meatus of the petrous bone was a single canal in the young *Mesoplodon*, but was divided into two in the adult *Mesoplodon* and in *Ziphius*. The surface anterior to the meatus was roughened and slightly convex in *Mesoplodon*, but was elevated into a prominent tubercle in *Ziphius*. In both, the stapes formed a solid column of bone ankylosed to the inner wall of the tympanum (Pl. I. fig. 5). The most important difference between the petro-tympanic bones in the two animals was the bilobed character of the under surface of the tympanic in *Mesoplodon* and not in *Ziphius*, a character which *Mesoplodon layardi* shares with the other species of *Mesoplodon* described by Professor Flower in his recent memoir on this genus,[1] which is possessed by the true *Dolphins* and, as he points out, also by *Berardius*. Thus, by its tympanic bone, *Ziphius* may be distinguished from *Mesoplodon* as readily as by the differences in the naso-premaxillary region, the value of which I dwelt on in my former memoir on these genera.[2]

In *Mesoplodon layardi* the sphenoid took but a very small part in the formation of the temporal fossa. The parietal formed the larger part of its floor, and in the younger skull could be followed as a distinct bone situated between the supra-occipital and the frontal to the vertex, where it was united by synostosis to its fellow. In the adult, though the outline of the parietal in the temporal fossa could be readily seen, no part could be traced beyond the fossa to the vertex, for it was overlapped by the growth of the supra-occipital, so that only the thin edge of the frontal bone appeared in the interval between the supra-occipital and superior maxillary. The vertex part of the frontal articulated anteriorly, as in *Mesoplodon sowerbyi*, with the superior maxillæ, præmaxillæ, and nasals. The frontal formed the roof of the orbit and possessed a strong postorbital, but a feeble preorbital process. The malar bone consisted anteriorly of a flattened plate, which articulated with both the superior maxilla and the lachrymal: from this plate a long slender zygomatic bar passed backwards below the orbit to articulate with the zygomatic part of the temporal. The lachrymal closely resembled in shape the corresponding bone in *Mesoplodon sowerbyi*; in these skulls it articulated anteriorly and externally with the preorbital process of the frontal, the malar, and the superior maxilla.

The mandible was absent in specimen *A*, only its anterior part was preserved in *B*, whilst in *C*, though both halves were present, the condyloid ends were much broken. In *C* the right and left halves were not ankylosed at the symphysis, which part of the bone was $4\frac{1}{2}$ inches long. In *B* the union between the two halves was complete, and the symphysis was $11\frac{1}{2}$ inches long.

During the time that the Challenger was in the harbour of Wellington, New Zealand, Mr Moseley visited the Wellington Museum, and made a careful comparison between the lower jaw and teeth of specimen *B*, and the jaw and teeth from the Chatham Islands preserved in that Museum, which have been described and figured by Dr Hector.

[1] Trans. Zool. Soc., vol. x., 1878.

[2] Trans. Roy. Soc. Edin., vol. xxvi., 1872.

He has most courteously placed his notes at my disposal, and in this place I shall quote what he says respecting the lower jaw.

"The peculiar upward curve of the inferior edges of the rami of the mandible immediately behind the termination of the symphysis is alike in both specimens. The upper surface of the symphysial portion is in the New Zealand specimen broader than in the one from the Cape; the whole beak-like mass constituting this symphysial portion being less attenuated and not presenting such sharp projecting alveolar ridges. In the New Zealand specimen the symphysial line appears superiorly as a deeply-sunken groove, to the suture at the bottom of which the bone curves evenly downwards on each side, whereas in the Cape specimen a slightly raised ridge in each bone runs parallel and close to the suture.

"In the New Zealand specimen the under surface of the symphysial beak is evenly rounded, except at its very hindermost part, where two very slight ridges are to be made out, situated one on each side of the symphysial line, and passing off into the inferior edges of the two rami. In the Cape specimen the symphysial beak shows a lateral groove towards the tip, situated below the alveolar border, and instead of being rounded on its under surface, is compressed and sharply keeled along the middle line. The mental foramen in the outer surface of the jaw below the position of the tusk is a small and simple aperture in the New Zealand jaw, but in the one from the Cape it is large, and leads to a canal in the bone. The swelling caused by the large alveoli of the tusks is alike in both specimens. The portion of the symphysial beak in front of the spot where the anterior margin of the tooth emerges from the alveolus is about 1 inch longer in the Cape specimen than in that from New Zealand. In the New Zealand specimen the alveolar margin of the rami behind the teeth is very much compressed and sharp, and the alveolar groove can only be traced for about 2 inches backward: it then becomes obliterated when the margin of the jaw is knife-edged. In the Cape specimen the alveolar margin is much broader, and the groove visible up to the cut end of the rami."

In the younger specimen *C* the alveolar groove extended from the anterior end of the mandible to $7\frac{1}{4}$ inches behind the socket for the tooth. It was a narrow groove in its entire extent except in the region of the tooth, where it expanded into an appropriate socket. A well-marked mental foramen communicated with the inferior dental canal below the position of the alveolus.

The Teeth.—I shall now proceed to describe the form and structure of the very remarkable teeth of *Mesoplodon layardi*, and as the study of the tooth in the younger animal has thrown great light not only on the structure but on the peculiarities of form of the adult teeth, I shall in the first instance describe it.

The teeth of the young *Mesoplodon layardi* were imbedded in their sockets, one in each half of the lower jaw. Each tooth consisted of a small triangular denticle, which represented the crown of the tooth, and of a larger part, which for descriptive purposes may be termed the fang. The denticle projected outwards and slightly upwards from about the middle of the upper border of the fang. It was 7-10ths of an inch in its basal diameter, and 4-10ths from apex to base. The fang was homologous with the strap-shaped shaft in the adult tooth, but instead of being vertically elongated and strap-shaped, its longer diameter of 2 inches was in the antero-posterior direction, whilst its greatest vertical diameter to the base of the denticle was only 8-10ths of an inch. Along its deeper border it possessed a cleft 2-10ths of an inch wide, which led into the pulp-cavity. On making a vertical section through the middle of the entire tooth, this cavity was seen to be prolonged almost as far as the apex of the denticle (Pl. II. figs. 15, 16).

The free surface of the denticle was completely invested by a glistening white enamel. A thin vertical section was then taken out of the middle of the tooth and polished for microscopic examination.[1] The cap of enamel was then seen to be of almost uniform thickness over the entire denticle, at the base of which it was somewhat overlapped by an up-growth of cement from the fang. When highly magnified the surface of section was seen to be marked by delicate bands, extending almost perpendicularly to the surface of the denticle, which indicated the rods of which the enamel was composed.

Subjacent to the enamel was a well-defined mass of dentine, which constituted the chief substance of the denticle. It was traversed by undulating branched tubes, which radiated outwards from the pulp-cavity, and were arranged with as much regularity as one sees in the crown of a human tooth. Where the branched terminations of the dentine tubes came into relation with the deep surface of the enamel, a layer of irregular, but somewhat stellate, spaces occupied the dentine matrix. These spaces corresponded in appearance with the so-called granular layer situated in human teeth more especially in the fang, between the dentine and cement, and may be termed interglobular spaces (fig. 18).

The dentine was prolonged downwards into the fang, and with a simple lens could be traced almost as far as the edge of the cleft at its root, but it formed so thin a lamina in the greater part of its extent, as to appear merely as a line in the unmagnified section. When highly magnified, the dentine in the fang, immediately continuous with that in the denticle, was seen to contain the tubes arranged in a regular manner, but as the dentine was followed further into the fang, the tubes began to break up into irregular groups, then to be sparsely scattered through the matrix, and at last to disappear, so that in the lower part of the fang the dentine was represented by a translucent matrix, having indefinitely-shaped granules irregularly scattered through it.

The fang of the tooth was invested by a yellowish-brown substance, which was smooth on its surface in proximity to the denticle, but in the region of the cleft was pitted with shallow grooves and small foramina, so as to have a porous aspect. In the section this substance was seen to vary in thickness, its maximum being 1-10th of an inch, and becoming thinner both towards the denticle and the cleft. To the naked eye it was

[1] This and succeeding sections were kindly made for me in the Challenger Laboratory by my friend Mr John Murray.

divided into a superficial and a deep layer by a well-defined line. The superficial layer consisted of cement, in which the lacunæ and branching canaliculi were large and distinct. The deeper layer was more opaque, and required a very thin section to determine its structure. It consisted of a granulated matrix traversed by numerous canals, which were for the most part arranged perpendicularly to the surface of the fang, so as to extend from the dentine to the cement. To some extent they branched, and adjacent canals communicated with each other (Pl. III. fig. 18).

The pulp-cavity was lined in the greater part of its extent by a well-defined layer, having a maximum thickness of nearly 1-10th of an inch. This lining could be seen with the naked eye to extend into the crown of the tooth, reaching on one wall of the cavity to within 1-10th of an inch of its apex, on the other to about 2-10ths of an inch. It had a brown colour, and the surface next the pulp-cavity was marked by numerous shallow grooves and small foramina. Examined microscopically this lining had essentially the same structure as the deeper layer of the outer covering of the fang. The canals were, however, of greater calibre in the inner lining, and passed obliquely from the surface next the pulp-cavity to that next the thin layer of dentine (fig. 18). The minute foramina on the free surface of this lining were the openings of these canals. Although, to the naked eye, the dentine, which formed the apex of the pulp-cavity, did not appear to have any of this substance in contact with it, yet, when examined microscopically, the part next the cavity was observed to be discoloured brown, and with its proper dentine tubes often indistinct, whilst some tubes of a larger calibre were seen in it.

The cement, as capable of recognition by the presence of lacunæ and canaliculi, terminated about 2-10ths of an inch from the edge of the cleft-like opening of the pulp-cavity, and previous to its termination it became very thin. The structure which formed the wall of the cleft was directly continuous with the deeper layer of the outer investment of the fang, and with the substance lining the pulp-cavity. It had a similar microscopic appearance, but the part next the cavity had in addition to the obliquely-divided canals, many canals divided transversely. There can, I think, be no doubt, that in the living tooth these canals had contained blood-vessels. In size they approximated to the Haversian canals in bone.

The question now arises, What is the nature of this very vascular substance, which formed the lining of the pulp-cavity, and the deeper layer of the external investment of the fang? If one could have traced its development, one would have had no difficulty in answering this question, as the several tissues of a tooth arise from definite structures. Thus the enamel proceeds from the enamel organ, the cement from the alveolo-dental periosteum, and the dentine, with its modifications termed vaso-dentine and osteo-dentine, from the pulp. The absence, however, of both dentine tubes and lacunæ and canaliculi in its matrix, and the presence of vascular canals, leave doubts, from a structural point of view, whether this substance ought to be regarded as a modified cement or a modified vaso-dentine. This difficulty would have been increased if the layer situated in the fang between the cement and dentine had been the only one present, as from its position it might have belonged either to the cement or to the dentine. But as a layer of similar structure also existed next the pulp-cavity, there can, I think, be little doubt that it had arisen from the pulp, and notwithstanding the absence of dentine tubes, may be regarded as a modified vaso-dentine, to which substance also the deeper layer of the covering of the fang may be referred. This conclusion is supported also by what is known of the structure of the teeth of some fish in which the dentine consists of a substance destitute of dentine tubes, but possessing a finely-granulated matrix in which vascular canals ramify.[1]

When I received from Mr Moseley the lower jaw of the adult *Mesoplodon layardi*, only the left tooth was in its socket, the right had previously been extracted. The socket was situated at the junction of the symphysis with the body of the lower jaw, but more of the tooth was implanted in the body than in the symphysis. The length of the extracted tooth was 14 inches, 6½ inches of which had been included in the alveolus, or surrounded by the gum. The breadth of the tooth, where it emerged from the alveolus, was 3½ inches. Each tooth consisted of a denticle proper and a strap-shaped shaft. The shaft was laterally compressed, and as it emerged from the socket, it curved obliquely backwards, upwards, and inwards, so that its inner concave surface had been in relation to the side and dorsum of the beak. As the summit of each tooth passed to the opposite side of the middle line, the two teeth crossed each other on the dorsum of the beak, and from the smooth appearance of the anterior border and inner surface of each shaft it is evident that they must have rubbed against each other, or against the beak, during the movements of the lower jaw in the act of opening the mouth. The shaft represents, though on a much enlarged scale, that part of the young tooth which I have named the fang.

The denticle proper projected almost directly upwards from the outer edge of the upper end of the strap-shaped shaft, where it became continuous with the anterior border. It was triangular in shape, its base being half an inch, whilst its diameter from apex to base was 3-10ths of an inch (Pl. II. fig. 17). The base sprang abruptly from the shaft, and some irregular patches of a glistening white enamel formed its outer surface, but the enamel was not continued upwards to the apex of the tooth, which was formed of dentine. In Professor Owen's figure of the denticle of the tooth of the original specimen, whilst the enamel is apparently worn off the tip of the denticle, the base is represented as enveloped by a more complete layer than in this animal. It is also stated that the matrix, by which is obviously meant what I have called the shaft of the tooth, is calcified without enamel.

In the extracted tooth the alveolar end was seen to be closed, and to terminate, as in Professor Owen's description of the original specimen, in a solid jagged border. The surfaces of the imbedded part of the shaft were grooved with irregular longitudinal

[1] Owen, Odontography, 1840–1845. C. S. Tomes, Manual of Dental Anatomy, p. 79, 1876.

furrows, and of a brownish colour. The surfaces of the protruded part again were comparatively smooth, and of a yellow colour. A longitudinal section was then made through the shaft from the alveolar border to the upper end close to the base of the denticle. The shaft was then seen to be solid throughout, except for a minute mesial chink 1-10th of an inch long, and admitting only the point of a fine needle, which was situated 7-10ths of an inch from the upper end of the shaft.

To the naked eye the shaft consisted in the greater part of its length of an external cortical part investing a central band. The cortical part was of a dull yellow colour; at the alveolar end it formed a thin lamina on each surface of the tooth, but at and near the line of emergence from the gum it was 2-10ths of an inch thick, and on the extruded part of the shaft it averged about 1-10th of an inch in thickness. The cortical layer consisted of cement containing well-marked lacunæ and canaliculi. In the centre of many of the lacunæ a minute solid particle was situated, apparently the dried and shrivelled mass of nucleated protoplasm which occupies the lacuna in a living tooth.[1]

Sections through Haversian canals were occasionally seen in the cement, more especially in its deeper part. The surface of the section through the cement was marked by numerous lines placed parallel to each other, and to the surface of the tooth, which gave it a laminated appearance.

In the alveolar part of the tooth, and in the larger portion of the protruded part of the shaft, the cortical layer was in apposition with the central band, which had an opaque white appearance, and varied in breadth from 2-10ths to 4-10ths of an inch. This band was traversed by canals, some of which were continuous with those of the cement, though others were divided transversely and obliquely. The matrix between these canals had a granulated appearance. The opaque central band had, therefore, the structural characters of the modified vaso-dentine described in the young tooth.

The upper end of the shaft, in proximity to the base of the denticle, was complex in structure, and consisted of several layers (fig. 19); *a*, the most superficial, consisted of cement, in which, however, no Haversian canals were seen. Immediately subjacent to *a* was the layer *b*, thicker than the cement, and of an opaque white appearance: it had the same general structure as the central band of the shaft, and the chief vascular canals were directed perpendicularly to the surface of the tooth. The next layer, *c*, was from $\frac{1}{3}$d to $\frac{1}{4}$th the thickness of *b*, and was even more opaque; some vascular canals were seen to pass at intervals from it into the layer *b*. Subjacent to *c* was the layer *d*, which was about equal to it in thickness: it was very translucent, and contained undulating and branched dentine tubes, which ran outwards to the layer *c*. In one or two places *c* was less opaque than usual, and could be seen to contain closely aggregated tubes, not unlike dentine tubes, in addition to the vascular canals already referred to; *c* may, therefore, be regarded as vaso-dentine, whilst *d* is pure dentine. As these two layers were traced from the

[1] See fig. 207, p. 756, of my Introduction to Human Anatomy, for an illustration of the contents of the lacunæ of a tooth.

summit to the sides of the shaft they were seen to blend with each other: *c* lost its great opacity, the tubes of the dentine disappeared, and vascular canals occurred only at considerable intervals. About an inch from the summit of the tooth these layers ceased to be recognisable. Subjacent to the dentine layer, in the summit of the shaft, was the layer *e*, which formed the central portion of this part of the tooth. It had essentially the same structure as the layer *b*, but the main stems of the vascular canals ascended almost vertically, so as to be divided longitudinally in the vertical section through the shaft. Many shorter canals, which had, doubtless, connected the vertical canals with each other, were, however, divided obliquely or transversely. Along the surface of apposition of this layer with the dentine *d*, sections through a canal were seen, into which some of the vertical canals were traced. Below, where the dentine terminated, the layers *b* and *e* became blended with each other, and together formed the white opaque band in the centre of the shaft of the tooth, so that they, like it, had the structural character of the modified vaso-dentine. The minute mesial chink in the shaft already referred to was a space in the layer *e*, and represented all that was left of the pulp-cavity.

We may now proceed to inquire by what process the unprotruded tooth of the young *Mesoplodon layardi* assumes the remarkable form and structure exhibited by the tooth in the adult animal. It must be observed that no change takes place in the shape of the denticle or crown proper; in its size, however, there is a slight diminution in the adult. This is doubtless due to the friction to which the denticle would be subjected soon after it had projected beyond the gum. For when the growth of the tooth had proceeded until it projected beyond the mouth of the animal, the denticle could have suffered but little from the effects of friction, as it is set at such an angle to the shaft as to be directed away from the animal's snout, and towards the water in which it swims. That the surface of the denticle does undergo some slight loss of substance after it is protruded beyond the gum is evident, however, from the disappearance, to a large extent, from its surface of the cap of enamel. We are to look, therefore, for an explanation of the mode of production of the peculiar form of the adult tooth, to changes in the fang, by means of which it is converted into the strap-shaped shaft. These changes are due to an enormous growth of two of the tissues of the fang, viz., the cement and the modified vaso-dentine.

As has already been stated, both these structures are present, though in proportionally small amount, in the fang of the young tooth, whilst they make up almost the entire mass of the strap-shaped shaft of the adult. By their growth the pulp-cavity is obliterated, except the merest rudiment near the upper end of the shaft. Similarly, the dentine which exists as a very definite layer in the fang of the young tooth is reduced in the shaft of the adult tooth to a layer situated only at its summit. By the growth of the cement and modified vaso-dentine, not only does the tooth protrude from its socket and the gum, but from the mouth, so as to curve around the side of the snout in the manner already described, and which would necessarily limit the power of opening the mouth.

The cement undoubtedly owes its origin to the alveolo-dental periosteum, which will serve as a centre of formation of new cement so long as the growth of the shaft continues. It is not possible to speak so positively of the origin of the tissue which constitutes the opaque central band of the shaft. If it be, as I have surmised, a modified vaso-dentine, then one would have to look to the pulp for its seat of production, but if it be a modified cement, then it would arise from the alveolo-dental periosteum. In the latter case, therefore, almost the entire shaft would be of periosteal origin. The tooth differs most materially from the tusks of the elephant or the narwhal, in which the pulp-cavity is persistent, and the continuous growth of the tusk is due to the conversion of the pulp occupying that cavity into dentine.

In the original specimen from the Cape, described and figured by Dr Gray and by Professor Owen, the teeth were not so large as in this animal, in which, indeed, the teeth have attained a size greater than in any previously recorded specimen. Dr Gray states that the length of the anterior edge of the exposed part of the tooth of his specimen was $9\frac{1}{2}$ inches, whilst in this one the same border was 10 inches to the base of the denticle, and nearly an inch more to the highest part of the shaft. Nothing is said by either of these authors of the teeth crossing each other on the dorsum of the beak, and in the front view of the teeth in the jaw given by Dr Gray (fig. 72, *c*) the summits of the shafts are represented as touching, but not crossing.

From Dr Hector's short account of the teeth in his specimen, which was caught at the Chatham Islands, and from his published figures (Pl. III. figs. 1–5), it is obvious that his animal was younger than the specimen *B*. The teeth in the New Zealand jaw are only 6 inches long and 3 inches wide, so that they could have projected only at the side of the beak and not reached its dorsum. From the notes taken by Mr Moseley, on his visit to the Wellington Museum, I extract the following more complete account of these teeth, and a comparison of their characters with those of the Cape specimen :—

"When the anterior margins of the teeth in the two specimens, at the spots where they emerged from the alveoli, are placed accurately side by side at the same level, the posterior margins of the teeth in the New Zealand jaw reach back and correspond in sweep of curve exactly to the vacant alveolar spaces which are conspicuous immediately behind the teeth in the Cape jaw. The teeth in the New Zealand specimen are thus inclined at a less angle than they are in the Cape one, and it appears that the teeth as they increase in age and length, become tilted up towards the vertical, leaving vacant alveolar spaces behind them. Possibly they are dragged up by attempts to open the jaw after they have overlapped. In the New Zealand specimen the dentinal caps (my denticles) are about twice as large as in the Cape one, and proportionately thick and stout. In both, these caps are, when the teeth are *in situ*, almost vertical in direction, having thus, curiously enough, the original direction which they had when within the young alveolus, notwithstanding the curving of the hypertrophied fangs. In the New

Zealand specimen, the fangs being little curved, the caps are thus almost parallel to the fangs, or only slightly inclined outwards from them, whereas in the Cape specimen the caps are directed at right angles to the fangs, which, towards their tips, are so bent as to be almost horizontal. The alveolar regions of the fangs present in both specimens a similar series of ridges terminating in denticulations. The tips of all the denticulations are closed in the New Zealand specimen, and there is no trace of a pulp-cavity, notwithstanding that the animal may be assumed to be young and with its teeth yet to grow, which it would do by a continuous addition from without by a periosteum which acts the part of a persistent pulp.

"The New Zealand teeth are much less curved than those from the Cape. If the dentinal caps are placed in apposition and parallel to one another, the younger New Zealand teeth are seen to be nearly two and a half times as broad as the older teeth from the Cape at the place of attachment of the caps of dentine. In each case the cap is placed on the anterior corner of the somewhat square-ended tooth, hence a large portion lies behind the cap in the New Zealand specimen, and but a small portion in the one from the Cape. On the anterior margin of the New Zealand teeth are semilunar excavations, cutting into their substance, and evidently caused by wear. The inner more spongy substance of the tooth being exposed it has decayed somewhat, leaving a harder external layer a little prominent. This decay is probably a *post-mortem* occurrence. In the Cape specimen there is no trace of this wear, or a very slight depression may possibly mark it.

"The dentinal cap of the tooth in the New Zealand specimen is marked by grooves passing in an inclined direction from apex to base. Similar grooves are to be seen in the tooth of the young specimen of *Mesoplodon hectori* in the Wellington Museum, the tooth being divided by them into three lobes, a central and two lateral, on the inner face. The adult New Zealand specimen shows the same form in its dentinal caps, the lobes being on the inner face, and a pair of teeth of the same species from the Chatham Island, preserved in the Museum, show the same form also. In the teeth of the young *Mesoplodon hectori*, the pulp-cavity is still open as a slit-like cavity, showing internally numerous fine ridges, which are apparently the commencement of the denticulations of the adult tooth."

In the skull described by Dr von Haast, the length of the anterior edge of the exposed part of the tooth was 8·74 inches, and the anterior edge was not worn away; but both in it and the Chatham Island specimen, described by Dr Hector, a sufficient space existed between the upper ends of the pair of teeth to allow of the beak to pass, when the animal opened its mouth. Dr von Haast states that the animal was a full-grown male, and from the ossification of the epiphyses, he judges it to be of mature age.

The tooth of a ziphioid cetacean, from Little Bay, Sydney, figured by Dr Gray, which he regarded as a new genus, *Callidon*, but which Mr Krefft, who obtained the specimen, named *Mesoplodon güntheri*, closely approximates, in the relation of the denticle to the fang, to the tooth of the young *Mesoplodon layardi* described in this communication. It differs, however, slightly in the shape of the fang, which in the Little Bay specimen is more elongated than in my specimen, so that the tooth is a little larger. There is nothing, however, in this character to found specific, still less generic, distinction on, so that I am prepared to support Professor Flower's opinion that the Little Bay cetacean is an example of *Mesoplodon layardi.*

The Little Bay animal is said to have been 18 feet in length, which is also stated to have been about the length of the specimen described by Dr von Haast. The animal from which the adult teeth described in this communication were procured was said to have been from 16 to 18 feet long, and both in it and in von Haast's specimen the teeth had protruded, so as to form large tusks, whilst in the Little Bay example, and the one from the Falkland Islands, which was certainly under 14 feet long, the teeth are rudimentary in size. Now, as the Little Bay and von Haast's animals were of about equal length, and as von Haast's specimen, with well-developed teeth, was determined to be of the male sex, it is not unlikely that the little Bay and Falkland Island specimens were females, so that the presence of well-developed tusks in the skull of *Mesoplodon layardi*, and it may be in the other ziphioid cetacea also, is probably a character of the male sex.

As I have had the opportunity of examining the structure of a tooth in a young *Mesoplodon sowerbyi*, and as no account of the unprotruded tooth of this species has yet been put on record, it may not be out of place to include a description of it in this Report.[1] The tooth was from the mandible of the skull, the characters of which I described some years ago in the Transactions of the Royal Society of Edinburgh.[2] In many of its characters this tooth differed from that in the skull of the adult male in the Oxford Museum, described by Professor E. Ray Lankester,[3] which is probably due to the difference in the age of the two specimens, and it may be to a difference in sex.

The two teeth of the young *Mesoplodon sowerbyi* were imbedded in their sockets, in the lower jaw, out of which only the apex projected. Each tooth was laterally compressed, and triangular in form. Its vertical diameter, from base to apex, was 2 inches, its antero-posterior diameter, along the base, $2\frac{1}{10}$th inches. The anterior border was longer and more oblique than the posterior, so that the apex of the tooth was directed upwards and backwards. There was no sharp demarcation into crown and fang; although

[1] I gave an account of this tooth, and that of *Mesoplodon layardi*, to the Royal Society of Edinburgh on June 2, 1879, and printed it in the Journal of Anatomy and Physiology, July 1879.

[2] Vol. xxvi. 1872.

[3] Transactions of the Royal Microscopical Society, printed in Quarterly Journal of Microscopical Science, vol. vii. 1867.

a sinuous slightly raised line, half an inch from the apex, seemed to mark off the crown from the fang, and probably indicated where the gum had embraced the tooth. The outer surface of the tooth was smooth, except near the base, which was marked longitudinally with shallow furrows; it was of a dull whitish-yellow colour.

About the middle of the elongated base was a narrow chink, which had evidently at one time extended along its whole length, but in course of time had become almost entirely occluded. When a vertical section was made through the middle of the tooth, this chink was seen to communicate with a pulp-cavity, which extended to 4-10ths of an inch from the apex of the tooth. Near the base of the tooth the cavity was so contracted that the opposite walls were almost in contact, but in the middle of the tooth it dilated into a well-marked cavity (Pl. III. fig. 20).

A thin vertical section was then cut out of the tooth from base to apex, and prepared for microscopic examination. Under a low power the tooth was seen to consist in its greater part of dentine, which formed the wall of the whole of the pulp-cavity, except at the basal end of its contracted portion. In the upper third of the tooth the dentine tubes radiated in a very regular manner from the pulp-cavity outwards, but in the lower two-thirds, they were broken up into clusters and tufts, and sometimes irregularly scattered throughout the dentine matrix. The surface of the section through the dentine was marked by contour lines parallel to its surface, which expressed the primary curvatures of the dentine tubes (fig. 20). But, in addition, a line of interglobular spaces lay in the substance of the dentine, parallel to these contour lines, and about midway between the most external of them and the exterior of the dentine. This line of interglobular spaces did not pass in one direction much beyond the apex of the pulp-cavity, but in the other it extended some distance into the fang.

The dentine in the crown was invested by a thin layer of substance, which had the position and relations of a layer of enamel to the dentine. It extended as far down the tooth as opposite the apex of the pulp-cavity, where it was overlapped by the cement, but at the very tip of the tooth it was absent, having apparently been worn off. The characteristic enamel structure was not so definite in it as in the corresponding layer on the crown of the young tooth of *Mesoplodon layardi*, but in thin sections it was seen to be traversed by fine lines extending perpendicularly to the surface of the tooth, which obviously indicated the direction of the rods of enamel. But the exterior of the crown did not have the brilliant white appearance so characteristic generally of the enamel.

The free surface of the fang was invested by a thin but definite layer of cement. Where the dentine was covered by the cement, a change in the structure of the dentine occurred. Vascular canals were seen to lie in it perpendicular to the free surface of the tooth, and forming loop-like curves immediately subjacent to the cement. This portion of the dentine was, therefore, a vaso-dentine. As the cement and vaso-dentine were traced lower down in the fang, other modifications became apparent. The vaso-dentine acquired greater opacity from the increase and general distribution through it of minute interglobular spaces, with which the line of interglobular spaces already described in the upper part of the tooth became continuous. But there also appeared between the dentine and cement a definite layer, at first thinner than the cement, but increasing in thickness as it extended down the fang, in the lower part of which it equalled in thickness the cement and dentine together (fig. 22). This layer was readily recognisable to the naked eye from its opaque white appearance. It contained numerous branching and anastomosing canals, the chief of which lay perpendicularly to the surface of the tooth. The matrix between the canals was granulated. This layer corresponded, therefore, in structure to the modified vaso-dentine described in the teeth of *Mesoplodon layardi*.

To the naked eye the wall of the pulp-cavity had numerous hemispherical bodies projecting from its free surface. When examined microscopically they were seen to be continuous with the dentine, for the dentine tubes were prolonged into them. The dentine formed, therefore, the wall of the pulp-cavity in the greater part of its extent; but the wall of the constricted part of the cavity in proximity to the end of the fang, and at the sides of the chink-like opening in it, was not dentine, but consisted of the substance which I have named modified vaso-dentine. It was not, however, so regularly constructed as the layer between the dentine and cement, for the canals were few in number in proportion to the matrix, and had no definite arrangement.

I shall now make some observations on the leading differences between the tooth of this young *Mesoplodon sowerbyi*, and that of the adult animal described by Professor Lankester. In the first place, the crown of the tooth of the adult projected (as I have ascertained from a measurement of a cast of the jaw presented by Dr Acland to the Anatomical Museum of the University of Edinburgh) $1\frac{2}{10}$ths beyond the edge of the alveolus, whilst only the tip of the tooth in the young animal projected out of the socket. The outer surface of the young tooth was almost uniformly smooth, and not rough and knotted as in the adult. The pulp-cavity, instead of being almost equal to the entire length of the tooth, was restricted in the adult to a small space in the crown, the rest of the tooth being solid. In this respect the tooth of *Mesoplodon sowerbyi* approximates to what I have described in the shaft of the tooth of the adult *Mesoplodon layardi*. The early stage of the closing up of the pulp-cavity is to be seen even in the young *Mesoplodon sowerbyi*, in which almost the whole of the cleft at the root of the fang is closed up, and the walls of the adjacent part of the pulp-cavity are closely approximated to each other. The enamel had evidently been worn off the crown of the adult, for Mr Lankester makes no reference to it. The dentine in the adult was confined to a small conical cap at the apex of the crown, and to a very thin layer extending about half-way down the tooth, instead of, as in the younger tooth, forming the larger proportion of its substance. The great bulk of the adult tooth was made up of cement, osteo-dentine, and of a substance which Mr Lankester calls globular matter. The cement was evidently considerably thicker in the adult than in my specimen, and the osteo-dentine and globular matter together formed a large proportion of the adult tooth. In the younger tooth, well-marked vaso-dentine was present, as already described, but I could not say that I recognised any definite osteo-dentine. The material which I have named modified vaso-dentine was also present in considerable quantity, and in its opacity it corresponded with the globular matter of Prof. Lankester. In its structure, however, it appears to differ, for he describes the globular matter as having "no structure excepting an indistinct botryoidal character visible with a low magnifying power." "The amorphous matter at length shades off into the dentine, numerous distinct, minute, 'interglobular spaces' becoming more and more distinct as one recedes from the opaque stratum, and their number diminishes." It is probable that this globular matter may represent in the adult the modified vaso-dentine of the younger tooth, for the numerous vascular canals which the latter contains may become obliterated through an extension of the process of calcification, so as to give it the more solid character present in the fully-formed tooth. In the granulated matrix of the younger tooth, an appearance was not unfrequently seen, which might have been described as interglobular spaces.

From Professor Flower's description of the structure of the teeth of *Berardius arnouxii*,[1] it would appear that in that ziphioid the teeth are very similar to those of the adult *Mesoplodon sowerbyi* described by Prof. Ray Lankester.

The observations which I have now recorded on the non-erupted teeth, both of *Mesoplodon layardi* and *Mesoplodon sowerbyi*, prove, that in the earlier stages their structure does not differ materially from the ordinary type of tooth one meets with, say in the human or carnivorous jaw, the crown being covered by enamel, the fang by cement, whilst the great body of the tooth consists of dentine, in which is a well-marked pulp-cavity, communicating with the exterior by a slit-like aperture at the root of the fang. The exceptional character which these teeth exhibit in the erupted condition is due to the disappearance of the enamel from the crown, to the cessation in the development of the ordinary dentine, to the excessive formation of osteo-dentine, of modified vaso-dentine, and of cement, by means of which the pulp-cavity becomes almost obliterated, and the fang assumes dimensions which, in the case of *Mesoplodon layardi*, lead to the production of a tooth having the very remarkable form and relation to the beak which I have described.[2]

I shall next describe the other bones of the axial skeleton of the younger *Mesoplodon layardi* (specimen *C*), which consisted of the spinal column, ribs, sternum, and a portion of the hyoid bone.

Spinal column.—The length of the column in the macerated spine was, with the

[1] Trans. Zool. Soc., vol. viii. p. 223.

[2] I have not thought it necessary to figure the skull of the adult *Mesoplodon layardi*, as the illustrations given by Professor Owen in his Monograph on the British Fossil Cetacea in the Memoirs of the Palæontographical Society, 1878, express so well the characters of the adult skull. As the petrous bone, however, of the adult has not been figured, and as so immature a skull as that described in the text has not previously been examined, I have had them drawn in Plate I.

epiphysial plates not in position, $88\frac{1}{2}$ inches. If 16 inches be allowed for the thickness of these plates, and another 16 inches for the thickness of the intervertebral discs, the total length of the spine would have been in the fresh state $120\frac{1}{2}$ inches—say 10 feet. The length of the skull proper was 25 inches, but as the lower jaw projected an inch beyond the upper, the entire skull was 2 feet 2 inches in length. The length of the skull being added to that of the spine makes the length of the axial skeleton 12 feet 2 inches, which is considerably below the length of 14 feet, stated by Mr Bonner, the captor, to have been that of the animal. Even if we suppose that, in the macerated condition, one or even two of the terminal caudal vertebræ were absent, and make ample allowance also for the thickness of the integument at the tail and beak, one cannot see that the animal could have been so long as stated by Mr Bonner. The vertebral formula was—

$$C_7,\ D_9,\ L_{10},\ Cd_{18} = 44\,.$$

It is possible that one or even two of the terminal caudal vertebræ may not have been ossified, as not merely were the plate-like epiphyses not ankylosed to the vertebral bodies generally, but the bones in their general aspect had all the characters of immaturity. In Dr von Haast's specimen already referred to, the vertebral formula was C_7, D_{10}, L_{10}, $Cd_{19} = 46$. In *Mesoplodon sowerbyi* the formula is also 46, made up as follows:—C_7, D_{10}, L_{10}, Cd_{19}, or, according to Malm,[1] C_7, D_{10}, L_9, Cd_{20}. In *Mesoplodon grayi* it is, as Professor Flower has shown,[2] 48—viz., C_7, D_{10}, L_{11}, Cd_{20}; and in *Mesoplodon australis*, 47—viz., C_7, D_9, L_{11}, Cd_{20}, though in both it is probable that one minute terminal vertebra is wanting.

The *cervical vertebræ* had in their total length an antero-posterior diameter of $3\frac{1}{2}$ inches. The atlas, axis, and third vertebra were united into a single bone. The fusion between the bodies and spines of the atlas and axis was very complete, but the pedicles and transverse processes were distinct. The body of the third was ankylosed to the second vertebra, but it was differentiated by a deep furrow at the place of fusion. The transverse processes, pedicles, and laminæ were quite distinct, but the laminæ were not united mesially, and there was, consequently, no spine. The breadth of the atlas was 6 inches, its vertical diameter was $5\frac{1}{4}$ inches. The remaining cervical vertebræ were separate bones, with loose epiphysial plates. Their bodies were thin plates of bones, and each possessed an inferior mesial tubercle. Their neural arches were incomplete mesially, except in the seventh, where the laminæ were united, and a spine an inch long was produced. The transverse processes not only in these posterior cervical vertebræ, but in the second and third also, were divided into a superior, projecting from the neural arch, and an inferior, from the side of the body, but these processes were not joined externally to form a "verte-

[1] Hvaldjur i Sveriges Museer år 1869 in Konig. Svenska Vetenskaps, Akad. Handlingar, Band 9, No. 2, Stockholm, 1871.

[2] On the Genus *Mesoplodon*, Trans. Zool. Soc., vol. x. p. 428, 1878.

brarterial foramen." The inferior transverse processes of the more anterior vertebræ were almost horizontal, but the more posterior had this process sloping downwards and outwards, and but slightly projecting; in the seventh it was reduced to a mere tubercle. On each side of the body of the seventh vertebra was a distinct articular surface for the head of the first rib (Pl. I. fig. 3).

In the union of the anterior three vertebræ into a single bone, this specimen agrees with the *Mesoplodon layardi* described by Dr von Haast, and it differs from *Mesoplodon grayi* and *Mesoplodon australis* described by Professor Flower, and from *Mesoplodon sowerbyi*, in all of which only the atlas and axis are fused together. It may be taken, therefore, as a piece of evidence, which is of value as far as it goes, in favour of the opinion expressed in this Report, that Dr von Haast's specimen from Saltwater Creek is of the same species as this one from the Falkland Islands.

In the *dorsal vertebræ* the bodies increased in size from before backwards. The first had a pair of slight tubercles projecting from its inferior surface in series with, but smaller than, the inferior transverse processes of the seventh cervical vertebra. A mesial ridge appeared on the inferior surface of the body of the sixth dorsal, which was more strongly marked in the hinder members of the series. In all, the laminæ and spines were complete, and became more massive from before backwards. The spine of the first, comparatively slender, was directed slightly forwards, that of the second was almost vertical, whilst those situated behind the second inclined a little backwards. Articular surfaces for the heads of the second, third, fourth, fifth, and sixth ribs were very distinct on the posterior border of the side of the bodies of the anterior five dorsal vertebræ, situated close to the place of origin of the pedicle. In the second, third, fourth, and fifth vertebræ a larger proportion of this articular surface was on the pedicle than on the body as compared with the first and sixth dorsal vertebræ. The articular surface for the head of the seventh rib was partly on the posterior border of the side of the body of the sixth, and partly on the anterior border of the seventh vertebra, its articulation with the seventh being better marked on the right than on the left side. The articular surface on the anterior part of the side of the body of the seventh vertebra was on a slightly projecting process, which was in series and obviously homologous with the much more strongly projecting processes from the side of the bodies of the eighth and ninth dorsal vertebræ. The anterior seven dorsal vertebræ had each a pair of broad transverse processes springing from the pedicles, close to the anterior articular processes, for articulation with the tubercles of the anterior seven pairs of ribs. These transverse processes projected forwards and somewhat downwards in the more anterior dorsal vertebræ, but in the sixth and seventh outwards and downwards. The long axis of the articular surface for the tubercle of the rib also changed in its direction, for on the transverse processes of the first and second it was almost vertical, further back it became oblique, but on the seventh dorsal it was horizontal and antero-posterior. The long axis of these articular surfaces corresponded to the direction of the surfaces of their transverse processes, which surfaces were flattened and not rounded. The eighth and ninth dorsal vertebræ had no transverse process projecting from the side of the neural arch, but instead a massive process was directed horizontally outwards from the side of the body nearer the anterior than the posterior surface. This process was nearly three times as big in the ninth as in the eighth vertebra, and in both it had a large articular surface at its outer end for the head of the corresponding rib. Zygapophyses were present as far back as the anterior pair of the sixth dorsal vertebra, but behind that they had disappeared, and a pair of well-developed metapophyses projected forwards, from the laminæ of the seventh, eighth, and ninth dorsal, to overlap and articulate with the laminæ of the vertebra immediately in front.

Compared with Dr von Haast's specimen this animal has one vertebra less in the dorsal series. This does not invalidate the opinion that they are of the same species, as it is well known that in the Cetacea variations to the extent of a vertebra and a pair of ribs may take place in the thoracic region. In *Mesoplodon grayi* and *Mesoplodon sowerbyi* there are also ten dorsal vertebræ, whilst in *Mesoplodon australis* the number is only nine. The transverse processes in my specimen were not rounded as in Dr von Haast's animal, and the articular surfaces for the heads of the ribs did not appear to rise quite so far above the base of the neural arch as he describes.

The *lumbar vertebræ* were almost uniform in shape, but increased in size from before backwards. The bodies were keeled on their inferior surface. At the anterior and posterior ends of the series the longitudinal and transverse diameters of the body were almost equal, but in the intermediate vertebræ the longitudinal was greater than the transverse. The transverse processes were not so long as the width of the body except in the anterior vertebræ. The base of the process sprang from the anterior half of the side of the body in series with the transverse processes of the eighth and ninth dorsal vertebræ —the processes projected forwards and outwards, and the free end was convex. The spines were long, laterally compressed, and sloped slightly backwards: the length of the eighth lumbar spine was 6 inches. A pair of broad lamelliform metapophyses projected forwards from the anterior border of the laminæ close to the root of the spine, but did not articulate with the vertebra in front, from the posterior edge of the laminæ of which a pair of much smaller processes projected backwards. As in Dr von Haast's specimen, the neural arches sprang from the centre of the bodies.

The *caudal vertebræ* diminished in size from before backwards. The first was $9\frac{1}{2}$ inches high and 7 inches between the tips of its transverse processes. The last was 9-10ths of an inch in greatest breadth, and 7-10ths of an inch in height. In the anterior four vertebræ the spines were massive, and these processes were present as far back as the tenth caudal, in which the neural arch and spine formed a slight ridge, and the spinal canal was diminished to the diameter of a goose-quill. The transverse processes were strong in the anterior four caudals, and had the same shape and direction as in the lumbar vertebræ; they rapidly diminished in size in the fifth and sixth, and in the seventh were reduced to a faint ridge projecting from the anterior half of the side of the body. Metapophyses, which were non-articular, projected forwards from the anterior edge of the laminæ of the anterior seven vertebræ, and a shorter pair of processes projected backwards from the posterior edge of the laminæ of the anterior four vertebræ. The posterior eight caudals were merely the bodies of vertebræ. The inferior surface of the body of each of the anterior fifteen caudal vertebræ was grooved antero-posteriorly, and on this surface in the anterior nine vertebræ were articular facets for eight chevron bones. Only five of these bones were present in this skeleton, viz., the larger and most anterior; it is not unlikely that the more posterior chevrons had not been ossified.

In von Haast's specimen, as in this, the spinous processes disappeared behind the tenth, and the transverse processes behind the seventh caudal vertebra; but there were nine instead of eight chevron bones. In both *Mesoplodon grayi* and *Mesoplodon australis*, again, Professor Flower found that the neural arch and spine were present on the eleventh caudal, and that the last trace of the transverse process did not disappear until the ninth caudal.

The Ribs.—There were nine pair of ribs, corresponding in number to the dorsal vertebræ. The first was the broadest and shortest, from which they increased in length, but diminished in breadth, to the fourth, when they again diminished in length to the ninth. The anterior seven each articulated both with a vertebral body and with a transverse process. From the second to the seventh inclusive, each rib possessed a distinct head and tubercle separated by an intermediate neck; but the first had an elongated articular surface at its vertebral end without any definite demarcation into head and tubercle. Each of these ribs was jointed by its head to the body of the vertebra in front of that to the transverse process of which it was articulated by its tubercle, but the head of the seventh rib was articulated with the bodies of both the sixth and seventh dorsal vertebræ, whilst its tubercle articulated with the transverse process of the seventh dorsal. The eighth and ninth ribs had each only a single articular surface at its vertebral end, which was jointed with the transverse process projecting from the side of the body of the corresponding dorsal vertebra. The greatest breadth of the first rib was $2\frac{1}{2}$ inches, its length along its posterior border was $11\frac{1}{4}$ inches. The greatest breadth of the fourth rib was in the region of the tubercle, viz., $1\frac{3}{4}$ths of an inch, and its length along the posterior border was 2 feet. The length of the last rib cannot be given, as it was broken.

In von Haast's specimen, where ten ribs were on each side, the eighth, ninth, and tenth had each only a single articular surface at its vertebral end for articulation with its corresponding vertebra. In *Mesoplodon grayi*, also with ten pairs of ribs, only the ninth and tenth had a single articular surface at their vertebral ends for articulation respectively, with the transverse processes from the side of the bodies of the ninth and tenth vertebræ, whilst the eighth rib was attached to the articular surfaces on the contiguous sides of the body of the seventh and eighth dorsal vertebræ, but not to any transverse process. In *Mesoplodon sowerbyi*[1] the anterior seven ribs were articulated by both heads and tubercles to their appropriate vertebræ, whilst the eighth, ninth, and tenth ribs had each only a single articulation with the transverse process from the side of the body of the corresponding dorsal vertebra. In *Mesoplodon australis*, again, the anterior six ribs were articulated by head and tubercle to body and transverse process; the eighth and ninth only to the transverse process from the side of the body of the corresponding vertebræ; whilst the seventh left rib was attached by the former method and the seventh right by the latter only.[2] In my specimen of *Mesoplodon layardi*, as in *Mesoplodon australis*, the seventh dorsal vertebra with its pair of ribs was the vertebra of transition.

Sternum.—The sternum consisted of three bony segments articulated together by intermediate bands of cartilage. A band of unossified cartilage about 1 inch deep was attached to the anterior border of the manubrial segment. Between the manubrial and second segment was a mesial foramen about $1\frac{1}{2}$ inch long and $\frac{3}{4}$ths of an inch wide, and a similar hole was between the second and third segments. The manubrium was 5 inches long by $4\frac{3}{4}$ inches in its greatest transverse diameter; its inferior surface had a faint mesial ridge, its superior surface was concave. Its inferior border had a mesial notch. The second segment was $3\frac{3}{4}$ inches long and notched both at its anterior and posterior borders, where it contributed to form the boundaries of the mesial sternal foramina. The third segment was $2\frac{1}{2}$ inches long and notched only at its upper border. The sternum articulated with four pairs of ribs. The first with the cartilaginous band at the anterior border of the first segment; the second with the plate of cartilage between the first and second segments; the third with the corresponding band between the second and third segments; the fourth with the sides of the posterior border of the third segment (Pl. I. fig. 4).

In von Haast's specimen the sternum consisted of four segments, of which the fourth was divided into a right and left portion. It also articulated with five pairs of ribs. In *Mesoplodon australis* four segments articulating with five pairs of ribs were also present, and in the immature sternum of *Mesoplodon grayi* four segments were recognised by Professor Flower. In *Mesoplodon sowerbyi* five segments are figured by MM. Van Beneden and Gervais,[3] the last being divided into two lateral halves. It is very probable, that in the immature skeleton of *Mesoplodon layardi* I am now describing, the fourth segment had not been ossified.

Hyoid bone.—The only representatives of the hyoid apparatus consisted of the pair of stylo-hyals, each of which was broken, but the articular surface apparently at the cranial end was preserved.

[1] Van Beneden and Gervais, Ostéographie des Cétacés, pl. xxii. fig. 1.

[2] See Flower in Trans. Zool. Soc., 1878, p. 431.

[3] Ostéographie des Cétacés, pl. xxii. fig. 2.

Ziphius cavirostris, Cuvier.

In November 1872 Dr Hector read before the Philosophical Society of Wellington, New Zealand, a memoir On the Whales and Dolphins of the New Zealand Seas.[1] In it he described and figured by the name of *Epiodon chathamiensis*, or goosebeak whale, a skull collected by Mr H. Travers at the Chatham Islands. He expresses the opinion that it is possible this animal may be identical with *Epiodon australis* from Buenos Ayres described by Burmeister, and states that except in the upward curve of the beak and the less development of the vomerine callosity, the skull resembles the *Petrorhynchus capensis* of Gray. He further mentions that the rostrum of an individual of this species, and having a less upward curve, found at Lyall Bay, near Wellington, is in the Colonial Museum.

In a memoir which I had previously read before the Royal Society of Edinburgh in May 1872,[2] I advanced facts and arguments to prove that the Cetacea which had been described by the several generic names of *Epiodon* and *Petrorhynchus* should be referred to the Cuvierian genus *Ziphius*, of which *Ziphius cavirostris* was the type species, and I further expressed the opinion that the exotic specimens which had been named *Ziphius indicus*, Van Beneden, *Petrorhynchus capensis*, Gray, and *Epiodon australe*, Burmeister, should be ranked, along with the several European specimens named in that memoir, as examples of the *Ziphius cavirostris*.

When a box arrived from the Challenger in 1875 containing a skull and lower jaw marked *Epiodon chathamiensis*, Hector,[3] which had been presented to the collection by the Colonial Museum, Wellington, I examined it with great interest, and compared it with the cranium of the *Ziphius cavirostris* from the Shetland Islands in the Anatomical Museum of the University of Edinburgh. The skull was, unfortunately, not perfect, as the occipital and sphenoid bones, in the region of the basis cranii and foramen magnum, the pterygoid bones and temporals were broken away, but the beak, the great prænasal fossa, the anterior nares and the summit of the cranium, which are the most distinctive parts of the skull, were preserved. There is no need for me to give a detailed description of this cranium, but it will be sufficient for my present purpose if I compare what there is of it with the skull of the Shetland specimen, described at length in my memoir, and point out wherein they correspond or disagree.

The skull, like the Shetland specimen, was evidently from an old animal, as the cranial sutures were to a large extent obliterated, the bones were massive and weighty, and the teeth were shed from the mandible, their sockets, as in the Shetland specimen, being occupied by a growth of bone. Owing to the occipital end of the skull having been so much injured, I am unable to give the entire length of the cranium, but several other measurements showed that it was on a somewhat larger scale than the Shetland skull.

[1] Trans. New Zealand Institute, vol. v.

[2] On the Occurrence of *Ziphius cavirostris* in the Shetland Seas, and a comparison of its Skull with that of Sowerby's Whale (*Mesoplodon sowerbyi*), Trans. Roy. Soc. Edin., vol. xxvi.

[3] Dr Hector writes to me that this specimen was got near Wellington. He has now had a good many specimens through his hands. This Cetacean, he says, is common in the New Zealand seas, though rarely captured or cast ashore.

In their general form the two crania closely resembled each other. The summit of each skull was formed of the same bones similarly arranged, but in the New Zealand skull the nasal bones were an inch longer, and somewhat more than an inch wider at the base than in the one from Shetland. In both the great prænasal fossæ and anterior nares were similarly shaped, and the bones forming their walls were similarly arranged; the only appreciable difference being that in the New Zealand specimen the transverse diameter of the fossa was about an inch wider, the præmaxillæ forming the sides of the fossæ were more massive, and from the inner surface of the left præmaxilla a stronger ridge projected than in the Shetland cranium. In the New Zealand specimen the greatest width between the two præmaxillæ was 10 inches, whilst that of the Shetland cranium was $8\frac{7}{8}$ inches. The beak was similarly constructed in both specimens. The mesorostral bones were almost identical in shape, but in the New Zealand skull it was $1\frac{1}{4}$ inch longer than in the one from Shetland—$14\frac{3}{4}$ inches as against $13\frac{1}{2}$ inches. In the New Zealand specimen a narrow longitudinal groove between 3 and 4 inches long was situated at the posterior truncated end of this bone, no similar groove existed in the Shetland animal. Both possessed an ecto-maxillary ridge and furrow; in the Shetland specimen the furrow was narrower and deeper than in the New Zealand, but in the latter the superior maxilla in the middle third of the beak had its sides more uniformly rounded, and projecting somewhat more laterally, than in the Shetland animal. In both, the under surface of the beak had a similar construction, and the palate bones articulated with each other mesially between the anterior ends of the two pterygoids, and separated the latter from the superior maxillæ. The mandibles resembled each other in shape and in projecting beyond the tip of the beak, but in the New Zealand specimen the bone was somewhat more massive and $2\frac{1}{4}$ inches longer than in the one from Shetland—$34\frac{3}{4}$ inches to $32\frac{1}{2}$ inches.

The evidence which I have obtained from a personal comparison of these two crania, belonging to animals dwelling in such widely separated seas as those of the Shetland Isles and New Zealand, is not such as to justify me in classifying them as distinct species. In all the essential features of form and construction they are practically alike. The differences which I have noted between them are merely such as are due to a difference in size, and to the New Zealand cranium having, along with its greater size, a somewhat more extended condition of ossification than the Shetland specimen, so that, so far as the cranial characters afford a basis for observation, I could come to no other conclusion than that the New Zealand animal is *Ziphius cavirostris*.

Since the skull from the Wellington Museum arrived in Edinburgh, the New Zealand naturalists have published additional information on this genus of Ziphioids.

In May 1876 a paper by Dr von Haast was contributed to the Philosophical Institute of Canterbury, New Zealand,[1] and also to the Zoological Society of London,[2] in which was described the skeleton of an aged female whale that had been stranded, in July 1872, in Lyttleton Harbour, Bank's Peninsula. This is apparently the same animal

[1] Trans. New Zealand Institute, vol. ix. p. 430, 1877. [2] Proc. Zool. Soc. Lond., June 6, 1876, vol. xliv. p. 466.

as is referred to by Dr Hector in his paper, read in November 1872, as having been captured in Port Cooper, and the skeleton of which was being prepared for the Canterbury Museum. Dr von Haast named the animal *Epiodon* (*Ziphius*) *novæ-zealandiæ*. In an appendix to his paper he applied the same name to another skull, also of an adult female stranded in July 1873 in Akaroa Harbour. Von Haast considers that these animals are closely allied, if not belonging, to the same species as *Epiodon chathamiensis*, but as there are some minor differences between them, of which he more especially refers to the form of the teeth, he prefers to apply a different specific name to these animals.

Professor Flower, at the same meeting of the Zoological Society,[1] in commenting on Dr von Haast's paper, stated that he saw no good grounds for distinction between *Ziphius novæ-zealandiæ* and *Ziphius chathamiensis*, and that, indeed, von Haast's two animals differed more from each other than either of them did from *Ziphius chathamiensis*. Further, that the photographs sent by Dr von Haast, when compared with the skull at the British Museum which Dr Gray had named *Petrorhynchus capensis*, did not show any greater differences than are consistent with the range of individual variation, and that no proof had yet been given that any clearly defined specific difference existed between *Petrorhynchus capensis*, *Ziphius australis*, and *Ziphius cavirostris*.

Dr Hector, in a second memoir in the Transactions of the New Zealand Institute (vol. x. p. 342, 1878), states that the specific distinction made by von Haast between the Chatham Island and New Zealand specimens is founded on little more than the form of the teeth, which in the specimen in the Canterbury Museum had become absorbed, only the fangs being left, whilst in the specimen from the Chatham Islands the teeth were still large and serviceable. He does not recognise, therefore, any specific difference between the animal he had originally described and those named by von Haast *Ziphius novæ-zealandiæ*. But Dr Hector goes still further, and, influenced evidently by the facts and arguments advanced in my memoir on *Ziphius cavirostris*, to which he makes special reference in his paper, now regards his *Epiodon* (*Ziphius*) *chathamiensis* as the same species as the *Ziphius cavirostris* of Cuvier; a conclusion which coincides entirely with that which I had arrived at from a comparison of the skulls of these animals. M. Van Beneden in a recent paper On the Geographical Distribution of the Cetodonts[2] reviews the whole of the evidence up to that time advanced on this subject. He now regards not only his *Ziphius indicus* but the specimens from the Cape, and that described by Dr Burmeister from near Buenos Ayres, as the same as the *Ziphius cavirostris*, so that he supports the opinion I had expressed in my original memoir, that the exotic as well as the European crania, which have up to this time been described, are all examples of one species—the *Ziphius cavirostris* of Cuvier. The present state of our knowledge of this cetacean strengthens, therefore, the statement which I had made in that memoir that the geographical range of the *Ziphius cavirostris* equals that possessed by the spermaceti whale.

[1] Proceedings, 1876, vol. xliv. p. 477. [2] Bulletin de l'Academie royale de Belgique, April 1878, vol. xlv. No. 4.

Megaptera lalandi (Fischer).

The vertebræ of the humpbacked whale (*Megaptera lalandi*) belonging to the collection consisted of the atlas, axis, and third and fourth cervical vertebræ. They were from an animal captured in the New Zealand seas, probably in Queen Charlotte Sound.

The atlas was a distinct bone, but the axis and third and fourth vertebræ were ankylosed into one block. The bones had evidently been exposed on the beach for some time, as they were rubbed and weathered, and had many small pebbles in their grooves and foramina. The transverse diameter of the atlas was 26 inches, its supero-inferior $14\frac{1}{2}$ inches. The spine was stunted. The transverse processes were massive and undivided. The groove for the sub-occipital nerve was converted into a foramen by a bridge of bone. The occipital articular surface was divided into two facets by a mesial notch and furrow. The axis had a transverse diameter of $32\frac{1}{2}$ inches, a supero-inferior of $13\frac{1}{2}$ inches. The spine was massive, and both it and the right lamina were fused with the corresponding parts of the third cervical. The transverse processes each possessed a superior and inferior division continued into each other externally by a broad plate of bone, so that the "vertebrarterial" foramen was completely bounded by bone. A broad stunted process, representing a rudimentary odontoid projected from the anterior surface of the bone, and was received into a corresponding hollow on the posterior surface of the atlas. The superior transverse process of the third vertebra was a slender plate of bone 4 inches long; the inferior transverse process was much stronger, and 7 inches in length. The superior transverse process of the fourth vertebra was $8\frac{1}{4}$ inches long, but the inferior was only 5 inches, both were strong bars of bones. Neither in the third nor fourth vertebræ did the superior and inferior transverse processes meet externally so as to complete the boundary of a foramen. The body of the axis was $15\frac{1}{2}$ inches in its greatest transverse diameter by 9 inches in its greatest supero-inferior. The body of the fourth cervical was 10 inches by $7\frac{3}{4}$, and as it was not so rounded at the sides as in *Balænoptera*, its shape approached the quadrangular. The fusion between the bodies of the second, third, and fourth vertebræ was not complete, but restricted to the sides of their anterior and posterior surfaces, so that intervertebral discs had obviously been present in the recent state between the greater part of the surfaces of the bodies. The left laminæ of the third and fourth vertebræ were fused with each other, but not those of the right side.

The presence of a large Rorqual in the seas of the Southern Hemisphere was determined by Cuvier, from a skeleton brought to Paris by Delalande from the Cape of Good Hope, and was named by him *Rorqual du Cap*. Fischer subsequently called it *Balæna lalandii*, but it was recognised by Schlegel that it possessed affinities to the long-finned Rorqual of the Northern Hemisphere, *Megaptera longimana*. Dr J. E. Gray considered that it formed a genus distinct from *Megaptera*, and named the animal *Pœscopia lalandii.* Its generic difference is not, however, accepted by zoologists generally, and MM. Van Beneden and Gervais associate it with the genus *Megaptera* as species *lalandii;*[1] at the same time they point out that the differences between its skeleton and that of *Megaptera longimana* are not of a strongly-marked character.

In 1864 Dr J. E. Gray received from New Zealand some ear-bones, which though very like those of *Megaptera longimana*, yet had the tympanics shorter and more swollen. He accordingly proposed to distinguish the animal from which they had been obtained as a new species by the name of *Megaptera novæ-zealandiæ.*[2]

MM. Van Beneden and Gervais hesitate to accept the New Zealand *Megaptera* as a distinct species from that of the Cape, and Dr Hector, who at first adopted Dr Gray's nomenclature, has in his latest memoir On the New Zealand Cetacea[3] regarded it as *Megaptera lalandii.* He states that the humpback is the most common whale around the coasts of New Zealand.

The cervical vertebræ in this specimen do not, however, entirely correspond with the vertebræ of *Megaptera lalandi* described by MM. Van Beneden and Gervais. In their specimen it is stated that all the cervical vertebræ were free, but that Cuvier had described the second and third as united by the upper part of the body, and that in the British Museum was a specimen in which the second was united to the third on one side only. In fig. 2, Pl. IX., the junction of the second and third with each other is represented by them, and in the same figure it can be seen that not only are the superior and inferior transverse processes of the cervical vertebræ behind the second not united together externally, but that those of the axis also are free at their outer ends. From this circumstance, as well as from the union of only two vertebræ with each other in the specimens above referred to, there can, I think, be little doubt that the specimen now described was of more mature age than those previously recorded.

In October 1870 a cargo of whales' bones was imported into Leith from the Cape of Good Hope. Messrs J. & J. Cunningham, the importers, kindly allowed me to examine them, and select some specimens for the Anatomical Museum of the University. The collection contained numerous bones of the Cape Humpback, and I had no difficulty in picking out several specimens of the atlas-vertebra of this animal. I have compared the atlas of the New Zealand animal with one of those from the Cape, and except that the furrow between two anterior articular surfaces for the occipital bone is somewhat broader and deeper in the Cape specimen, there is no appreciable difference between them. It should be stated that the atlas from the Cape is a somewhat larger bone than that from New Zealand.

[1] Ostéographie des Cétacés, p. 130.
[2] Proc. Zool. Soc., 1864, p. 208, and Catalogue of Seals and Whales, p. 128.
[3] Trans. New Zealand Institute, vol. x. p. 335, 1878.

Balæna australis, Desmoulins.

The block of vertebræ, marked "Right Whale of New Zealand," consisted of the seven cervical and first dorsal vertebræ ankylosed into one mass. They were from an animal captured at the peninsula of Kaipara.

The bones were broken in places and generally friable, with the roots of plants in the intervertebral foramina, presenting the appearance of having long been exposed to the weather. The fusion of the cervical vertebræ with each other was very complete, for not only were the bodies ankylosed into a solid mass, but also the spines and laminæ. The fusion of the first dorsal by its spine and laminæ with the corresponding parts of the seventh cervical was also complete, so that the spines and laminæ formed a massive crest of bone which sloped upwards and backwards.

The body of the first dorsal was, however, connected, through an irregular band of ossification by only its inferior border, with the corresponding part of the seventh cervical; for the bodies generally of these two vertebræ had evidently been separated in the usual way by an intervertebral disc. The left transverse process of the atlas was broken, but when entire the vertebra must have had a transverse diameter of at least 29 inches. Its width across the anterior articular surfaces was 14 inches, and these surfaces were separated from each other by a non-articular depression, varying in width from 2 to 3 inches. The length of the cervical part of the block, along the line of the spines, was 14 inches, along the inferior surface of the bodies, $11\frac{1}{2}$ inches, when the body of the first dorsal was included the length was 15 inches.

The superior transverse processes were present in all the cervicals. Those of the first and second vertebræ were massive, and projected outwards for several inches; the remainder were much more slender, and in the case of the third to the sixth comparatively short, whilst that of the seventh was again longer, and curved outwards and forwards. In the case of the anterior six cervicals, these processes were fused into a continuous bar of bone at their outer ends, whilst the superior transverse process of the seventh was not ankylosed on the right side, but on the left it was united to the transverse process of the first dorsal vertebra. The inferior transverse processes of the second and third vertebræ were massive and partially ankylosed, that of the fourth was much more slender, and fused with that of the third. They were absent in the fifth, sixth, and seventh. In no instance did the superior and inferior transverse processes unite externally so as to bound a "vertebrarterial" foramen.

The transverse process of the first dorsal vertebra was in series with the superior transverse processes of the cervicals, and like them projected from the side of the neural arch. It was 11 inches long, and curved forwards and outwards external to the superior transverse processes of the more posterior cervicals, so that its free end was close to the transverse process of the atlas. A faint tubercle projecting from the side of the body of this vertebra probably represented a rudimentary, inferior transverse process.

These bones are evidently a portion of the skeleton of the *Balæna* or *Eubalæna australis*. In their form and appearance they closely correspond to the block of cervical vertebræ, figured by Van Beneden and Gervais, in Plates I. and II. fig. 19, as the cervical vertebræ of that animal. M. Van Beneden states that in *Balæna australis* there is no trace of inferior transverse processes in the last four cervical vertebræ, and that this constitutes a noticeable point of difference between this species and the *Balæna antipodarum*, in which all the cervical vertebræ, except the seventh, have an inferior transverse process. In the Challenger specimen, the inferior transverse process was absent in the seventh, sixth, and fifth cervical vertebræ, but present in the fourth, third, and second, so that in the presence of this process in the fourth vertebra, it differed from the specimen described and figured by M. Van Beneden. I am inclined to think from the appearance of his figure, that his specimen must have been from a younger animal, as the lines of demarcation between the spines and laminæ of the vertebræ are more distinct than in the Challenger specimen, and the first dorsal vertebra is not ankylosed to the seventh cervical. The absence, therefore, of an inferior transverse process in the fourth vertebra in M. Van Beneden's animal, may, perhaps, be due to the ossification not having advanced to a stage so far as was the case in the Challenger specimen.

Cetacean Bones dredged from the Bed of the Ocean (Pl. II.).

The dredge brought up in various localities, from a great depth, numerous tympanic and petrous bones of Cetacea, together with fragments of other bones of the skeleton. They have been all carefully picked out by Mr John Murray from the other contents of the dredge, and arranged according to their locality, and the depth at which they were obtained. The conditions under which they were found will be described by Mr Murray in his Report on the deep-sea deposits. At his request, and that of Sir Wyville Thomson, I undertook to determine, as far as possible, the generic and specific characters of these bones, and have compared them with the collection in the Anatomical Museum of the University of Edinburgh. In 1876 and 1879 I took a number of selected specimens to the Museum of the Royal College of Surgeons of England, and, along with Professor Flower, compared them with specimens in that magnificent collection.

The bones were almost without exception coated with a brown material consisting of a mixture of the peroxides of manganese and iron, along with earthy matters; sometimes only with a thin layer, but at other times imbedded in masses of these minerals,[1] which frequently assumed a nodulated or botryoidal arrangement, and the manganese had also penetrated into their substance. In attempting to peel this material, which for the sake of brevity will be spoken of as manganese, off the exterior of the bones, they

[1] See Mr Murray's paper in Proc. Roy. Soc. Edin., December 18, 1876, p. 257.

not unfrequently broke up into fragments, for their texture and cohesiveness were often greatly injured; but at times Mr Murray had succeeded in removing the whole of the manganese from the exterior of the bone, so as to enable one to study its form.

In the catalogue of the dredgings which has been compiled for the use of the naturalists engaged in describing the animals collected during the voyage of the Challenger, the stations at which the dredge was put down are all designated numerically, and the latitude and longitude are recorded, so that the locality can be determined on the map; the date when the dredging took place, and the depth of the ocean at the spot are also given. I have extracted from this catalogue these important facts in connection with the description of the cetacean bones obtained at each station.

The stations are numerically arranged according to the dates when the dredgings were done, but instead of taking the first at which cetacean bones were observed, it will be more convenient to start with the description of the station where the largest number and the greatest variety of the bones of these animals were brought to the surface. I shall commence, therefore, with a description of the bones found at Station 286.

Station 286, lat. 33° 29′ S., long. 133° 22′ W., October 16, 1875, 2335 fathoms. This station was remarkably rich in cetacean remains. About ninety tympanic bullæ were recognised, and, in addition, there were various fragments coated and imbedded in peroxide of manganese, many of which appeared to be portions of tympanic bones. In the first place I made a rough classification of these bones according to their size, and found that they could be arranged into five groups.

The *first* group was represented by a single specimen nearly 6 inches long, and by a fragment of another, which had apparently been of the same magnitude. They were impregnated with manganese, and much corroded on the surface. The more perfect specimen had been cut in two, and one half sent for chemical analysis before I saw it; but from the half that remained I judged it to have been about the same size as the tympanic bone of the great Northern Rorqual (*Balænoptera sibbaldi*), stranded at Longniddry, which I described some years ago.[1] A section through this bone is figured by Mr Murray in his Report on deep-sea deposits (Pl. VII. fig. 2). On comparing it with the corresponding tympanic bone of this animal, they were seen to have a somewhat similar general configuration, but the corrosion of the surface of the deep-sea specimen prevented a close comparison being instituted. From the magnitude of the specimen, it is probable that it is the tympanic bulla of a great Southern Rorqual, perhaps the *Balænoptera antarctica*, or a closely-allied species.

The *second* group consisted of fifteen tympanic bullæ, varying in size from 3 inches to 4 inches, but these were divisible into two very distinct types.

In the one type, consisting of the somewhat larger specimens, were two admirably-preserved bones with the deposit of manganese so thin that the form of the bone was not

[1] Trans. Roy. Soc. Edin., Nov. 1870, vol. xxvi.

interfered with. The one bulla was 3·6 inches long, the other was 3·4 inches. They closely corresponded in size to the tympanic bones of the northern pike whale (*Balænoptera rostrata*). The larger specimen also resembled in its configuration the bulla of *Balænoptera rostrata*, it is figured by Mr Murray (Pl. VII. fig. 3); the smaller was also very like it on the external convex surface, but the internal surface, where it curved towards the tympano-periotic fissure, was much more convex in the deep-sea specimen than in the recent *Balænoptera rostrata*. There can, I think, be no doubt that both these specimens are from Cetacea of the genus *Balænoptera*, and from an animal closely allied to, if not identical with, the *Balænoptera rostrata* of the North Atlantic Ocean. It is possible that they may have belonged to the pike whale of the Southern Ocean, named by Dr Gray, *Balænoptera huttoni*, an animal which Dr Hector states,[1] "is hardly distinguishable from the northern *Balænoptera rostrata*."

Belonging to the same type of bullæ, but not more than 3 inches or 3·2 inches long, were several bullæ, all of which, with one exception, were thickly coated with manganese, and the hollow of the bulla was almost filled with it. They were not only shorter than the bulla of *Balænoptera rostrata*, but not so swollen out (Pl. II. fig. 11). I am not aware of any existing *Balænoptera* in which the bullæ have such small dimensions; but in the series of fossil ear-bones from the Red Crag of Suffolk, in the Museum of the Royal College of Surgeons of England, collected by Professor Flower, is a specimen marked 1452*x*, which he is disposed to regard as a small *Balænoptera*, that agrees in size with these specimens, and has a general resemblance in form, although differences in the smaller features of detail can be recognised. These bullæ may have belonged to a species of *Balænoptera* no longer extant.

The other type of bulla belonging to the second group consisted of two bones 3 inches in length. They were much more compressed laterally than was the case with the bullæ of the *Balænopteridæ*, and were concave on the outer surface, but the inner surface was almost entirely broken away, so as to expose the interior of the bulla. In both specimens (obviously a pair) the outer surface was scored with elongated, somewhat curved furrows, as is represented in Plate VII. fig. 5 of Mr Murray's plates on the deep-sea deposits. The general direction of these furrows corresponded with that of the long axis of the tympanic bone; but, though generally alike, they were not quite symmetrical in the two bullæ. In one specimen the grooved surface was completely coated with a very thin layer of manganese, in the other only partially so. The fact, however, that the manganese lined the grooves shows that they must have been imprinted on the bones before the deposition of manganese began at the bottom of the ocean. Whether they are natural marks, or artificially produced by the teeth of a fish or other marine animal, it is difficult to say. These bones seem to belong rather to the type of the *Balænidæ* than the *Balænopteridæ*, though they are very much smaller than the

[1] Trans. New Zealand Institute, vol. x. p. 337.

tympanics of any of the *Balænidæ* that have come under my observation—not more indeed than about one-third the size of the corresponding bones of the *Balæna australis.* The British Museum, the Museums of the Royal College of Surgeons, and the University of Edinburgh, do not contain any specimens similar in size and form, or marked with similar furrows. Whether they belong to existing species or to some extinct cetacean must for the present be left undetermined, though, from their scanty coating of manganese as compared with the thick covering possessed by others of the bones, obtained from the same station, it is not likely that they were so ancient as the more thickly coated forms.

The *third* group consisted of eight bullæ, from $2\frac{1}{2}$ to 3 inches in length. Only one specimen, which was unfortunately not entire, could be freed from manganese, so as to enable one to see its form. It was 2·6 inches long. It had a certain similarity in form with the tympanic bone of the *Ziphius cavirostris* referred to in a former part of this report as having been obtained from Shetland. It differed from it, however, in several particulars. It was not only longer, but generally more massive, and did not possess the somewhat unciform lobe at the posterior end of the under surface seen in *Ziphius cavirostris* (Pl. II. fig. 12); on the outer surface a faint concavity extended in the longitudinal direction instead of being slightly convex, as in *cavirostris.* The inferior surface, again, was more rounded, and not raised into a feeble roughened ridge as in the Shetland specimen (Pl. II. fig. 9). For the present this bone must be left undetermined.

The *fourth* group consisted of about forty specimens, generally from 1·6 to 2 inches long, although one was 2·3 inches, and another 2·2 inches. In all, the posterior end of the under surface had the bilobed character of the bulla. The two largest specimens (Pl. VIII. figs. 1, 2, Mr Murray's Report) were compared both with Professor Flower's figures of the petro-tympanic bones of *Berardius arnouxii*[1] and with the bones themselves, to which they approximated somewhat in size. They differed, however, from the tympanic bullæ in that animal in having the external posterior lobe more boss-like, and in possessing a much wider furrow between that lobe and the internal posterior lobe; moreover, the inferior surface in them was not so irregularly roughened as in *Berardius.* In appearance they corresponded closely with the tympanic bullæ of *Mesoplodon layardi,* described in an earlier part of this report, but they were on a larger scale, for not only was the larger of the two bullæ half an inch longer; but its greatest width was 1·5 inch, whilst that of *Mesoplodon layardi* was 1·3 inch. They should, I believe, be referred to the genus *Mesoplodon,* though probably to a larger species than *layardi,* for although my specimen of *Mesoplodon layardi* was from an immature animal, yet the petro-tympanic bones in the Cetacea assume their full dimensions at a comparatively early period of life. In both these specimens the petrous bone was united with the tympanic. It closely resembled in shape that of *layardi,* but was somewhat bigger, for its length was 2·2 inches, whilst that of *layardi* was 1·9 inch.

[1] Trans. Zool. Soc., vol. viii.

Of the remaining specimens of this group the larger number closely corresponded in size to the bullæ of *Mesoplodon layardi*, and were almost identical with them in the configuration of the lobes, in the broad, roughened, inferior surface, and in the curvatures of the inner and outer surfaces, so that I think they should be referred to that animal. I have figured a characteristic one in Plate II. fig. 8. A few specimens in this group were a little smaller than *Mesoplodon layardi*, but possessed the same general characters of shape, and two specimens were somewhat broader, and more flattened on the inferior surface, than in the immature Falkland Isle *layardi*.

The *fifth* group consisted of at least twenty-four specimens, which varied in length from 1 inch to 1·7 inch. They were all bilobed, and had the general configuration of the tympanic bulla of the *Delphinidæ*. The longest possessed a transverse diameter of 1·1 inch, and in its general form resembled the bulla of a *Globiocephalus*. It is figured in Pl. VIII. fig. 6, by Mr Murray. Others were from animals of the genus *Delphinus*, whilst the smallest had the size, and almost exactly the shape, of the common porpoise. A specimen figured in my Plate II. fig. 13, and from another aspect in Mr Murray's Plate VIII. fig. 7, was 1·3 inch long, and ·7 inch wide. It was obviously not one of the Dolphins, for it was not bi-lobed posteriorly, whilst its small size precluded it from belonging to the Baleen whales. Professor Flower, to whom I showed the specimen, thought from its resemblance in form to the tympanic bulla of the sperm whale (*Physeter macrocephalus*), though of course very much smaller, that it might be the bulla of the short-headed sperm whale of the southern seas (*Kogia*, Gray). There was no tympanic of this whale in the Museum of the College of Surgeons with which to compare it, but in the stores of the British Museum I fortunately met with a specimen marked *Kogia macleayii*, which was from a young animal, and had unquestionably a considerable resemblance to the deep-sea specimen. The latter was slightly larger, but they were almost identical in shape ; only, the deep-sea specimen was somewhat more roughened on the inferior surface, the anterior or Eustachian orifice was somewhat wider and the internal surface deeper. There can, I think, be little doubt that this bone should be referred to a species of *Kogia*. Two other specimens also occurred in this series which at the first sight seemed to have some resemblance to the bulla of *Kogia*, but on further examination were found to differ in several respects from it. The best preserved was 1·1 inch long, and is figured in Plate II. fig. 14. It was divided posteriorly into two lobes, but the intermediate depression was very shallow, and was not prolonged as a sharply differentiated groove along the inferior surface. The external posterior lobe was relatively large and boss-like, whilst the internal posterior was much smaller, and almost pointed. It cannot be regarded as one of the Dolphins, but was probably from an animal allied to *Kogia*, though generically distinct from it.

In this station forty-two detached petrous bones were also obtained. The longest was 2 inches, which is 0·1 inch less than the one already referred to in the fourth group as still attached to the bulla of the big *Mesoplodon*. Several were 1·8 and 1·9 inch long, and in their configuration resembled the petrous bone of *Mesoplodon*, and, without doubt, belonged to the bullæ of this animal already referred to as found in the same station. Others were of the same magnitude as the petrosal in the genus *Delphinus*, and very similar in form, whilst two specimens were smaller than those of the common porpoise. In all, the manganese had been deposited in the canals and foramina in the bones, and had given a coating more or less thick, in different instances, to the entire bone. Mr Murray has figured three specimens in Plate VIII. figs. 8, 9, 9*a*, 14 and 14*a*.

Fourteen specimens also occurred which consisted not only of the petrous, but of a portion of the elongated "mastoid" element continuous with it. These varied considerably in size, the largest being 3·6 inches long, and the smallest 2·5 inches, and the latter is figured by Mr Murray in Pl. VIII. fig. 3. They were all deeply impregnated with manganese, which had filled up the hollows and foramina, and coated the entire bone, so that it was difficult to obtain an exact idea of its form. It is not unlikely that these may have been the petro-mastoid elements belonging to the tympanic bullæ of some of the Baleen whales already stated to have been found in this station.

In addition to these ear-bones, numerous fragments of other bones were also present, all, with one exception, being deeply impregnated with manganese. The most noticeable of these was an elongated bar of bone 8·1 inches in length, which Professor Flower and I concurred in regarding as the beak of a Ziphioid whale. Sections of the beak were made by Mr Murray which confirmed the accuracy of this opinion. The beak and sections through it are figured by Mr Murray (Pl. X. fig. 1, *a*, *b*). Three other, but much smaller, fragments of bone, which also seemed to be portions of the beaks of Ziphioids were also present.

A number of fragments of flat bones, most of which were portions of the brain case, though one or two might have been bits of the shaft of a rib, occurred. The largest, figured by Mr Murray (Pl. X. fig. 2, *a*), was marked on its inner surface by a groove for a venous blood sinus.

An irregular mass of spongy bone, 4 inches by 8, by 3, consisting apparently of a portion of the expanded wing of a superior maxilla, was present. It was noticeable, not only from its size, but from the paucity of manganese deposit as compared with the other bones. Another smaller portion of similar spongy texture was surrounded with nodulated masses of manganese; this is figured by Mr Murray (Pl. X. fig. 3). A third mass, 5 inches by 5, having its surfaces concavo-convex, was covered by, and deeply impregnated with, manganese and iron deposition, so that it had quite a mineral appearance. It was also apparently a part of the expanded wing of the superior maxilla. Further, there were between one and two hundred smaller fragments, looking on the exterior like nodules of manganese, which, when broken through, exhibited evidence of bone structure. In one the fracture had displayed the helicoidal turn of the cochlea.

If we were to suppose that the eighty-nine tympanic bullæ obtained in this station had been exact pairs, and that the numerous petrous bones all belonged to the same animals as the tympanic bullæ, it would follow that the remains of at least forty-five whales were brought from the bottom of the ocean in this single station by one haul of the dredge; but as the bones were not in pairs, the remains of a much larger number of whales were obtained in this station. It may further be noted that a recognisable proportion of these animals were Ziphioids, and many of them belonged to the genus *Mesoplodon*, so that the central part of the South Pacific Ocean is obviously a favourite habitat of this family of cetaceans.

Station 131, lat. 29° 35′ S., long. 28° 9′ W., October 6, 1873, 2275 fathoms. A tympanic bulla $2\frac{1}{2}$ inches long, very slightly discoloured with manganese. This bulla closely corresponds with that of the *Ziphius cavirostris* from Shetland, so that I have no hesitation in associating it with that genus, and most probably with that species. I have figured it in Plate II. fig. 10, alongside of the Shetland *Ziphius*, so that the two may be compared with each other. The South Atlantic Ocean is, therefore, a habitat for this cetacean, a fact which is of interest in its bearings on the determination of the zoological position of the *Epiodon australe*, Burmeister, from Buenos Ayres, and of the *Petrorhynchus capensis*, Gray, from the Cape of Good Hope, both of which I have referred (p. 27) to *Ziphius cavirostris*.

Station 143, lat 36° 48′ S., long. 190° 24′ E., December 19, 1873, 1900 fathoms. A small fragment of bone was brought up by the dredge, about the size of a boy's playing marble. It consisted of cancellated tissue, and was coated and impregnated with manganese, and had foraminifera attached to it. It was too small a piece for one to say what bone it had formed a portion of, but it was probably from a cetacean.

Station 160, lat. 42° 42′ S., long. 134° 10′ E., March 13, 1874, 2600 fathoms. Several tympanic bullæ were found. One is figured by Mr Murray in transverse section, and surrounded by manganese (Pl. VIII. fig. 11). It possessed the bilobed form, but the lobes were more nearly equal in size than in *Mesoplodon*, so that one could not definitely pronounce it to belong to that genus. Two others had the *Mesoplodon* characters, but the one had the internal posterior lobe more massive and the outer surface more concave in its posterior half than the other. In one the furrow between the two lobes was somewhat narrower than in *Mesoplodon layardi*. Another tympanic bone was *Delphinus*. A petrous bone was apparently that of a *Globiocephalus* (Mr Murray's Pl. VIII. fig. 10). A nodulated mass of bone, not so big as a cricket ball, was covered by botryoidal deposits of peroxide of manganese, and penetrated by deposits of manganese and iron, so that it was dense and of stony hardness. There were also three small fragments of bone, one a flat bone.

Station 274, lat. 7° 25′ S., long. 152° 15′ W., September 11, 1875, 2750 fathoms. A tympano-periotic bone from a *Globiocephalus*, figured by Mr Murray (Pl. VIII. figs. 4, 5); another from one of the *Delphinidæ* (Mr Murray's, Pl. VIII. figs. 12, 13).

One in size and configuration like a *Mesoplodon*. Six separate petrous bones and four separate tympanic bullæ, either broken or so encrusted with manganese that it was difficult to determine them precisely, but they were all from the smaller species of Cetacea. There were several manganese nodules, one of which had for its nucleus a fragment of bone the size of a thick wafer.

Station 276, lat. 13° 28′ S., long. 149° 30′ W., September 16, 1875, 2350 fathoms. Two tympano-periotic bones of *Mesoplodon* closely resembling *Mesoplodon layardi*, figured by Mr Murray (Pl. VII. figs. 6, 7). In addition there were eight separate petrous bones and six tympanic bullæ. One of these bullæ was a *Globiocephalus;* another had the same form as the two specimens described at the end of the fifth group of Station 286, one of which is figured in Plate II. fig. 14; the remainder belonged apparently to the genus *Delphinus*.

Station 281, lat. 22° 21′ S., long. 150° 17′ W., October 6, 1875, 2385 fathoms. Six tympanic bones and three petrous bones. The largest tympanic was 1¼ inch long, the smallest 1 inch. They all belonged to the family of dolphins.

Station 285, lat. 32° 36′ S., long. 137° 43′ W., October 14, 1875, 2375 fathoms. This station gave one tympanic bone, 4·7 inches long, from a large species of *Balænoptera* (Mr Murray's, Pl. VII. fig. 1); one 3·2 inches long, and two others about 2·7 inches long, from smaller species of *Balænoptera*, such as are referred to in the second group of Station 286. A tympanic bone, 3½ inches long, was not swollen out as in *Balænoptera*, but was much smaller than the bulla of either *Megaptera lalandi* or *Balæna australis*. This bone was imperfect, as the part of the outer aspect which turns over into the hollow of the bulla was broken off. Upwards of twenty-five smaller sized, separated tympanic bones, which may be referred to the genera *Mesoplodon*, *Delphinus*, and *Globiocephalus*. At least eighteen petrous bones recognisable as belonging to the above genera of toothed whales. A petro-mastoid bone, 4 inches long, probably belonging to one of the Baleen whales, but with its form obscured by manganese incrustations. Numerous small fragments of bone thickly coated with manganese.

Station 289, lat. 39° 41′ S., long. 131° 23′ W., October 23, 1875, 2550 fathoms. Three large tympanic bones were obtained here; one 4 inches long, another 3¼ inches, the third about 3 inches long. They were all thickly covered with nodulated manganese. Sufficient of this deposit was removed to show that they were all apparently the bullæ of whales of the genus *Balænoptera*. Two nodules containing bony nuclei were also present.

Station 293, lat. 39° 4′ S., long. 105° 5′ W., November 1, 1875, 2025 fathoms. In this station only one small fragment of bone, the form of which was quite lost through impregnation with manganese, was found.

Station 299, lat. 33° 31′ S., long. 74° 43′ W., December 14, 1875, 2160 fathoms. This station contained one bilobed tympanic bulla, with the petrous bone attached, apparently a *Globiocephalus*.

It is important to observe that no ear-bones or fragments of other cetacean bones were obtained from the dredgings north of the Equator. The stations south of the Equator, where the bones of Cetacea were found, may be arranged in two groups, the one in comparatively close proximity to continental land, the other in mid-ocean. In the first of these groups the number of ear-bones found in any single station was small, apparently, because, from their proximity to land, and to the influence of the solids suspended in the currents of great rivers, they would become covered over, and imbedded in detritus falling to the bottom of the ocean. Thus only one bone, and that the tympanic bulla of a *Ziphius*, resembling *Ziphius cavirostris*, was obtained in the South Atlantic at Station 131, off the east coast of South America. One station (160) south of the Australian continent yielded only a few ear-bones. A station (299) off the west coast of South America yielded only the tympano-periotic bone of a single species, one of the Delphinidæ. Stations 143 and 293 gave only fragments of bone, which could not definitely be pronounced to be cetacean. All the other stations, viz., 274, 276, 281, 285, 286, 289, belonged to the second group, and were in the central southern portion of the Pacific Ocean, *i.e.*, in localities the farthest removed from continental land. These, as Mr Murray has pointed out in his Report, are areas of exceedingly slowly accumulating deposits, and consequently in them the bones dredged up at each station were, as a rule, much more numerous than at the stations nearer to the great continents, for they were not imbedded in thick strata of substances which had fallen to the bottom.

In all the localities, except 299, 293, and 143, where merely a single ear-bone or a small fragment of bone was found, the deposit at the bottom of the ocean was, as Mr Murray informs me, a red or chocolate-coloured clay, containing, besides the ear-bones, many hundreds of sharks' teeth and nodules of manganese. The preservation of the ear-bones and of the fragments of the beaks of ziphioid whales is accounted for by the extreme density of these portions of the skeleton. Some of the bones were in a much better state of preservation than others. In some the manganese coating was extremely thin, and but little had entered into the Haversian canals and lacunæ, so that a fractured surface was greyish-white (Mr Murray's Pl. X. figs. 1*a*, 1*b*, 2*a*, 4*a*). Others again were not only thickly encrusted with the mineral, but the Haversian canals and lacunæ were infiltrated with it, so that a fractured surface was dark brown or black, and the bones were extremely brittle. The chemical composition of these bones was thus entirely altered, and this was more especially the case with the fragments of the flat bones, and others of a more porous texture which formed the nuclei of so many of the manganese and iron nodules. It is worthy of note that no bone was identified as belonging to the great sperm whale (*Physeter macrocephalus*), although the track of the Challenger, at the stations where such large hauls of cetacean bones were dredged up, was through the seas frequented by this huge cetacean; but the tympanic of the short-headed sperm whale (*Kogia*) was obtained at one station (286). Further, it is to be noted that the bones obtained did not present any evidence of having been rolled or rubbed. They had evidently rested quietly in the spots where they had been deposited, and in many cases the tympanic and petrous bones were still attached to each other, although they could be separated by the exercise of but little force.

The sharks' teeth belonged to the genera *Carcharodon*, *Oxyrhina*, and *Lamna*, and are to be referred to no species, so far as we know, now living. They are identical with the sharks found in the Tertiary deposits. The question, therefore, naturally arises, Are the cetacean remains associated with them on the floor of the ocean the bones of existing or extinct forms? Of the resemblance of the greater number of these bones, more especially the tympanic bullæ, to existing genera, I have given a number of examples, and have occasionally had to point out how closely some of them correspond with existing species, so that they may be referred to them. But whilst these may be the bones of species still extant, there are others which present greater difficulties in the identification, so that, like the sharks, they may have belonged to animals which had lived in a previous geological epoch.

This observation will more especially apply to the undetermined bones found at the various stations in the central southern portion of the South Pacific Ocean. In none of these stations was the depth less than 14,000 feet, and in one (274) it reached 16,500 feet. From the position of these stations in mid-ocean, its floor in them is subjected, as Mr Murray has shown, to a minimum amount of deposition from above, so that but little change can have taken place in the ocean bed in these localities during a great period of time. The occurrence of the teeth of sharks, identical with known Tertiary species, lying so loosely on the ocean floor that they can be scraped up by the dredge, may show either that the sea bottom in these regions has remained unchanged, and with scarcely any appreciable gain from deposition since Tertiary times, or that some species of shark have continued to haunt these waters from the Tertiary down to the present period. In the former case, which other data render not improbable, the remains preserved may represent organisms existing during the Tertiary epoch, as well as animals which have lived and died in the ocean from that time to the present. From the peculiar circumstances of the case, therefore, animal remains, belonging to periods of time widely remote from each other, may be lying side by side in the same place on the sea bed, so that the association together of their remains may not necessarily imply that they were co-temporaneous. But if there has been, as seems not improbable in these very deep localities in mid-ocean, no appreciable geographical change since the Tertiary epoch, and if the food supply and the climatic conditions as regards ocean temperature have remained uniform, one sees no good reason why animals which lived in these seas during those remote times should not also be found there at the present day, if our knowledge of the oceanic fauna were complete. It may be precipitate, therefore, to pronounce the ear-bones, which we have not been able to refer to living species, to be those of extinct cetaceans, for a more complete examination of the fauna of the South Pacific Ocean may perhaps supply us with their existing representatives. For this reason, as well as from the fact that a complete collection of the ear-bones of known cetacea does not exist in the museums to which I have had access, so that our acquaintance with the configuration of these bones in already recognised species is still imperfect, I have thought it advisable not to erect those, which I was unable to determine, into new species, but merely to point out their characters, and to defer an expression of opinion on their systematic classification until the possession of more ample means of comparison places at our disposal the data which may be requisite.

EXPLANATION OF THE PLATES.

The drawings in these plates are all from nature. Those of the bones and of the form of the teeth have been executed by Mr J. Dunlop Dunlop, whilst the microsocpic sections in illustration of the structure of the teeth have been made by Alfred H. Young, M.B.

Fig. 1. A profile view of the skull of the immature *Mesoplodon layardi* from the Falkland Islands. (Specimen *C.*) Reduced one-fourth.

2. A front view of the same skull. Reduced one-fourth.

3. Profile view of the series of cervical vertebræ of the same animal. Reduced one-third.

4. Front view of the sternum of the same animal. Reduced one-fifth.

5. Petrous bone of an adult *Mesoplodon layardi* from the Cape of Good Hope. (Specimen *A.*) Natural size.

6. Transverse section through the beak of an adult *Mesoplodon layardi* from the Cape of Good Hope. (Specimen *B.*) Reduced one-half.

7. Inferior surface of the right tympano-periotic bone of the immature *Mesoplodon layardi* from the Falkland Islands. Natural size.

8. Inferior surface of the right tympanic bone of a *Mesoplodon*, probably *Mesoplodon layardi*, dredged at Station 286. Page 37. Natural size.

9. Inferior surface of the right tympanic bone of the *Ziphius cavirostris* from Shetland. Natural size.

10. Inferior surface of the right tympanic bone of a *Ziphius*, resembling *Ziphius cavirostris*, dredged at Station 131. Page 39. Natural size.

11. Outer surface of tympanic bone of a *Balænoptera*, dredged at Station 286. Page 35. Natural size.

12. Inferior surface of tympanic bone of a cetacean, dredged at Station 286. Page 36. Natural size.

13. Inferior surface of left tympanic bone of a *Kogia*, dredged at Station 286. Page 37. Natural size.

14. Inferior surface of a right tympanic bone, dredged at Station 286. Page 37. Natural size.

15. Tooth of young *Mesoplodon layardi*. Natural size.

Fig. 16. Vertical transverse section through the same tooth to show the pulp cavity. Natural size.

17. Vertical transverse section through the upper part of the shaft of the tooth of the adult *Mesoplodon layardi.* The right shaded portion is the outer surface of the tooth, from the upper end of which the denticle projects. Natural size.

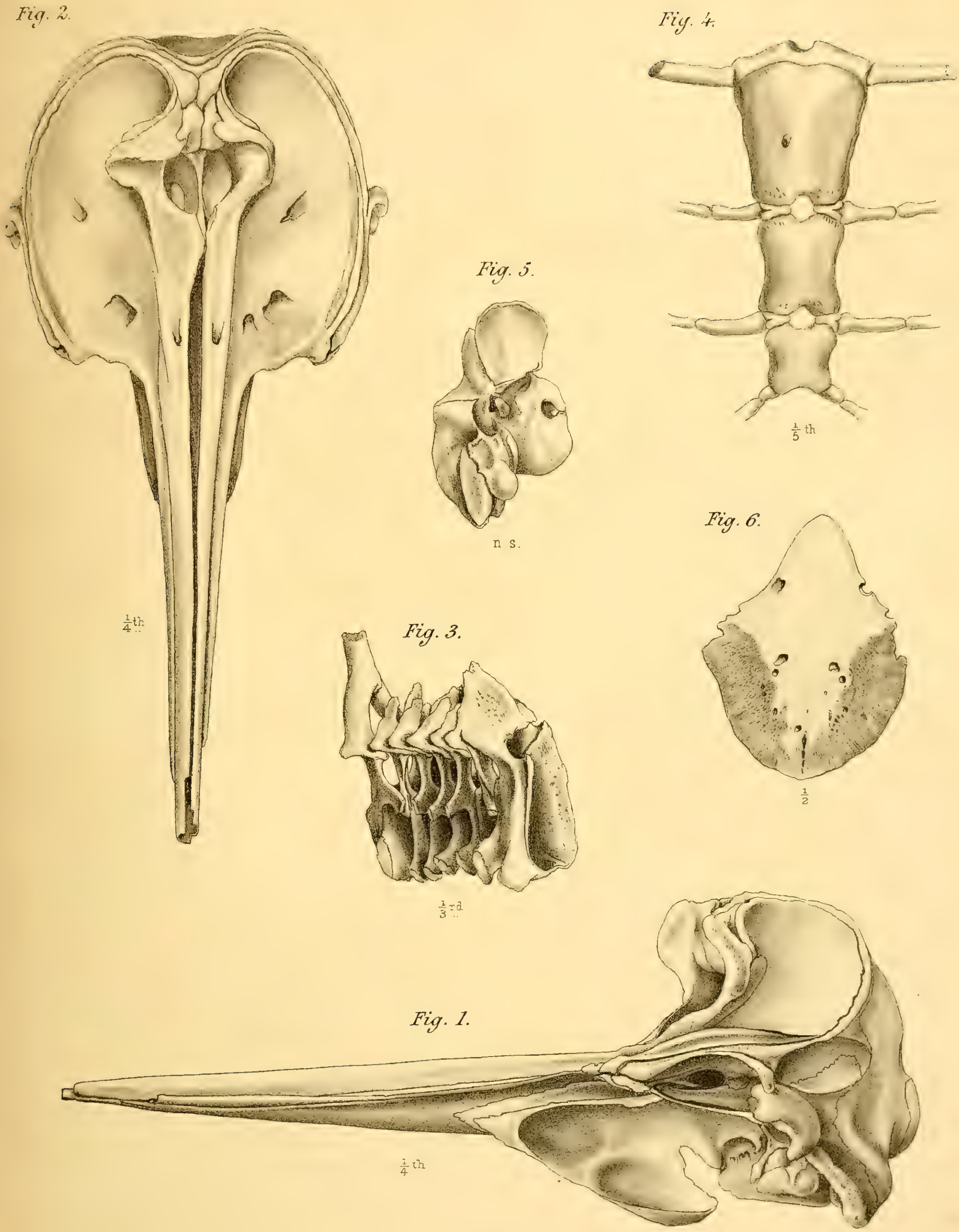
18. A magnified vertical transverse section through the tooth of the young *Mesoplodon layardi.* *P*, pulp cavity; *e*, enamel; *d*, dentine; *c*, cement; *v*, modified vaso-dentine on exterior of dentine; *v'*, modified vaso-dentine lining the pulp cavity; *i*, the interglobular spaces. Page 11.

19. A magnified vertical transverse section through the summit of the shaft of the tooth of the adult *Mesoplodon layardi.* *a*, Cement; *b*, the subjacent modified vaso-dentine; *c*, a layer of more opaque modified vaso-dentine; *d*, dentine; *e*, modified vaso-dentine of centre of shaft. The peripheral canal on the surface of this layer between it and the dentine is shown. As this drawing was not made until some months after the description was written, during which time the balsam used in mounting the section had contributed to make it more translucent, Mr Young was enabled to recognise and figure a faint lamellation about the canals of the central layers, as well as to see the passage of an occasional canal from the layer *b* into the dentine, through which they probably extended obliquely into the layer *e*. Where *b* and *e* blended with each other, the passage of canals directly from one to the other was seen. Page 14.

20. Vertical transverse section through the tooth of *Mesoplodon sowerbyi.* Natural size.

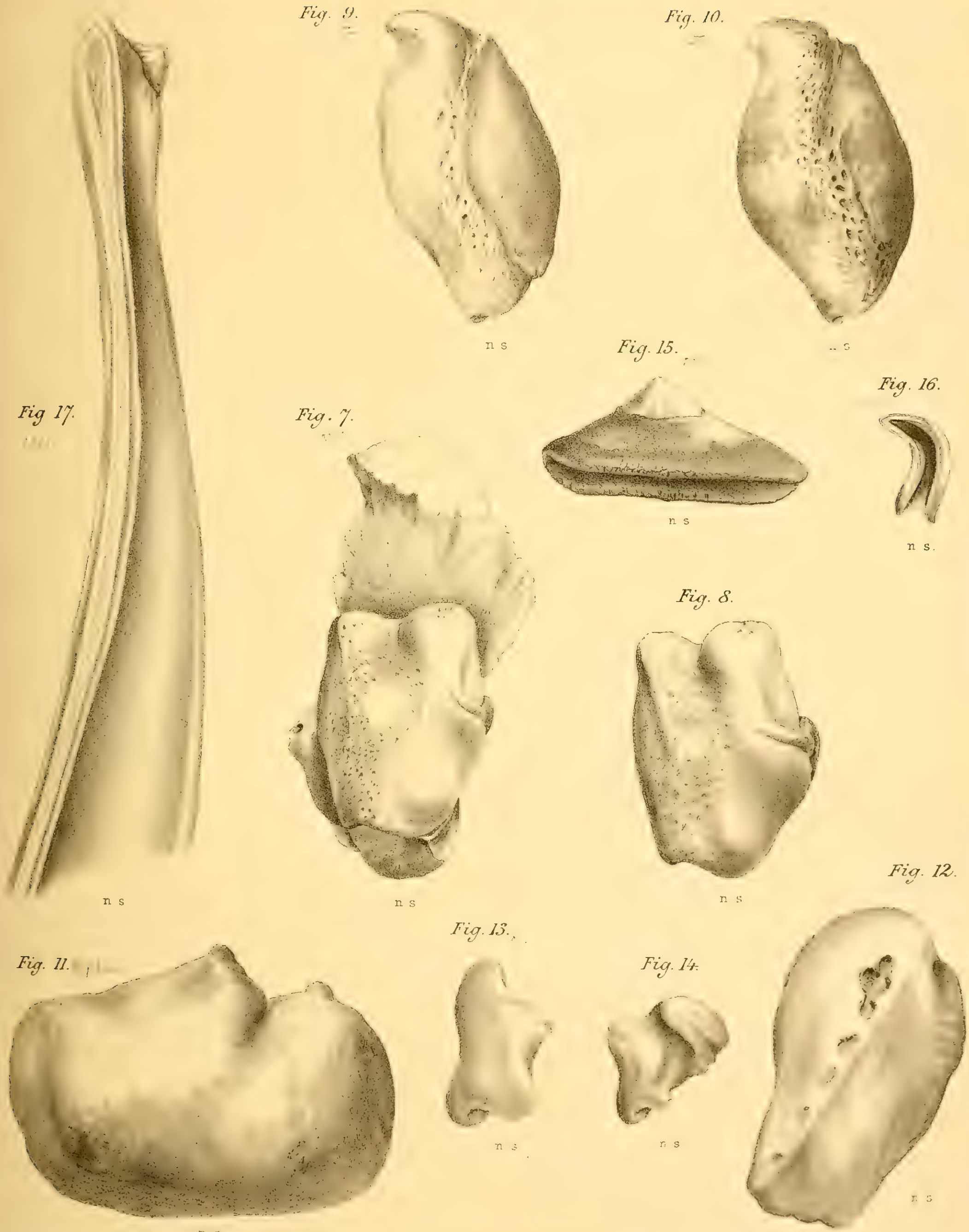
21. A magnified vertical transverse section through the upper half of the same tooth. *e*, Layer of ill-defined enamel; *d*, dentine; *c*, cement; *v*, vaso-dentine; *mv*, modified vaso-dentine. *P*, pulp-cavity. Page 19.

22. A similar magnified section through the lower half of the same tooth. *P*, pulp-cavity; *d*, dentine; *mv*, modified vaso-dentine; *c*, cement. Page 20.



J. Dunlop Dunlop, del. F. Huth, Lith^r Edin^r.

MESOPLODON LAYARDI.



J Dunlop Dunlop, del.

F. Huth, Lith^r. Edin^r.

EAR BONES AND TEETH OF ZIPHIOIDS, &C.

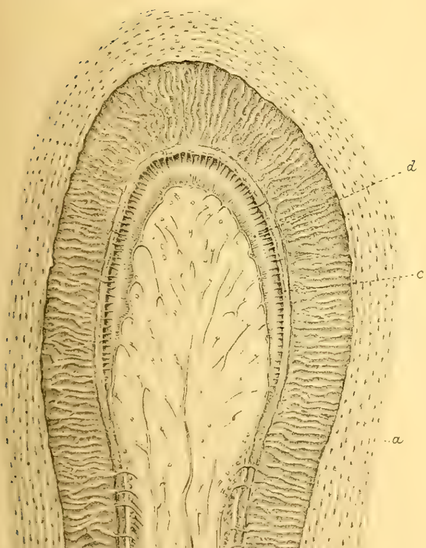
Fig. 18.

Fig. 20.

Fig. 22.

Fig. 21.

Fig. 19.



A. H. Young, del. ad nat.

F. Huth, Lith.r Edin.r

TEETH OF MESOPLODON.

THE

VOYAGE OF H.M.S. CHALLENGER.

ZOOLOGY.

REPORT on the Development of the GREEN TURTLE[1] (*Chelone viridis*, Schneid.). By WILLIAM KITCHEN PARKER, F.R.S.

PART I.—THE CRANIUM, FACE, AND CRANIAL NERVES.

IN the spring of last year (1878), my friends Sir Wyville Thomson, F.R.S., and Mr H. N. Moseley, F.R.S., kindly put me in possession of a very fine and perfect series of the embryos of this most important type.

These had been carefully preserved in spirits. The larger specimens came to me from Sir Wyville Thomson and the smaller ones from Mr Moseley. The former, to my great satisfaction, accepted my offer to prepare from these invaluable specimens a monograph for the Challenger series of Zoological Memoirs.

These embryos have been measured by me along their curved axis, from the snout to the end of the tail; those measurements were as follows :—

First stage, 6½ lines long—three specimens.

Second stage, ¾ inch long—eight specimens.

Third stage, 1¼ inch long—thirteen specimens.

Fourth stage, 3 inches long—two specimens.

Fifth stage, 4 inches long—a large number of specimens; these were just ready for hatching.

As by far the greatest number of morphological problems are concentred in the head,

[1] Since the above was written, Sir Wyville Thomson has made over to me (March 22, 1879) a large series of embryo Turtles, lately sent to the Admiralty from Ascension by Dr Maclean, R.N., who was one of the surgeons of the Challenger Expedition. I have to express my acknowledgments to the Admiralty for the promptitude with which they acceded to Sir Wyville Thomson's request to procure these specimens, and to Dr Maclean for carrying out his instructions so thoroughly. Most of these later specimens have still to be worked out embryologically, but they yield me two stages more immature than the smallest found in the first collection, viz., those gathered by Mr Moseley. These with the other five stages, and the adult, give me eight stages of this type of skull.

this present paper will treat of that region only ; the limbs, limb girdles, and spine will take up less space : these will be worked out for me by young fellow-labourers.[1]

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Note on the Development of the Olfactory Nerve and Olfactory Organ of Vertebrates, Proceedings of the Royal Society, February 13, 1879, p. 324.

First Stage. Embryo, 3½ lines long.—The body is composed of about twenty-seven somatomes, and the ventral surface of the body from the pericardium to the commencement of the caudal region (composed of four or five somatomes) is wide open.

There are evident thickenings where the limbs will be formed. The ventricle (Pl. I. fig. 1, *h*) is at present a large looped vessel, the auricles being rudimentary.

The mesocephalic flexure is perfect, and the hind-brain (C 3) is very long, showing ten or twelve thickenings on each side below, from which the nerves are arising. The mid-brain (C 2) is large, and completely bent upon itself, and the fore-brain (C 1), which is inferior in position, is separated from the mid-brain by a considerable pineal enlargement. The pituitary body has not begun to be formed.

The nasal folds (*ol.*) are already formed, and the eyeball is seen as an imperfect ring enclosing the large lens ; each of the auditory sacs (*au.*) is a short-necked lagena with an oval mouth, and having a very definite rim.

Four clefts (*cl.* 1–4) are apparent, lessening in size from before backwards, the opening of the last not being clear ; they are surrounded by a clear line of cells, possibly derived from the hypoblast which lines the slits.

[1] The sections of the head were all prepared for me by my son, Mr W. N. Parker.

The oral space (*m.*) is a narrow slit from side to side, the fore-brain being bent very near to the mandibular fold (*mn.*), which is twice as large as the others, and lies almost horizontally. In front of this, in the sub-orbital region, a very slight rudiment of the maxillo-palatine fold (*mx.p.*) is seen, but the naso-frontal fold is not yet formed.

Second Stage. Embryo, 6 *lines* ($\frac{1}{2}$ *inch*) *long.*—In this stage (Pl. I. fig. 2) the embryo has added a large number of somatomes, there being almost twice as many as in the last stage.

The heart has now its three compartments tolerably distinct. The cephalic flexure is the same as in the last stage, as is also the outer form of the head with its cerebral enlargements.

The rudiments of the nose, eyes, and ears (*ol.,e.,au.*) are more definite, and the openings of the latter are still quite evident. The pituitary involution is beginning, and the oral space (*m.*) is wider; the four long arcuate clefts (*cl.* 1–4) are narrow, but clearly open slits, with a definite margin, and are enclosed by five visceral folds, the mandibular (*mn.*), the hyoid (*hy.*), and three corresponding to branchial folds.

The maxillo-palatine fold (*mx.p.*) is now in the form of an oval leaf, broad against the mandible, and with a sharp point towards the nose; between its anterior margin and the eyeball (*e.*) there is a very definite hollow space, the lachrymal cleft (*l.cl.*), which, like the continuous oral clefts, appears to be homologous with those behind the mouth. The naso-frontal folds are still not apparent.

Third Stage. Embryo of Green Turtle, length along the axis 6$\frac{1}{2}$ *lines.*—In this stage the embryo is fairly formed, for there are rudiments of all the principal organs.

The somatomes were apparently all marked out, for I could count fifty-two at least behind the head (Pl. I. fig. 3); the segments of that part are more obscurely indicated, but by counting the "clefts"—four post-oral, two pre-oral, and one oral—it is evident that there are, at least, seven.

Hence we may conclude that the primitive form of this type was composed of not less than sixty segments, or about half as many as are seen in the lesser and shorter kinds of serpents, and considerably less (about 5-6ths) than are present in the embryo of a swan.[1]

Three folds had separated the embryo from the yolk—the head-fold, the tail-fold, and the side or body-fold. The two former had made the embryo lie free at its extremities, and altogether the three parts of the general enfolding had given to it a great distinctness from the nourishing mass below.

The head, as well as the tail, is seen to have curled itself round towards the supporting and sustaining yolk, hence the *mesocephalic flexure*, which results in most important modifications in the organs and parts of the cephalic region.

[1] In working out this type I shall proceed on the supposition that the head is a segmented region as well as the body, and make it part of my business to show and interpret the signs of the archaic segments.

The attenuated tail is coiled and serpentiform ; the swollen and huge head is so bent that the mid-brain lies in front, and the fore-brain below ; the hind-brain is a long, subarcuate, compound region, going back to the first evident somatome or *muscle-plate.*

In this small embryo—not much larger than the larva of the cheese-fly—the body-segments are already divided into three well-defined regions, namely, cervical, dorsal, and caudal.

Of the fifty-two recognisable muscle-plates, the first dozen are closely packed, and the next are twice as wide. These latter overlie the rudiments of the axial part of the great trunk ; and the clear selvedge seen below this second region is the line above which the infero-lateral bones of the carapace will be developed, these lying below the ribs and their dermal outgrowths.

The space from the front of the huge heart (*h.*) to the interspace between the umbilical vessels (*u.v.*) and the tail, will be enclosed by the nine bones of the *plastron.* These are mere parostoses, for the Chelonian, like the fish and serpent, has neither sternal ribs nor sternum ; it has only four of the pairs of bones and one of the unpaired bones of the abdominal region of the " Plesiosaur."

Half of the ventral region is now taken up by the heart and its pericardium (*h.,pcd.*), and the hind part of the space is open below, showing the Wolffian bodies ; behind, the umbilical vessels (*u.v.*) are seen emerging.

The *somatomes* have their lower margins all in a row from the space between the ear-sac and visceral clefts (*au.,cl.*) to the end of the tail, the coiled part of which occupies the space between the right and left pelvic limbs.

The region of the trunk is indicated by the presence of the limb-buds (*pc.m.,pv.m.*) which grow out from a continuous ridge directly below the segmental muscular masses, and which is separated from that ridge by a clear line of depression.

This line, and the buds that spring from it in two places on each side, are due to a thickening of the mesoblast at the upper part of the *somatopleure.*

The very sharply-defined groove below the broad segments of the rudimentary trunk marks the lower outline of the carapace (see next stage, fig. 7), which will in time so develop as to form a pent-house to the limbs, whilst the dermal plates in its lower edge will articulate, by sutures, with the symmetrical bones of the lower or abdominal plane.

At present, the only clear Chelonian *stigma* is this beginning of the lower edge of the carapace ; the limbs are on the outside, as in non-shielded types.

Now, we can clearly see that the girdle is only the upper dorsal end of the limb, this free part is a roundish thick *fin,* separated from the body by the axillary or the inguinal space, as the case may be.

The development of the intercalary vertebral rings in the massive cervical region, with its crowded muscle-plates, will place the heart at an increasing distance from the throat Now, the pericardium touches the arch of the tongue or second post-oral (*hy.*), as in the embryos of fishes (see Salmon's Skull, Phil. Trans., 1873, pl. i.).

The tissue bounding the fourth post-oral cleft, and which answers to the third branchial arch of a fish, lies under the fourth (evident) muscle-plate; and this would answer in the adult to the region of the third cervical vertebra.

This corresponds with the fact that the ventral cephalic region—the perforated respiratory pharynx—is not nearly so much retracted as the dorsal or cranial part of the head.

There has been, evidently, a secular retraction and shortening of the head and throat in existing (*Holocranial*) Vertebrates; but the region of the clefts and gills has suffered less change than the part containing the enlarged, but (relatively) shortened, neural axis.

As far as possible the head has formed a coil similar to that of the tail, both hanging over the lengthening and narrowing umbilical pedicle, and thus getting more and more clear and free of the subjacent yolk.

From this coiled condition the head never recovers more than partially; thus parts that would have retained their proper distance from each other as serial elements of a row of segments are, so to speak, huddled together, and this state of things gives rise to "a struggle for existence" in the ventral moieties of the segments.

That, however, which imprisons the elements of the face sets the dorsal region free, and thus the swelling and growing vesicles of the brain expand the neural canal, producing what in the spinal region would be morbid or abnormal—a state of "spina bifida."

At present the middle vesicle (C 2) is not only relatively very large, but it also looks directly forward, whilst the fore-brain (C 1) looks downwards and backwards.

Already the fore-brain has budded out into a pair of additional swellings—these are the rudiments of the hemispheres (C 1*a*); these do not yet reach the mid-brain. The pineal body (*pnl.*) grows from this intervening part.

Behind the globular mid-brain, the hind-brain (figs. 3, 5, C 3) is seen to be divided into two regions, the second of which passes almost insensibly into the myelon (fig. 6).

The axial tissue below these nervous masses is thickening into embryonic cartilage; but the sides, and more especially the roof, of the skull, are composed of very delicate layers of cells that are only beginning to break up into strata.

The outermost cells are derived from the *epiblast*, and the innermost from the *mesoblast;* this latter has thus intruded itself between the enfoldings of the upper layer of the *blastoderm*, at the part where that layer dominates everything else, being here most accumulated and developed.

The sectional view (fig. 6) shows that the mid-brain (C 2) is bent like a horse-shoe; the tissue in the cavity of this bend is the *middle trabecula* of Rathke, and is traversed by the apex of the notochord (*nc.*), its investing structures, and the third nerves (*motores oculorum*).

There are three pairs of chambers built in the sides of the dome-like structures of the cranium ; these are for the complex machinery of the organs of special sense, which are placed at the outgoings of the nerves that are specially modified for them.

Indeed, the middle of these, the eyeballs, are not so much supplied by modified nerves, as by a direct outgrowth on each side of the fore-brain itself.

But these three things—the crowding of the inferior parts themselves, the free *hypertrophy* the brain of vesicles, and the lodgment in the cranial walls of special chambers for the organs of special sensation—all go to modify the lower or facial parts of the head.

Further back, especially in the lower kinds of gill-bearing Vertebrata, there exists a very regular series of open passages into the throat, and of arches, or skeletal bars, to form the skeleton of the respiratory region.

But when the digestive cavity opens in front, a right and left cleft open freely into each other below; in this way the mouth (*m.*) is formed by the extension of the third pair of clefts, counting from before backwards (the first post-oral is the first cleft of embryologists).

The first post-oral bar, which forms most of the framework and machinery of the mouth, is the dominant *visceral arch;* it gets the start in growth, and aborts or even suppresses the arches in front of it to a great extent.

It may so bend itself over and subdivide as to form by itself the antagonising upper and lower jaws, as in the Selachians (see Trans. Zool. Soc., vol. x., plates xxxiv.–xlii. ; but, as a rule, rudiments of pre-oral arches supplemented by subcutaneous bones, form and finish the upper jaw.

On the whole, however, the series of clefts and folds along the face of the embryo of the Turtle, at this stage, are very regular (fig 3), although those in front of the mouth are rather indistinct.

The sense capsules (*ol.*,*e.*,*au.*) are intimately connected with the arches and clefts below, and their outworks are largely formed by modification of these oro-faucial structures.

Even now the nose and eye, and afterwards the ear, influence in many ways the growth of the parts of the lower face and throat, so that these are specialised to functions that are altogether secondary, as it regards that which was their first form and function, as the ventral portions of a simple segmented creature.

The slit-like recess below the nasal sac (*ol.*), and the gaping space between the eyeball and maxillo-palatine fold (*mx.p.*) are apparently openings of the same nature as those behind them ; they both very soon become open inwards.

The tubular cartilage that forms round the external nostril is homologous with the "labial" that serves the same purpose in the Ichthyopsida, and belongs to the same category as the *opercular cartilages* behind and around the mouth in the gill-bearing types.

The sinuous opercular folds behind the nose (the first of these, *mx.p.*, perhaps representing two) are precisely like their counterparts in the larger embryos of the Skate (see On the Skull of the Selachians, Trans. Zool. Soc., 1878, vol. x., pl. xli. fig. 1).

These folds, in this gill-less type, are now at their height, and will soon, for the most part, become fused, closing in the post-oral clefts.

The eyeball (*e.*) is now very large, and its folds have not quite united. The ear-sac (*au.*) is a short-necked lagena, the neck being the primary involution. The base of the pouch lies over the first post-oral cleft (*cl.* 1).

A basal view, from which the inferior arches have been partly cut away, shows that the floor of the skull is open under the fore-brain (fig. 4, C 1), where the oral involution (see also fig. 6, *py.*) is passing inwards towards the postero-inferior face of that vesicle.

The double maxillo-palatine fold (*mx.p.*) is sharply severed from the nasal fold in its ethmoidal or front part. It has a thin inner part, in which the palatine bone will be formed, and a thick outer part, which will contain the maxillary and its sharp, ensheathing horny plate.

The cornua trabeculæ being very short, and the prenasal not developed as yet, the *fronto-nasal process* (*n.f.p.*) is but little freed from the inferior cranial wall and prenasal folds.

When the first post-oral arch has been cut through on one side, then its "head cavity" (*h.c.*) is seen; it has already given off the pro-oral diverticulum, which lies in the hind region of the maxillo-palatine fold.

In this view the angles of the wide, gaping mouth (*m.*) are seen to be the third of a series of gaps in the facial wall, the fourth of which becomes the tympanic cleft (*cl.* 1).

On their inner side (fig. 6) the clefts are seen to be large angular pouches; they began on the inner face of the throat, in the hypoblast.

Fourth Stage. Embryos $\frac{3}{4}$ inch long, measured along their curve.—In this, as in the last stage, very much can be learned by a study of the undissected embryos. I have given a complete side view of this, as of the last (Pl. I. fig. 7).

We here see at a glance how rapidly this embryo is becoming transformed, and how soon the general form will become changed into the special Chelonian type.

The changes in form are of the greatest interest. The whole embryo has become so bent upon itself that the fronto-nasal process is only one-third the distance from the coil of the tail that it had in the last stage.

This also brings the umbilical vessels (*u.v.*) much nearer to the middle of the ventral region; this region is half filled by the enormous heart and its pericardium (*h.,pcd.*).

The cephalic and cardiac regions are now about equal in bulk; the head is still more curved on itself than in the earlier stage, and the fronto-nasal process (*n.f.p.*) almost reaches the pericardium.

The whole embryo is now clearly divisible into four regions, viz., the head, the neck, the trunk, and the tail; this last is of nearly equal length to the others, but they are also almost equal to each other in bulk.

The proximate part of each limb lies adherent to the infero-lateral region of the body, in a manner very similar to what is seen in the Osseous Fishes, where the moieties of the shoulder- and hip-girdles are permanently arrested; moreover, the latter are small, and lie low down at the ventral edge of the body-wall in those types.

The shoulder-plate adheres like a Limpet to the side of the bulbous *chest*, and it is in reality the outer layer of the imperfect *somatopleure*, growing down over that huge diverticulum of the *splanchnopleure* — the pericardium — which encloses the heart.

The hind *flipper* is still a mere discoid expansion of the growing limb; the fore flipper is growing into angles, the hinder of which will soon become the elongated part of the *manus:* it lies outside the lower edge of the incipient carapace.

The supero-lateral segments are still more sharply divided into the crowded series of the neck, and the widening series of the trunk; below the latter a very definite marking off of the lower edge has taken place; these smaller areas will contain the intercalary dermal plates. The deep sulcus between the marginal row of cutaneous folds and the ingrowing abdominal part of the body-wall is ultimately bevelled down, but it shows well that the plastron is not formed in a structure which was flat originally, but trough-shaped.

Of course, in a body so built in as that of the Tortoise, the "muscle-plates" of the dorsal region are to a large extent aborted; and the mass of the mesoblast has to be converted into the connective tissues into which the costal ectostoses run.

One pair of muscle-plates, at any rate, behind the ear, will belong to the occipital arch, as they are largely inserted into it; this gives us the hinder cranial limit. It is seen behind the lageniform ear-sac (*au.*); this lies directly over the fourth post-oral cleft, now rapidly closing up.

The intervening folds are being packed close together, and are at present narrow arched bands of tissue; only the first and second of these will enclose a permanent cavity, which, however, will be completely sealed up externally.

Much of the metamorphosis taking place within these parts is now visible externally, the outward form is being remoulded most effectually by the inward growth-processes.

The elevations now seen on each side of the hind-brain are as follows:—(*a*) The auditory sac (*au.*) as an obliquely-placed pouch, with its neck (primary involution) looking upwards and forwards.

(*b*) Four elevations below this, namely, in front, the crescentic upper region of the mandible (*mn.*), already assuming the very image of the quadrate, with its tympanic cavity and its condyle.

Then, in the hollow of the crescent, a discoid body has developed; this is caused by the distal part of the upper segment of the hyoid arch—the circular *extrastapedial;* the rest of the arch is forming in the second post-oral fold (*hy.*). Between this elevation and the hollow of the quadrate elevation, we see the beginning of the membrana tympani.

Behind the discoidal elevation two lesser prominences are seen; these are caused by the thick post-tympanic ligament, and the *digastric* muscle.

The fold of the angle of the mouth (*mx.p.,m.*) still shows itself to be as true an "opercular fold" as those which succeed it; it is the post-lachrymal part of the huge maxillo-palatine fold, as the thick ethmoidal end is the pre-lachrymal part; that *cleft* lies between these two regions (see Pl. II. figs. 2, 3, *l.cl.,mx.p.*).

The lateral view (Pl. I. fig. 7), the directly inferior view (Pl. II. fig. 2), and the view from below, but with the head tilted back, and with the lower arches removed (Pl. II. fig. 3)—all these must be compared together to get a clear conception of the parts round the mouth.

The extent to which the supra-oral parts are modified by the eyeball is evidently great; that organ is now at its relatively largest size, exceeding the mid-brain in bulk.

This preoccupation of so much of the face, and the enfolded form of the whole head, have wrought great changes in the shape of the series of the facial folds. The evidence in favour of the view of the double nature of the great sub-ocular fold ("maxillo-palatine," *mx.p.*) is as follows:—

In this stage it is somewhat hour-glass shaped; it develops a head-cavity in its hind part, and not in its fore part; the lachrymal cleft is over its narrow part (Pl. II. fig. 3, *l.cl.,mx.p.*); and in many kinds of Vertebrates there is a distinct visceral cartilage in the fore part, and another in its hind part—one the true endoskeletal-palatine or "ethmo-palatine," and the other the "epipterygoid."

The space between the maxillo-palatine fold and the "fronto-nasal process" (foremost right and left visceral folds in one lobe) is quite distinct and clear; and the outer part of the nasal roof articulates with the maxillo-palatine fold. This outer limb of the nasal paraneural cartilage contains the rudiment of the "lateral ethmoid," which, however, becomes complicated, in many types, by fusion with the trabecula and the ethmo-palatine cartilage, or axis of the fore part of the maxillo-palatine fold.

The large lachrymal cleft lies over this junction, but indeed organically close behind it. Yet both the lateral and inferior views suggest the direct serial homology of the fronto-nasal with the maxillo-palatine in its fore part, and the chink between them may be called a *cleft,* whether its homology with the post-oral clefts be conceded or not.

The double terminal part, the *fronto-nasal process* (*n.f.p.*) contains both the inner limb of the crescentic nasal roof-cartilage, and also the foremost part of the basi-cranial bar (prenasal cartilage), which curves down into this lobe. In many Vertebrata this lobe contains both the paired and single elements of this fore part of the cranial floor; in this type only the single rod (Pl. II. fig. 5, *p.n.,i.tr.*), the other bars ("cornua trabeculæ"), stopping short of this region.

Without further dissection than the removal of the lower part of the post-oral folds several important things can be seen (Pl. II. fig. 3).

The double oral cleft has been laid open at the angles; behind and within these the Eustachian openings of the first post-oral or tympanic cleft (*eu.*) are seen; they are wide apart, and crescentic, with the concavity on the outer side. They are in this view evidently comparable with the pre-oral chinks.

These latter spaces, both open on each side, over the fore part of the oral recess; between them the palate is carinate ("vomerine region"), and half-way behind the fronto-nasal fold an open space appears, into which the oral lining has grown, as an indrawn, tubular recess.

This peculiar diverticulum is the rudiment of the *pituitary body;* it stands on the debatable ground where the hypoblast and epiblast meet, but according to the best observers is formed from the latter layer of the blastoderm (see Balfour's Elasmobranchs, p. 189).

The upper view (Plate II. fig. 1) shows the size and front position of the mid-brain (C 2), the oblique position of the huge eyeballs (*e*), the superorbital folds (*s. ob.*), and the three tracts covering the hind-brain (C 3), whose upper part is very thin, and thinly covered with skin.

Also we see the auditory sacs (*au.*), the tympanic region (*co.*), and the occipital and cervical muscle-plates. In the halved head, vertically cut (fig. 4), we see the effects of the cranial flexure at its uttermost degree of development; the sigmoid flexure of the hind-brain, the looped form of the mid-brain, and the low position of the fore-brain.

In these hand-sections the razor separates the cortical from the medullary matter of the brain, which thus forms a coat that might be mistaken for the membrano-cranium.

The floor of the hind-brain (C 3) is thick, but its roof is thin; in front, over it, the cerebellar folds (C 3*a*) are forming.

Also the mid-brain is folded forwards and backwards, within, whilst at its middle it stretches over a large vertical space in which ascend the posterior clinoid wall (*p.cl.*), and the notochord (*nc.*); down it the third nerve descends to the orbital muscles; the interspaces are filled with a gelatinous stroma. The highest part of this cavity in the folded mid-brain is acute, behind that it is rounded, where the swelling base of the hind-brain retires as it ascends to the cerebellum.

The fore-brain (C 1) has developed median vesicles, and three pairs of vesicles.

The first azygous part to be noticed is the upper or the pineal gland (*pnl.*) ; it runs up between the mid-brain and the hemispheres (C 2, C 1*a*) ; the second is below, and will be the infundibulum (*inf.*). The hindmost pair of vesicles are largely constricted off as the essential part of the eyeball ; their constricted stem is the hollow optic nerve (2) ; this tube is close in front of the beginning of the infundibulum.

In front, as the external views also show, the fore-brain has budded into the hemispheres, right and left (C 1*a*) ; behind, where the solid olfactory nerves are given off, a rudimentary olfactory vesicle (C 1*b*) has appeared ; it is, however, now, and for a long time to come, quite distinct from the nerve itself (1), whose fibres grow downwards and backwards.

The *chondrocranium,* of necessity, is greatly modified by the folded form of the neural vesicles that are supported by it ; it follows, very accurately on the whole, the elegant curves of the lower surface of the brain.

The notochord (*nc.*) lies above and between the moieties of the investing mass (*iv.*), but where these parts are at their greatest height in the mesocephalic hollow space, the notochord retreats, and then curves forwards, like a semi-erect caterpillar ; its end is bulbous.

In front of this ascending part the skull floor is open (figs. 2–4), for here the oral involution is intussuscepted, and here the internal carotid arteries (*i.c.*) enter.

Cartilage, however, is seen at the mid-line in this section (fig. 4, *i.tr.*) ; this will be understood better by reference to the bird's-eye view (fig. 5).

In front, the section is a little on the near side of the middle, so that the prenasal cartilage (figs. 5–7, *p.n.*) is not seen, but the solid olfactory nerve, and the beginning of the *rhinencephalon,* or olfactory bulb, are brought into view.

The cavity of the mouth is seen to be bounded in front by the retral fronto-nasal process (*n.f.p.*), on its sides by the maxillo-palatine fold (*mx.p.*), and behind by the inferior arches, two of which, the mandible (*mn.*) and the hyoid (*hy.*), are shown in section in the floor of the throat.

When this small head is *scalped,* and the brain removed, then the post-pituitary wall (*p.cl.*) is the highest part of the object, and two retreating floors are seen, the one in front and the other behind (fig. 5).

This high thick wall is cartilaginous in its middle part, and is strongly buttressed by tissue growing in on each side between the eye and the ear (*e.,au.*).

Only the hinder part of the notochord is seen, the fore part is towards the observer ; its investing cartilages (*iv.*) are seen in the occipital and hind part of the basisphenoidal regions as a pair of broad plates.

Each of these plates is crescentically cut away in two places ; the hinder or larger emargination is in relation to the egg-shaped ear-ball (*au.*) ; and the first notch which goes further in, is for the exit of the large trigeminal nerve (5).

The thick chondrifying capsule of the ear (*au.*) is cut through horizontally in this preparation so as to show the junction of the anterior and posterior canals (*a.s.c.,p.s.c.*), and the two ends of the horizontal canal (*h.s.c.*)

Between each ear-capsule and the skin there is a large sulcus or ditch; this runs forwards into a large oval hole, just outside the trigeminal nerve (fig. 5; 5); the sulcus is the tympanic cavity, and the hole the "Eustachian tube"; both of these are parts of the first post-oral cleft (Pl. I. fig. 7, *cl.* 1).

The hind basin is short and wide, but the front basin is egg-shaped, with the broad end in front and the narrow end behind. But this narrow end dips largely, and there it is open below (*py.*); a little further forwards it is perforated on each side for the large optic nerves (2), and quite at the fore edge the olfactory nerves (1) pass out, and grow downwards and backwards over the nasal space or cleft.

Between the optic nerves and olfactory sacs the basin has cartilaginous sides, the orbito-sphenoids (*o.s.*); and after a while this cartilage will bridge over the space where the trigeminal nerves run out and connect the orbito-sphenoids to the post-pituitary wall by a temporary alisphenoidal band.

The middle part is taken up by three cartilages, the *trabeculæ* and *intertrabecula;* here the chondrification corresponds very exactly to my first stage in the Selachian (Trans. Zool. Soc., vol. x. pl. xxxv. figs. 3 and 5, *tr.*). But there the middle part is still soft, and it has not become definite along the middle in the interocular region; in the Turtle the three bars are coeval.

The lateral bars are like those of the Tadpole (Batrachia, part 2, Phil. Trans., 1876, pl. lv.); but there the middle one develops slowly, and in three distinct parts, ultimately uniting the symmetrical bars.

In the Tadpole the thin flat intertrabecular floor of the orbital region chondrifies first; then the meso-ethmoidal wall, and lastly, the anterior space between the cornua trabeculæ, where in some kinds ("Hylidæ"), it sends forth a well-formed "prenasal rostrum."

In the Axolotl ("Urodeles," Phil. Trans., 1877, pls. xxii., xxiii.) the trabeculæ gradually grow up to the frontal wall, and then become fused together in the internasal space.

But in the larva of *Seironota* (*Ibid.*, pl. xxix. figs. 1, 2) they sooner reach the fore part of the head; in all the "Urodeles" the intertrabecular cartilage is but feebly developed, and that merely as a conjugation of the trabeculæ in the nasal region.

Altogether, whether we compare these things in the Turtle with types below or above, the intertrabecula has in it a unique development as to relative size and continuity, and in its early appearance, contemporaneously with the paired bars (trabeculæ).

All the three rods are nearly circular in section at present (fig. 10), but this is a very temporary state of things, for they all soon grow into vertically compressed plates, and the chondrocranium, from having a flat-bottomed Batrachian form, grows up into a high wall between the eyes, as well as developing a partition in the nasal region.

Other Batrachian characters show themselves in later stages in the Turtle's skull, but this is the stage at which it approximates nearest to that of the Tadpole; this is especially seen in the flat, out-turned ends (cornua) of the paired trabeculæ (figs. 5–7).

This stage is especially valuable as helping, in comparison with what is to be seen in Tadpoles and larval Urodeles, to a clear conception of the true nature of the prochordal part of the trabeculæ.

I apply the term *basineural* to the paired elements of the skull-base and skull-walls, and their homology with the series of paired cartillages of the spine (neural arches) is clearly to be seen in the stage before us.

The axial part, the notochord, with its thin mesoblastic sheath, stops behind the oral involution; but the three mesoblastic tracts are carried on to the frontal wall of the embryo, the trabeculæ continuously, and the intertrabecula, with only a short tract suppressed. This, however, becomes all filled up afterwards, or long before the time of hatching.

Now, however, and during the next stage, until the middle of the incubating period, the prochordal part of the trabeculæ is segmented off from the parachordal part.[1]

The tissue is continuous, but the cartilage divides and forms a temporary joint, inherited, I have no doubt, from some old type to whom such a joint was useful.

The prochordal tracts (seen from above in Pl. II. figs. 5 and 7; from below, in fig. 6; and in section in figs. 9 and 10, *tr.,i.tr.*) occupy half the lower region of the skull, which, however, is shorter by two-fifths than it would have been if the mid-brain had stretched out in a straight line instead of folding itself into a sudden loop.

But the chondrocranium only shows a tendency, in the curved form of the notochord, to loop itself; it really begins again at a new point, and the prochordal part of the trabeculæ is set on at the base of the ascending part.

In the next stage we shall see a more perfect looping, even of the basal part of the skull; now, we see the floor merely breaking out again under the fore-brain. The prenasal end of the intertrabecula bends, already, somewhat downwards in the front of the head; behind, it runs under the fore half of the pituitary space; at that part the three rods are all rounded (fig. 10, *tr.,i.tr.*).

Further forwards, between the eyes (fig. 9), the intertrabecula is on a still lower plane than in the pituitary space; this is an important fact to be noticed, as the carination of the orbital septum in this type is due to this low position of the middle bar. There also the three bars are only separated by less solid tissue; further forwards (Pl. IV. fig. 1, *tr.,i.tr.*) they are more distinct again, and there the trabeculæ give out

[1] For some years I supposed this distinction of parts to be primary; I am now satisfied that it is secondary (see Proc. Roy. Soc., Feb. 13, 1879, p. 339).

large wings—the orbito-sphenoids (*o.s.*). Now, as in the Tadpole, these "wings" arise from the very floor of the skull; this will be greatly changed afterwards.

A careful comparison of the sections and dissections figured from the embryos of this stage will make plain the development of the pituitary body (*py.*).

The views from below (Pl. II. figs. 2, 3), and in the vertical section (fig. 4), show but little of the complexity of this structure; this, however, is illustrated by other preparations. In a horizontal section of the fore part of the basis cranii (Pl. II. figs. 6, 7, lower and upper views) the formation of this quasi-glandular structure is seen to be by the oral lining passing inwards, upwards, and backwards. The actual opening is now heart-shaped (fig. 6), and the fold has its walls composed of rather larger subglobular cells.

This pituitary pouch is obliquely placed; its upper part going backward. Seen from the roof (figs. 7 and 8) the sides appear thicker than the top; the end is almost separated from the rest, and its walls are very thick.

But the upper part, which alone becomes the pituitary body, is not so simple as these aspects seem to show; it becomes racemose, and the temporary, open, lower portion becomes also curiously folded.

We get additional light upon the structure of this unexplained "body" by sections which, in the fore part of the head, are vertically transverse, but owing to the cephalic fold become almost parallel with the floor of the skull behind (Pl. IV. figs. 1–5).

The first of these sections has already been referred to as showing the low position of the trabecular (orbito-sphenoidal) alæ (*o.s.*) on each side of the carinate "inter-trabecula." The second section (fig. 2) goes obliquely through the mass of the high "post-pituitary wall" (*p.cl.*), exposing the huge Gasserian ganglia (5), the upper part of the auditory capsules (*au.*), and the notochord (*nc.*), both in its ascending and in its horizontal part. The membranous space in which it lies is the "posterior basi-cranial fontanelle," the trabeculæ and parachordals proper, pass into each other on each side of this space in front.

That this section is above the pituitary body is seen by the fact that it shows the budding *infundibulum* (*inf.*), but none of the lobes that are to be grafted upon it. Another section (fig. 4), made at a somewhat different angle shows this budding lobe of the fore-brain (C 1, *inf.*) in front of the lobed and winged rudiment of the pituitary body (*py*).

Part both of the trabeculæ and cranial walls, the alisphenoids behind, and orbito-sphenoids in front, are seen, and the internal carotids (*i.c.*) are coming up to form the "circle of Willis."

The ophthalmic branch of the fifth (5^1) is seen passing forwards on the inner side of the eye (*e.*), and the third nerves (3), each with its distal ganglion are shown; this second enlargement of the "motor oculi" lies directly above the origin of the diverging orbital muscles.

Another section (fig. 3) is through the oral involution, and shows a slice through the lower part of the most solid lobe of the pituitary body (*py.*), the trabeculæ (*tr.*) are cut through on each side; the curious foldings of the lips of the involution are seen here as in fig. 4.

A section on a still lower plane (fig. 5) shows well the junction of the parts that form the pituitary floor, or *sella turcica;* the trabeculæ, intertrabecula, and fore part of the investing mass (*tr.,i.tr.,iv.*). Here the lower part of two of the pituitary lobes are cut through, and the sixth nerve (6) is seen passing outwards, having been severed from the floor of the hind-brain, towards the *external rectus* muscle; outside this is seen a fragment of the trigeminal nerve ($5^{2,3}$). The internal carotids (*i.c.*) appear further forwards.

These embryos of so large a reptile, although only a third the size of the Tadpole of a Common Frog, show many most important things. Among these are the various visceral folds and clefts; the large size and great length of the intertrabecular bar, the size and height of the post-pituitary wall, with the end of the notochord; also the commencement of the pituitary body, of the infundibulum, and of the olfactory tract, whilst the optic nerve is still hollow.

The olfactory nerves are still quite solid and independent of the hollow olfactory tracts; beneath them, and beneath the eyeballs also, a curious gap or cleft is seen on each side, which at once suggests the idea of a series of clefts, as there are also a series of folds truly homologous with the clefts and folds behind the mouth; and, indeed, the mouth itself, with its opercular fold, the hind part of the upper lip, may be considered to belong to the same category.

Much earlier embryos would have been required to show the origin of the third pair of cranial nerves from the dorsum of the middle cerebral vesicle. I am satisfied that the sixth pair (abducentes) grow from the inferior surface of the hind-brain.

As the embryonic cartilage has become almost hyaline, in most tracts where that tissue has to be developed, a very short time suffices to bring this stage on to the next, in which almost all the endo-skeletal structures will be well marked out and laid down in that solid tissue.

Fifth Stage. Embryos one inch and a third in length, measured along the curve.—(*a.*) *Lateral view of embryo.*—In actual size these embryos equal a honey-bee, yet their development is very perfect; and as the chondro-skeleton is now complete they are at a stage which represents the permanent skeleton of cartilaginous fishes (Marsipobranchii and Elasmobranchii), and the temporary skeleton of amphibian larvæ.

Small as these embryos are, they have assumed already much of the form which is permanent in this gigantic species. The chick of the Common Fowl arrives at this stage by the end of the first week of incubation, but is hatched in a much more immature state than the young of the Turtle. The Australian Fowl (*Talegalla lathami*) is retained in the large egg until it is as ripe as the hatching Turtle.

On the whole, the growth of the parts is so alike, in both Turtle and Fowl, that to one most familiar with the development of the bird, it requires some reflection for the mind not to become unconscious that the structures seen belong to a creature of another and a lower *Class.*

Thoroughly Chelonian in outer form, these embryos are yet overloaded with brain- and sense-capsules. The head is very disproportionate to the body, and the eyeballs out of all proportion to everything else (Pl. III. fig. 1).

The neck is now much shorter relatively than in the last stage, but is very thick; the carapace now forms a large pent-house to the trunk, and the abdominal walls are much flatter, although still very convex. The umbilicus (*u.v.*) is now fairly in the middle of the abdomen, and its thick rim is relatively much smaller.

Both the ribs and spines mark the carapace, and its lower edge all round is a thick fold in which the infero-lateral dermal scales will be formed. Fore and aft, the rim of the carapace has overlapped the limb-girdles, the specialisation which, of all others, is most characteristic of the Chelonia; the regions and rays of the limbs are evident, although covered with skin and muscles.

The tail is rather long, and coils forwards under the abdomen, so as to reach nearly to the umbilicus, which has just room for its vessels between the tail and the upper lip.

The folds of the neck indicate the old closed seams or clefts; the first post-oral is, however, utilised, and although covered with skin, is a conspicuous part because of its internal expansion, and the parts that enclose it and grow into it.

These parts are the curved and hollow "quadrate" cartilage, the modified skin forming the *membrana tympani*, and the discoidal symplectic end of the *epihyal* element, now transformed into the *columella auris* (Pl. III. fig. 1, and Pl. IV. fig. 7, *q.,m.ty.,co.*). Over these parts the auditory capsule (*au.*) is visible as an ovoidal swelling; some distance further forward the eyeball (*e.*) occupies a large region in the upper face; and in front of it the nasal organ (*ol.*) is seen as a rounded eminence perforated at the top.

Below and between the nasal openings (*e.n.*) the rostral prickle or spine (*r.sp.*) forms the actual end of the head, the opening of the mouth is still a good distance further back, and the mandible (*mn.*) is relatively small and feeble.

The folded mid-brain (C 2) still preponderates over the other vesicles, and although much further back than in the last stage, is a very tumid region, yet the same thing is seen in the snake at this stage. (See Snake's Skull, 3d stage, Phil. Trans., 1878, pl. xxviii. figs. 1, 2, C 2.)

(*b.*) *Upper view of head.*—The hemispheres (figs. 1, 2, C 1*a*) cover the primary vesicle, yet they make but little projection in the roof of the head. The hind-brain projects but little, as it is largely bent forward (see fig. 4, C 3), and the cerebellum (C 3*a*) is only rudimentary at present. Comparing this head with that of the last stage, it is seen how rapidly the permanent form is being assumed, and how fast the various folds of skin—eyelids, superorbital ridges, lips, &c.—are growing. The upper third of the head is not at present protected even by cartilage (see section Pl. III. fig. 5).

(*c.*) *Lower view of head.*—Below, we see that the maxillo-palatine folds have coalesced with the fronto-nasal fold (compare Pl. III. fig. 3, with Pl. II. figs. 2, 3) to form the upper cheek, in which afterwards the maxillary and jugal bones appear laterally, and the premaxillaries in front.

There is still a large cleft in front between the eyeball and these two conjoined folds; this is part of the original "lachrymal cleft" (*l.cl.*, see also Pl. II. figs. 2, 3); the nasal cleft is near the well-rimmed nasal aperture and passage (*e.n.*). The eye, behind, rests on a cushion of thickening tissue, which overlaps the ball almost to the iris; this is the large lachrymal gland (*l.g.*). Round the ball the upper and lower lids are now clearly seen (figs. 1–3).

A comparison of the head in this stage with that of the last will show how rapidly the generalised "Sauropsidan" head has been transformed into the specialised head of a Chelonian.

(*d.*) *Vertical section of head.*—A vertical section of the head, both with the brain *in situ*, and also with it removed (Pl. III. figs. 4, 5), helps much to elucidate the nature of the metamorphosis that has taken place in so short a time as between my fourth and fifth stages.

The cavities of the brain vesicles are decreasing rapidly; the hemispheres (fig. 4, C 1*a*) form the foremost part of the brain; the hind-brain (C 2) looks upwards and backwards, and is becoming very solid; and the hind-brain has, above and in front, some convolutions that form the rudiments of the cerebellum (C 3, 3*a*).[1]

The folded form of the mid-brain gives rise to a large space which now looks upwards and backwards, and which contains some very important parts soon to be described.

The optic and olfactory nerves are solid,—the former was tubular, and the latter will have a cavity, when the olfactory tract or vesicle is formed and has communicated with the nerve.

The infundibulum (figs. 4 and 4*a*, *inf.*) is forming, but like the pituitary body (*py.*) is still imperfect; moreover, these two bodies are at present quite separate from each other.[2]

The chondrocranium (Pl. III. fig. 5) is now at its greatest perfection, and it has

[1] In this section the cortical matter of the brain is shown as partly severed from the medullary part, which is due to the tearing action of the razor.

[2] The structures here shown on the face of a solid section will be largely illustrated by figures taken from the transparent sections made in three directions.

acquired its proper Chelonian characters; it was more like that of a Batrachian in the last stage.

The roof is open up to the occipital ring (*s.o.*); the sides are continuously cartilaginous (*al.s.,o.s*); the hind part of the base (*b.s.,b.o.*) is very deep; and the fore part of the base arises now from the top of a steep wall, the orbito-nasal septum (*p.e.,s.n.*).

This sectional vertical view shows a chondrocranium quite similar to that of the chick near the end of the first week of incubation (Phil. Trans., 1869, pl. lxxxi. fig. 3), for at that time the prognathism of the Fowl's face is only just beginning; and if the premaxillaries existed then they would be vertical, and not almost horizontal, a direction they possess in the bird very early.

The composition of the hollow posterior, and vertical anterior, basal parts will be largely illustrated by other views (sectional); the fore part of the nasal septum shows a small pre-nasal rod directed downwards; the "alæ" or shelving side-walls are well seen in this view.

As in the embryo Whale[1] and Pig (Phil. Trans., 1874, pl. xxxiv. fig. 6) the orbito-sphenoids (*o.s.*) are very large, and a lesser fold of cartilage is continued from them along the sides of the cavity for the mid-brain, and unites with the top of the ear-capsule; this is the large "alisphenoid" (*al.s*).

The orbito-sphenoids are notched by the optic nerve (2) postero-inferiorly, and the alisphenoids similarly by the trigeminal nerve (5); these latter "wings" are buttressed on their inner side by the dilated ends of the huge "post-clinoid wall" (*p.cl*).

This "wall" is due to the enfolded form of the embryonic head, but as the para-chordal cartilages stop short above, and do not follow the folding of the mid-brain, they of course only form a single plate thus ending free above.

We shall see that the median tracts of the basis cranii do, in some degree, become folded over; but the paired cartilages stop above, and begin again below; there is, therefore, a hiatus in the chondrocranial floor, which, where it begins its prochordal growth, below and in front, is a sort of added part, or outgrowth of the primary basal tracts, which would, normally, end where the notochord itself ends.

I look upon this peculiar modification of the basi-cranial axis as due to a specialisation taking place for the purpose of finishing an actual or practical end to the skull, the organic end having been bent under the head; its position would be directly below the fore-brain, after the cranial flexure had taken place.

Nevertheless, I do not doubt the homology of these paired tracts and their lateral alæ (trabeculæ and orbito-sphenoids) with the paired tracts and their alæ that grow on each side of the notochord (post-sphenoidal and occipital regions).

This outgrowing front region of the skull is a correlate of the outgrowing and

[1] See Eschricht, On *Balæna japonica*. Copenhagen, 1869 (pl. ii. figs. 1–3, *k*).

front parts of the brain, namely, the *hemispheres* and *olfactory tracts;* these, assuredly, are serially homologous with the developments of the brain further back.

The hinder parts of the cranial walls are suppressed for a considerable space by the intrusion of the large egg-shaped periotic sacs (*au.*); these are distinct cartilaginous balls, and take up much room in the walls of the skull; moreover, they push certain cranial nerves away from each other very much by their intrusion. These are the seventh and the ninth; the eighth is part of the seventh, which gives up its dorsal branch for this (auditory) specialisation.

The closing in of the occipital arch, behind, compresses the space between the post-auditory nerves; and now, also, the hypoglossal (12) becomes enclosed in the occipital cartilage.

The notochord and its sheath (figs. 4, 4*a*, 5, *nc.*) is now only half as high as the post-clinoid wall; its end is bulbous, and somewhat curved forwards: this is seen still more in the thin sections of other individuals.

The pituitary body (*py.*) is seen in these views (figs. 4, 4*a*, 5) as a small vesicle overlying a larger sac, obliquely, and both are quite distinct from the closed papilliform rudiment of the infundibulum (*inf.*); in reality, however, the pituitary body is more complex at this stage than this view would indicate, and this will be seen in the figures of the thin sections.

(*e.*) *Upper view of chondrocranium.*—This dissection (Pl. IV. fig. 6) shows how well the cavity of the cranium is floored with cartilages, but it gives an imperfect idea of the size of the transverse wall (*p.cl.*) that rises within the cavity of the mid-brain. The growth of the cartilage is seen to be continuous from end to end.

At the fore end the olfactory nerves (1) notch the orbito-sphenoids (*o.s.*); and behind, these large wings are again notched by the optic nerves (2).

In the middle of the space behind the optic foramina the three main lobes of the growing pituitary body (*py.*) are seen, with the post-clinoid wall behind them.

This, the highest part of the basi-cranial axis, runs into the alisphenoids (*al.s.*), laterally; behind them, at the bottom of the deep recess, the basal plate has a round notch on each side in which lies the Gasserian ganglion (5); between the ganglia the notochord (*nc.*) turns upwards suddenly.

Behind these notches the plates have again a concave margin, for here the auditory sacs (*au.*) fit in; into them the eighth nerve (8) is seen entering; behind them the glossopharyngeal and vagus (9, 10) are seen emerging.

In this preparation the roof was cut away; the foramen magnum (*f.m.*) is seen to be large and reniform.

(*f.*) *Lower view of chondrocranium.*—This dissection (Pl. IV. fig. 7) displays some important parts, not the least remarkable of which is a small round recess at the angle in front of the palate, close behind the prenasal rostrum (*p.n.*), which is turned backwards, as well as downwards. This recess, or middle nasal passage (*m.n.p.*), is like that which is seen in many "Urodeles" (Phil. Trans., 1877, pl. xxix. p. 579), and appears to be a petromyzine remnant.

In front of and behind the recess the sub-carinate orbito-nasal septum (*s.n.,p.e.*) is seen; behind, each lateral element of this longitudinal wall is articulated to the fore part of the base of the transverse post-pituitary wall.

The rest of the basis cranii is the gently concave continuation of the transverse wall; its moieties are separated by the notochord (*iv.,nc.*), and the auditory sacs lie on its bevelled edge, as in the Skate and Shark (Trans. Zool. Soc., vol. x. part. 4, pls. xxxiv.–xlii. 1878). On the under surface of the auditory capsules two fenestræ can be seen on each side, from the foremost of which a rod of cartilage is seen emerging; these are the fenestra ovalis and fenestra rotunda, and the rod is the columella (*f.o.,f.r.,co.*).

The hollowed quadrate cartilage (*q.*) is seen outside and in front of the columella; and half-way between each quadrate and the notochord the Eustachian passages (*eu.*) are seen to open; these are extensions of the first cleft, which has become large in the body of the quadrate.

(*g.*) *Upper view of the inferior arches.*—These arches (Pl. III. fig. 6) are very similar to those of a Frog whose branchial pouches have recently been absorbed. Only such parts are chondrified in the Turtle as are left after metamorphosis in the Frog, where the four outer pouches, and the four rudimentary intra-branchials are almost removed, leaving the sub-basal "thyro-hyals" for attachment to the larynx.

The free mandibles (*mn.*) are united by a plate which requires but little further segmentation to convert it into a basimandibular element.[1]

This is evidently a somewhat rare modification of the mandibular arch, but, according to Mr Charles Stewart, it occurs in the Crocodile also. This sub-orbicular piece is clearly marked off from the terete rods (*mk.*), which thicken upwards, and end in a reniform condyle.

The upper element of the hyoid arch will be described with the auditory apparatus: it is the shaft of the columella (Pl. IV. fig. 7, *co.*); the "cerato-hyal" (Pl. III. fig. 6, *c.hy.*) is a gently arcuate rounded rod set on the basal piece behind the pyriform "hypohyal" (*h.hy.*).

The basal piece is a broad apiculate plate of cartilage, which is, in reality, a basi-hyobranchial (*b.hy.,b.br.*), as it belongs to two arches; it ends, as in metamorphosed Frogs, in a pair of divergent "hypo-branchial" horns (*h.br.*), or thyro-hyals.

[1] The basal pieces constantly run in front of the bars to which they belong, and, knowing this, I have already suggested to Professor Huxley, that the "median ventral cartilage" of the Lamprey cannot belong to the mandibular arch, as it lies behind it, but is most probably a true "basi-hyal" (see Huxley, "On the Cranio-facial Apparatus of Petromyzon," Journ of Anat. and Phys., vol. x. p. 421).

Transversely Vertical Sections of the Head, from Snout to Occiput.

First Section.—The first of these sections (Pl. III. fig. 7) cuts through the horny spike of the nose (*r.sp.*), and the fore part of the septum nasi (*s.n.*) in front of the external nostrils; it shows the thickness of the cartilage below, which afterwards forms a distinct descending "prenasal rostrum."

Second Section.—The next section (Pl. III. fig. 8) is through the outer nostrils (*e.n.*), and shows the same vertical cartilage a little further back; the openings of the nose are right and left of it, and these are surrounded by reniform "alinasal" cartilages (*al.n.*), placed back to back.

Third Section.—This (Pl. IV. fig. 8) is behind the outer opening, and brings the septum nasi and aliseptal roof and wall laminæ (*s.n.,al.sp.*) full into view. The septum is thick and rounded below, narrow in the middle, then thick again where it passes into the roof cartilages; these pass down the sides into the floor, across the bottom of the passage (*n.p.*), which is a sinuous chink, turned outwards above and below, and widest in the middle

Fourth Section.—This (Pl. IV. fig. 9) is through the middle of the nose, and just catches the fore part of the eyelids; it is narrower and deeper than the last, and shows the upper part of the nasal passage as a recess; in this, as in the other sections, granular tracts are seen where the investing bones will be; the osteoblasts are beginning to form.

Fifth Section.—This section (Pl. IV. fig. 10) is through the back of the nose and front of the eye; the olfactory nerves (1) are seen descending through a chink which corresponds to that part in the mammal which is first pectinate and then becomes cribriform. This section is behind the nasal roof, and, therefore, the middle wall is the perpendicular ethmoid (*p.e.*); here the nasal passages (*n.p.*) are deep, and their convex face looks towards the septum; the cartilage of each side nearly meets the septum below; the fore part of the orbito-sphenoids (*o.s.*) are also severed, and they are convex on their inner face here.

Sixth Section.—In this section (Pl. IV. fig. 11) the fore end of the hemispheres (C 1*a*), and of the beginning of the olfactory tract (*rhinencephalon*, C 1*b*) are seen, and the olfactory nerves (1), still quite distinct from those vesicles, are seen running down into the nasal sacs, through the right and left chinks—here non-cribriform.

The deep nasal passage bends inwards at its lower third, and outside that bend the nasal wall sends inwards a small rudiment of the "inferior turbinal" (*n w.,i.tb.*)

Here the perpendicular plate is very thin in the middle, for this is the part which, in Lizards and Birds, becomes fenestrate.

In this section the convexity of the orbito-sphenoids (*o.s.*) is outside, and not inside, as in the last section.

Seventh Section.—Here (Pl. V. fig. 1) the narrow fore part of the *hemispheres* (C 1*a*) are severed, and the thick orbito-sphenoids (*o.s.*) on which they lie are very nearly straight in section. The nasal passage is not so high, and is bent inwards at the middle; the floor (*n.p.*) turns upwards, thickening there. The perpendicular ethmoid (*i.tr.*) is much lower, and is not continuous, yet, with the alæ (*o.s.*), and it is to be observed that this partition is still a single cartilage.

Eighth Section.—We have now reached the fore edge of the crystalline lens which is shown *in situ* in the eyeball (Pl. V. fig. 2, *e.*); and the naso-palatine canal (*i.n.*) is a small passage with its convexity inwards; granular tracts on each side show where the maxillaries and palatines (*mx.,pa.*) will be.

The *internal rectus* muscle is cut across, and part of the *inferior rectus* is shown lengthwise (*in.r.,if.r.*); and here the hemispheres (C 1*a*) are enlarging, and lie in the orbito-sphenoidal trough (*o.s.*). These plates, which in the former sections were free below, are now continued downwards on each side of the orbital septum, which is seen to be composed of a pair of flat plates, embracing a middle piece, which is round below, and sharp above. The thin plates are the trabeculæ (*tr.*) which end behind the front, when the last section was made; they send upwards the orbito-sphenoids as in the Batrachia, and indeed, in all other types, except when these are independently developed, as in the Ophidia. The middle plate, or "intertrabecula" (*i.tr.*), forms all the septum nasi and perpendicular ethmoid at this stage; here it is the "presphenoid," for it finishes the "anterior sphenoid" below.

Ninth Section.—This section (Pl. V. fig. 3) is from a little behind the last, and shows, on the whole, the same structures; but the hemispheres (C 1*a*) are much larger here, and the naso-palatine passages are now open to the roof of the mouth (*n.g.*); they have formed the *internal nostrils* (*i.n.*).

Tenth Section.—This section (Pl. V. fig. 4) is behind the inner nostrils, and behind the stem of the orbito-sphenoids (*o.s.*), the part which is continuous with their root, the trabeculæ; here, in front of the common optic foramen, the presphenoid is composed of a low intertrabecular wedge, and the two flat trabeculæ (*i.tr.,tr.*); they arise above the middle plate, and it descends below them, forming a rounded keel to the interorbital septum. Part, both of the superior and internal rectus muscles (*s.r.,in.r.*), are cut through, between the large eyeball (*e.*), and the widest part of the orbito-sphenoid (*o.s.*), which, of course, is widest where it holds the most bulbous part of the hemisphere (C 1*a*).

Eleventh Section.—Here (fig. 5) the "thalamencephalon" (C 1) is seen below the wide hemisphere (C 1*a*), and the trabeculæ (*tr.*), at this part, are thick above and below, and thinned out in the middle; the intertrabecula (*i.tr.*) is now oval in section.

Twelfth Section.—We now come to the optic nerves, and their chiasma (fig. 6, 2), and their entrance into the eyeball to form the retina (*rt.*). The thalamencephalon is surmounted by the hemispheres (C 1, C 1*a*), and between these above, part of the *pineal* *gland* (*pnl.*) is cut through. Here the trabeculæ (*tr.*) are rounded rods, like those of the Snake, and they occupy very little of the sides of the intertrabecula (*i.tr.*) which is pyriform in section, its thick end being below.

Thirteenth Section.—This section (Pl. V. fig. 7) is at the point where the presphenoid passes into the prepituitary part of the basisphenoid; here the trabeculæ (*tr.*) are much larger, and more perfectly round in section. At a great height above, the orbito-sphenoids (*o.s.*) are seen just where they pass into the lesser alisphenoids.

The hemispheres (C 1*a*) are now ending behind; and under them the thalamencephalon (C 1) is beginning to give off a bud which becomes the "infundibulum" (*inf.*), but the small body seen here below this part is part of one of the lobes of the pituitary body (*py.*).

Fourteenth Section.—(Pl. V. fig. 8) Here the mid-brain joins the fore-brain (C 2, C 1) directly above the fore part of the pituitary space. The infundibulum and pituitary body (*inf.,py.*) are quite distinct, and closed towards each other; this will be seen better in the next section. The sinuous cartilaginous wall is here the alisphenoid (*al.s.*), which is continuous below with the trabecula (*tr.*), and in front with the orbito-sphenoid. Here the "intertrabecula" (*i.tr.*) is broader and shallower than the trabeculæ, and lies on a somewhat lower plane, to finish the pituitary cup.

The granular tract on each side which dips outwards, over the palatal skin, is the beginning of the pterygoid bone (*pg.*); osteoblasts are now rapidly forming. On the outer edge of each pterygoid there is the section of a cartilaginous rod; it is flattish, and has its convex edge looking inwards and upwards; this is the "epipterygoid" (*e.pg.*), still continuous with the quadrate.

A granular tract on each side shows where the jugal process of the maxillary will be; and below, on each side of Meckel's cartilage (*mk.*), a similar tract shows the beginning of the dentary (*d.*). In the root of the tongue a pair of cartilages is cut through, which is the fore part of the larynx (*lx.*).

Fifteenth Section.—The back of the eyeball (*e.*) is cut through in this section (Pl. VI. fig. 1), and here the back part of the "thalamencephalon" (C 1) joins the broadest part of the mid-brain (C 2). The principal lobe of the pituitary body (*py.*) is seen to be closed above, open below, and alate; the part of the fore-brain above it is where the infundibulum (*inf.*) is beginning to bud off. The alisphenoidal walls of the chondrocranium (*al.s.*) are here very irregular, answering to the form of the organs both inside and out.

The terete trabeculæ (*tr.*) are severed behind the median rod, so that there is a membranous floor to the *sella turcica* at this part. The cartilaginous epipterygoid and the young bone-cells of the pterygoid are seen also in this section (*e.pg.,pg.*); and below the mouth (*m.*) we get a section of the mandibles, hypo-hyals, cerato-hyals, basihyal, and larynx (*mk.,h.hy.,c.hy.,b.hy.,lx.*).

Sixteenth Section.—The head is here (Pl. VI. fig. 2) cut through where the basis cranii runs upwards into the hollow of the mid-brain; the top of the ascending *wall* will be seen in the figure of the next section (fig. 3, *p.cl.*). Here we have the bent part of the base, close at the back of the pituitary space.

The pituitary body here shows a racemose structure, and three quasi-glandular lobules are cut through (figs. 2, 2*a*, *py.*). The thick sides of the investing cartilage end above in the thin, sinuous alisphenoids (*al.s.*) ; below, they form the front boundary of the foramina ovalia, but only the orbito-nasal branch of the fifth nerve (fig. 5^1) is seen in this section.

There is a recess, partly membranous (*posterior basi-cranial fontanelle, p.b.c.f.*), below and behind the pituitary raceme; here the notochord (*nc.*) is cut through at four places!

This is one of the most important and instructive parts of this demonstration, and will be more fully illustrated in other sections (the longitudinally vertical); but here we can see how suddenly the notochord turns upwards, following the folding of the mid-brain, and also that it turns down again at its apex, ready to follow the folding brain.

In the fourteenth and fifteenth sections the "epipterygoid" cartilage was seen severed from the apex of the *pedicle* of the quadrate. Here this "pier" is cut along its most external part through the pedicle (*pd.*), and body (*q.*), and part of the hinge with the mandible (*mk.*) is shown. On each side of the larynx the cerato-hyals and first branchials are seen (*lx.*,*c.hy.*,*h.br.*).

Seventeenth Section.—The sections are now becoming very oblique, although parallel with the others; the top of the huge *post-clinoid* wall (Pl. VI. fig. 3, *p.cl.*) is cut through, and lower down, the fore part of the *investing mass* (*iv.*). Here the alisphenoid (*al.s.*) is lower, is very sinuous, and runs into the post-clinoid wall below.

Below the broad mid-brain (C 2) the infundibular region of the fore-brain (*inf.*) is seen shining through the slice of the post-clinoid wall behind it. The basilar artery (fig. 3, *b.a.*) remains in this section, but the cartilage below it is largely cut away.

At the lower angles of the post-clinoid wall the foramen ovale is cut through, and also the "Gasserian ganglion" (5); the root of both the second and third branches is seen curving outwards towards the temporal muscle (*t.m.*).

The space between the post-clinoid wall and the investing mass has been made by the cutting away of the antero-inferior part of this ascending basis cranii; this removed part is figured in the last section (fig. 2). The notochord (*nc.*) lies on the narrow inner part of the investing mass (*iv.*); in front of this part it lay in an oval membranous tract, the *posterior basi-cranial fontanelle,* but the moieties of cartilage close in under the median rod; externally, they are very thick, and are grooved by the internal carotids (*i.c.*). The quadrate cartilage (*q.*) is here four-sided, the sides being concave, and the angles rounded off; the mandible (*mk.*) is cut through at its posterior part, and the cerato-hyals and first branchial (*c.hy.,h.br.*) are also seen in section, the two latter embracing the larynx (*lx*).

Eighteenth Section.—Here (Pl. VI. fig. 4) only part of the mid-brain (C 2) is figured, and the hind-brain (C 3) without its cerebellar outgrowths; the hind half, the Gasserian ganglion, and the root of second and third branches (5), are shown *in situ*, with the root of this huge segmental nerve on each side springing high up from the substance of the hind-brain (C 3). This is the fore part of the interauditory region, but from the obliquity of the section behind the flexure, the top of the post-clinoid wall, and the fast lessening alisphenoid (*p.cl.,al.s.*), are still seen.

The periotic region is cut through, and the anterior semicircular canal (*a.s.c.*) laid open, crosswise; here the ganglion geniculatum (8) is cut through in its fore part, and some of the fibres of the "portio mollis" are seen passing into the ear-capsule through the meatus internus.

The investing mass (*iv.*) is thick at this part, and the notochord (*nc.*) is partly imbedded in it above. The pedicle of the quadrate (*q*) is cut off in front and outside; this cartilage is being scooped. In this scooped space the first cleft (*cl.* 1) is seen, and near the investing mass its inner opening or Eustachian passage is also laid open.

Nineteenth Section.—This slice (Pl. VI. fig. 5) is close in front of the columella. The arch of the anterior semicircular canal, and the ampulla and part of the tube of the horizontal canal (*a.s.c.,h.s.c.*), are laid open on each side.

The space between the capsule and investing mass (*iv.*) is occupied by the beginning of the seventh and eighth nerves (not shown in this figure), and the facial nerve (7) is laid bare for some extent. It passes under the fore part of the capsule, and appears between the quadrate and the cerato-hyal (*q.,c.hy.*). Here the quadrate is greatly scooped on its outer face to form the tympanic cavity (*c.ty.*).

Twentieth Section.—This is the most important of the sections of the hind-skull (Pl. VI. figs. 6, 6*a*), for it lays the columella (*co.*) bare throughout its entire extent, and shows much of the distribution of the "portio mollis" nerve (8). The cavity of the hind-brain (C 3) is laid open, and the roots of the auditory and facial nerves are shown arising from its sides.

The auditory capsule is here at its widest part, where the "canals" open into the vestibule; and here the capsule shows three openings, namely, the meatus internus (8), the fenestra ovalis (*f.o.*), and the fenestra rotunda (*f.r.*).

The facial nerve (7) was on the last slice (fig. 5, 7), but the auditory branch (8) is well shown here; first its broad origin in the medulla oblongata by several roots, next the ganglion geniculatum (*g.gc.*), and then, associated with this by a short string of fibres, the ganglion cochleare (*g.cl.*), which lies in a pouch-like hollow on the inner face of the capsule. Below this second ganglion the small budding cochlea (*cl.*) is seen opening inferolaterally, by the fenestra rotunda. Here the investing mass (*iv.*) and the capsule (*au.*) are united, but their line of junction can be clearly seen.

Opposite the meatus internus, where the portio mollis (8) is entering, there is a rather large opening; it is below the middle of the overhanging side of the ear-capsule. This is the fenestra ovalis (*f.o.*), and it is closed by the dilated end of the columella (*co.*). At this part the quadrate (*q.*) is bent on itself at a right angle to form the roof of the tympanic cavity. Between its base and the columella (*co.*) the first cleft (*cl.* 1) is seen curved upwards, and dilated externally. The columella follows exactly this crescentic curve, and is, altogether, a quadrant. The tissue in the fenestra ovalis, surrounding the head of the columella (upper part of hyoid arch), is not yet chondrified; it becomes afterwards the stapedial end or "operculum" of the columella, which is at present only hyoidean.

In the branchial arches of the Selachians, and indeed of Fishes generally, the proximal piece, like the distal piece, is composed of two pieces,—a "pharyngo-branchial" above, and an "epi-branchial" below. The hyoid arch of *Chimæra*, *Acipenser*, and of many of the Batrachia, is subdivided in the same way, for indeed the hyoid is a branchial arch.

In Osseous Fishes, and in several kinds of Batrachia, the cartilage is not segmented, but the upper hyoid element has two bony centres—a proximal and a distal.

Here the most archaic and generalised condition obtains, for the "mediostapedial" part of the columella (*m.st.*) is separated by a joint from the stem of the orbicular "extra-stapedial" (*e.st.*). We shall see that the distal part of the arch is composed also of two pieces, so that at this great height above the low Cartilaginous Fishes, even the new specialisations have not touched the old morphological subdivisions.

The conformity of the Chelonian in its development to old patterns will show itself again and again as we proceed with this demonstration.

Twenty-first Section.—The basioccipital region (Pl. VII. fig. 1) is here cut off close to the condyle (*oc.c.*), and the enclosed notochord (*nc.*) is large. Between the basal cartilage and the auditory capsule there is a large space through which the ninth and tenth nerves pass out; the vagus (10) has been cut through beyond the ganglion, but the glosso-pharyngeal (9) is well shown with its long root growing out of the sides of the medulla oblongata (C 3), its large ganglion, and its stem.

The upper cervical muscles are shown, for the razor passed in a plane parallel with the axis of the neck; the auditory capsules are cut through where the ampulla of the posterior canal is imbedded (*p.s.c.*), and where the horizontal canal (*h.s.c.*) is ending in the vestibule. The scooped quadrate (*q.*) is cut through close to its end.

Twenty-second Section.—In this section (Pl. VII. fig. 2) the arch of the posterior canal (*p.s.c.*) is severed, and the sides of the occipital arch (*e.o.*) are seen at the front of a series of lateral cartilages—the neural arches of the neck. These end below in broad bases that enclose the mesoblastic (cartilaginous) sheath of the notochord (*n.a.*,*nc.*). Here the medulla oblongata (C 3) is seen passing into the medulla spinalis (*my.*)

Vertical Sections of the Head taken from Left to Right Side, Longitudinally.

Some of the most valuable preparations of the head at this stage were made in this way, the object being sliced centripetally.

First Section.—The skin being removed, the temporal muscle, the outer part of the quadrate, and the end of the columella (Pl. VI. fig. 7, *t.m.,q.,co.*), were exposed, and the front part of the eye (*e.*) removed.

Second Section.—Here (Pl. VI. fig. 8), farther in, the thinning out of the quadrate (*q.*) to form the tympanic cavity (*cl.* 1) is shown, and that cavity is partly opened through the membrana tympana (*m.ty.*); in this opening the columella (*co.*) is seen.

Third Section.—In this slice (Pl. VI. fig. 9) the auditory capsule is laid open so as to expose the three canals (*a.s.c.,h.s.c.,p.s.c.*), and the ampulla of the foremost. The tympanic cavity (*c.ty.*) is more fully laid open, the stem of the columella (*co.*) is cut through, and the hinge of the lower jaw is severed (*q.,ar.*).

Fourth Section.—The auditory capsule is here quite opened (Pl. VII. fig. 3, *au.*). The angular tympanic cavity (*cl.* 1) lies between the hinge of the lower jaw (*q.,ar.*) and the two chief elements of the hyoid arch, the columella (*co.*), and the cerato-hyal (*c.hy.*).

Fifth Section.—This section (Pl. VII. fig. 4) shows many of the cephalic structures; the body of the eyeball and the thickest part of the ear-capsule are cut through; behind the former are seen, first the " external rectus " muscle (*e.rm.*), and then the Gasserian ganglion sending forward the orbito-nasal (5^1), and having the common stem of the other branches ($5^{2,3}$) cut through.

Below these parts a V-shaped cartilage is seen, this is the pedicle of the quadrate (*pd.*) severed from its body; from the apex a short rod grows downwards and forwards, at less than a right angle; this is the "epipterygoid" (*e.pg.*), not distinct in its formation from the quadrate, as in the Lizard.

At some distance below this part the mandible (*mk.*) is largely exposed, the fore half and the articular region are cut away. The bilobate section of the ear-capsule (*au.*) has in its upper emargination a tube entering like a Dentalium-shell; this is the aqueductus vestibuli (*aq.v.*), or remains of the primary involution. In the lower emargination, the mediostapedial (*co.*), or stem of the columella, is cut across as it is passing outwards and a little backwards. The recess in which it fits is the fenestra ovalis. A little of the occipital arch (*e.o.*) is seen behind the ear-capsule, and between that arch and the columella two large nerves are seen emerging, each with its ganglion; these are the ninth and tenth (9, 10), as was seen in the twenty-first transverse section (Pl. VII. fig. 1; 9), the glosso-pharyngeal has a very long root.

Sixth Section.—Here (Pl. VII. fig. 5) the sense-capsules (*e.,au.*) are nearly cut away, so that the optic nerve (2) is seen entering the eyeball; the motor oculi (3) is seen arising from the fold of the mid-brain (C 2), and a small remnant of the auditory capsule (*au.*) is seen just where the columella (*co.*) fits in.

Much of the "epipterygoid" (*e.pg.*) and all the pedicle (*pd.*) are seen in this slice; over the lower part of the quadrate (*q.*) the tympanic cleft (*cl.* 1) is seen, and below, the angular part of the lower jaw (*ag.*) is cut through; in front of this is the angle of the mouth (*m.*). In this sub-mesial section the roots of glosso-pharyngeal, vagus, and hypoglossal nerves (9, 10, 12) are well seen, arising from the sides of the thick lower part of the medulla oblongata (C 3).

In the ninth the fibres pass out near to each other, but in the tenth there are clearly to be seen five main bundles, and in the twelfth, three. The ninth passes behind the cerato-hyal (*c.hy.*), and the twelfth is bounded behind by part of the occipital arch (*e.o.*).

Seventh Section.—This section (Pl. VII. fig. 6) is equivalent to the last, but is seen reversed, the parts seen are the same, on the whole, but some things are better displayed, and some new things come into view. The motor oculi nerve (3) is seen to have a bulbous or ganglionic origin from the sharp fold of the mid-brain (C 2); it goes downwards and forwards, and passing over the post-clinoid wall (*p.cl.*) forks, and, according to Milnes Marshall, forms at that point a ganglion. Its main branch is seen in this section to cross the orbito-nasal branch of the fifth (5^1) on its inner side, above and behind the entrance of the optic nerve (2), and it is still seen in front of the external rectus muscle.

Much of the Gasserian ganglion (5) has been cut away with the stem of the second and third branches. Behind that ganglion another, not much less than it, is seen; this is the ganglion geniculatum (*g.gc.*) of the seventh and eighth nerves.

The descending stem or facial nerve has been cut away, but the roots of this segmental nerve are seen to be copious, and to arise from the sides of the base (at this late stage) of the medulla oblongata (C 3), at just under the fold where the mid-brain (C 2) begins. The large oblong ganglion is seen to send down a stolon of fibres which run into another, the ganglion cochleare (*g.cl.*), see also Pl. VI. figs. 6, 6*a*.

The ninth, tenth, and twelfth nerves (9, 10, 12) are seen as in the last figure, but with a tract of the auditory capsule (*au.*) between them and the observer.

Eighth Section.—This section, so much of it as is figured (figs. 7, 7*a*), corresponds with the solid vertical section already described (Pl. III. fig. 4); it is a little to the left of the middle, so as to show the orbito-nasal septum perfect. The fore-brain (C 1) is giving off a small diverticulum in front (there is one on each side), the rhinencephalon (C 1*b*), but this "olfactory tract" is quite distinct from the solid olfactory nerve (1) which arises from the fore and upper part of the brain. The optic nerve (2) has been cut through close to the brain; and the third (3) is seen running down to the post-clinoid wall (*p.cl.*). An azygous bud is growing out of the fore-brain at its posterior region; this is the infundibulum (*inf.*), and is seen to be quite separate from the lobes of the racemose pituitary body (*py.*), the upper part of which becomes the permanent engrafted pouch.

The notochord (*nc.*) is seen running up for some distance into the thin, median part of the post-clinoid (*p.cl.*); there it is somewhat bent forward, and it is covered at its fore end with a sheath of thickening cartilage. This section being near the middle, shows the distance between the investing mass and the "intertrabecular" bar. There is here a membranous space below the pituitary body, not yet floored with cartilage.

Only the lower part of the hind-brain (C 3) is figured, and this is shown running, after it has formed its downward flexure, into the myelon (*my.*). The notochord is seen to become larger as it enters the vertebral column.

Horizontal Sections of the Head.

In this series the head was sliced from above downwards; by this means the fore part was displayed in deeper and deeper regions in a regular manner, but, on account of the mesocephalic flexure, the hind part of the head was cut across from side to side almost at a right angle to its axis.

First Section.—Part of the brain is shown in this section (Pl. VIII. fig. 1). The fore-brain is cut through where the "rhinencephala" (C 1*b*) are budding out, and the mid-brain (C 2) where it is passing into the hind-brain, behind the folded part.

The recesses in which the olfactory lobes lie are the same as those which became cribriform, first in cartilage and then in bone, in the Mammalian skull. The chondrocranium is cut through along its sphenoidal alæ, the orbito-sphenoid passing directly into the alisphenoids (*o.s.*,*al.s.*). Between these walls and the eyeball (*e.*) the upper orbital muscles and nerves are seen.

Second Section.—A little deeper down (Pl. VIII. fig. 2) the olfactory nerves are seen giving off branches to the nasal mucous membrane; the orbito-sphenoidal cartilages (*o.s.*) are converging below, and the alisphenoidal part (*al.s.*) is here thin and wavy These run into the top of the post-clinoid walls (*p.cl.*) at its sides; this is cut through at its top, and does not show the middle part.

Third Section.—Here (Pl. VIII. fig. 3) the nasal cavity is cut across, and the olfactory nerves are seen to be highly subdivided as they enter the cavity on each side.

The septum nasi, and alæ (*s.n.*,*al.sp.*) are cut through, and the orbito-sphenoids (*o.s.*) are seen to their base, where they arise from the lateral elements of the orbital septum (trabeculæ). The alisphenoids (*al.s.*) are in two parts at this level; they bound the recess into which the infundibulum grows to meet the pituitary body, and in the fore part of which the optic nerves (2) pass out to the orbit, and their upper lobe is seen to articulate with the post-clinoid wall (*p.cl.*) at its outer edges, as the front part of these alæ do with the front of the wall on each side of the pituitary recess. The internal carotid arteries (*i.c.*) are seen ascending on each side in this recess, and behind the wall the basilar artery (*b.a.*) is seen, with its side branches. The post-clinoid wall (*p.cl.*) is elegantly sinuous in adaptation to the pituitary body in front, and the ascending part of the hind-brain behind.

Fourth Section.—In this slice (Pl. VIII. fig. 4) both the nostrils and the general nasal cavity are seen on each side of the thin septum (*s.n.*), which is composed of the "intertrabecula" only.

The orbito-sphenoids (*o.s.*) are cut away so as to expose the middle (intertrabecular) plate (*i.tr.*), and the part of the lowered orbital septum is seen over which the optic nerves (2) pass. Only the stem or narrow part of the alisphenoid (*al.s.*) is seen at this level; the top of the common optic passage (2), and of the foramina ovalia (5) are seen; and part of the Gasserian ganglion and of the ophthalmic (orbito-nasal) nerve, right and left.

Fifth Section.—Here (Pl. VIII. fig. 5) the eyeballs are shown as fairly cut through the middle, for the optic nerves are seen entering the cavity and becoming the retina (*e.*, 2, *rt.*). The nostrils (*e.n.*) are laid open, and at this part the nasal wall (*al.sp.*) is shown separate in the substance of the fore face. This section is very important, for it shows the single nature of the septum nasi (*s.n.*), and that the orbital region of the cranio-facial wall is triple (*tr.*,*i.tr.*). This wall is narrowed below the common optic passage, and is dilated largely behind. The concave hinder margin bounding the pituitary space, with its sections of the lobulate pituitary body (*py.*), is concave, and therefore the intertrabecula is shorter behind than the trabeculæ (*i.tr.*,*tr.*).

At this level the foramina ovalia are at their widest, and in them lie the large Gasserian ganglia (5), whose roots are seen to be coming from their origin in the medulla oblongata; their main mass of outgoing fibres form the stem of the second and third branches.

The boundaries of these foramina are the post-clinoid wall in front, and the ear-capsule (*au.*) behind; the former is straighter down here than above, the latter is so cut as to show the arch of the anterior canal (*a.s.c.*).

Sixth Section.—Only the hind half of this section is figured (Pl. VIII. figs. 6, 6*a*); it spans a stratum very little lower than the last, for the Gasserian ganglion (5) is still seen. This is the most instructive of all these horizontal sections, because of the light which it sheds on the formation of the chondrocranium. Here the narrow hind part of the intertrabecula is wedged in between the broad hind part of the trabeculæ (*i.tr.*,*tr.*) which are seen to articulate with the post-clinoid wall (*p.cl.*) by sinuous condyles.

The internal carotids and basilar artery (*i.c.*,*b.a.*), besides other branches, are cut through, but that which is of most importance is that here the notochord (*nc.*) is so bent upon itself as to appear twice in this section, both times imbedded in the post-clinoid wall (*p.cl.*). In the hinder section of the notochord we see that all the three cartilaginous elements are fused into one ascending plate; these, although non-segmented, answer to the neural arches and mesoblastic sheath of the notochord in the spine. It is evident that the axis of the cranium did bend over between this plane and the plane of the last section (fig. 5); now we shall see whether or no the cranium at its base follows the infolding of the mid-brain, and how far the fore end of the notochord comes short of the organic end of the fore-brain. That vesicle is turned downwards, so that its organic end is below, and even a little backwards in its direction, so that the optic vesicles are very near to the original or organic end. But in the fourth stage the fold of the head was very large (Pl. II. fig. 4), and the notochord (*nc.*) ran up high into the space behind the post-clinoid wall (*p.cl.*); afterwards, in this stage, it is relatively scarcely half as high as the cartilaginous wall (or upturned basis cranii), yet it has become much more deflected at its tip (Pl. III. figs. 4, 5, *p.cl.*,*nc.*). This and the next section throw a beautiful light upon the condition of the notochord near and at its fore end, and of the prolongation of its secondary or mesoblastic sheath.[1]

All the characteristic structures of the notochord are seen in the hinder section (Pl. VIII. figs. 6, 6*a*, *nc.*), but in the fore- or down-turned part there is nothing but hyaline cartilage, with crescentic corpuscles arranged concentrically, mesoblastic, like the rest of the sheath, behind; thus the notochordal sheath is prolonged beyond the chord itself, which loses itself in front in this secondary coat.

The head is so much bent that even here the section is made through the upper part of the auditory capsule and the enclosed anterior canal (*au.*,*a.s.c.*).

Seventh Section.—This section (Pl. IX. fig. 1, 1*a*) throws still further light upon the behaviour of the basal elements of the chondrocranium, as they come near to the organic end of the head.

This section is partly near and partly below the base of the orbito-nasal septum; in front, the prenasal rostrum (*p.n.*) or fore-growth of the "intertrabecula" is cut through, where it turns downwards; the median bar is then narrower, then thickens, and becomes narrower, twice over, before it reaches the pituitary space.

At this low level the trabeculæ are only in sight at two places, viz., behind, where they become condyloid to articulate with the base of the "wall," and in front, where they form two short rounded "cornua" (*tr.*,*c.tr.*) a little way within the nasal region; in front of these "horns" the median bar alone exists. Part of the nasal wall (*n.w.*) is cut through in this section, and the cavities are shown on a plane lower than that of the external nostrils.

Part of the Gasserian ganglion and the stem of the second and third branches

[1] For Mr Balfour's description of the notochord, see his "Elasmobranchs," pp. 74, 138, &c., pl. vi. figs. G, H, I, where the downward curve of its apex is shown. In *Chelone*, as in the *Selachians*, it is thus true that "anteriorly the termination of the notochord cannot be seen, it can only be traced into a mass of mesoblast at the base of the brain, which separates the epiblast from the hypoblast" (p. 75). What change the prochordal part of the mesoblastic sheath undergoes in *Chelone* will be understood by the descriptions now to be given.

(5) still come into view, and the "geniculate ganglion" (7) is also seen just inside the skull.

The Eustachian passages (*cl.* 1) are seen on each side of the pituitary region, but far apart; the ampullæ of the anterior and horizontal semicircular canals (*a.s.c.,h.s.c.*) are laid open in the auditory capsule (*au.*), and the occipital arch (*s.o.*) comes now into view at its fore-edge. The "meatus internus" (*m.i.*) behind the geniculate ganglion (7), and the "aqueductus vestibuli" (*aq.v.*) are also shown; as also the three chief arteries (*i.c.,b.a.*).

But more important than all this is the structure revealed here in the back of the pituitary region, for here the razor has cut through a distinct lobe or nodule of cartilage, the downward continuation of the solid sheath of the notochord (Pl. IX. fig. 1, 1*a*, and Pl. VIII. fig. 6, 6*a*, *nc.*). We can tell exactly how far this descends, for in the next thin slice (Pl. IX. fig. 2) we are below it; and in the former (Pl. VIII. fig. 6), this part was fused with the front of the post-pituitary wall (*p.cl.*).

Moreover, we can see that this tract of cartilage is at a greater distance from the notochord at this place, for here the latter lies in a groove of the basal plate, and is not now embedded completely in it (see also Pl. VIII. fig. 6, *nc.*).

The whole "intertrabecular" bar (*i.tr.*) is manifestly as much a direct continuation of the mesoblastic sheath of the notochord as the prochordal part of the trabeculæ are outgrowths of the parachordal tracts, and both these single and paired elements are necessitated by the down-growth of the fore-brain.[1]

Eighth Section.—The hind part only of this section has been figured (Pl. IX. fig. 2, 2*a*); here, on each side of the pituitary space, we see a tract of new bone, the pterygoid (*pg.*) and a rod of cartilage subparallel with and outside it, the epipterygoid (*e.pg.*); this has been severed from the pedicle of the quadrate. The Eustachian openings of the first cleft (*cl.* 1) are exposed behind that cartilage, and this is bounded on its inner side by the investing mass (*iv.*), which is confluent with the auditory capsule (*au.*), the cavity of which is laid bare below the anterior, and partly below the horizontal canal, and through the posterior (*p.s.c.*). The cochlear ganglion (*g.cl.*) lies in the "meatus internus," and fibres are seen passing from it into the sac. Here, and in the next section (fig. 3, 3*a*), the lateral cartilages are retiring from the notochord to form the well-known "posterior basi-cranial fontanelle." On each side of the basilar artery (*b.a.*) a nerve is seen

[1] We are evidently treading close upon the causes of the cranial modifications as compared with what is seen in the spine. Most of the segmental muscles are suppressed, the segmental nerves are greatly modified, the hæmal region is marked by dehiscence of the walls (to form clefts) down the middle of each proper segmental region, these regions being marked out also by the forks of the cranial nerves embracing them. Then, also, the attempts at secondary segmentation by the formation of distinct neural cartilages and notochordal constrictions are very slight, although the three homologous tracts of mesoblast are there, and are continued up to the actual front of the head. Lastly, the arrest of the notochord, which stops short even of the organic end of the down-folded head, is a most important factor in this great modification of the cranium as compared with the spine.

passing forwards, and escaping under the narrow bridge of cartilage; these two nerves are the sixth or "abducentes," and are on their way to the "external rectus" muscle of the eyeball; they come from the base of the medulla oblongata between the roots of the fifth and seventh, and are probably the "anterior roots" of one or both of these nerves (Milnes Marshall).

Ninth Section.—Here (Pl. IX. fig. 3, 3*a*) the nasal passages are seen passing into the posterior or internal nares (*i.n.*), between which the palatal covering of the septum nasi is seen. Between the lowest part of the nasal cavities a passage is seen—the "middle nasal passage" (*m.n.p.*); it is half-way between the prenasal cartilage (*p.n.*) and the openings of the nasal passages behind. This is also seen in the palatal view of the skull (Pl. IV. fig. 7).

Behind the nasal outlets the palate is open; this is the pituitary space (*py.*), and at a shorter distance behind this space the notochord is seen invested with its own and its mesoblastic sheath. Right and left, we see the beginning of the pterygoid bone (*pg.*), and outside it is the epipterygoid cartilage (*e.pg.*) now seen to be continuous with the pedicle of the quadrate (*pd.,q.*), which is cut through along its greatest length above the tympanic excavation; between the pedicle and the auditory capsule we see the Eustachian passages (*cl.* 1).

In this section, as in the last, we see the cartilaginous sheath of the notochord (*nc.*, *s.nc.*) quite distinct from the paired cartilages that correspond to the neural arches of the spine; it is, however, thin, and the cells of it are flat.

Tenth Section.—The lining skin of the floor of the mouth appears in this slice (Pl. IX. fig. 4), and the upper lip, lower jaw, tongue, and larynx (*mx.p.,mn.,tg.,lx.*) are here indicated in relation. The bulging middle third of the investing mass is here seen, with the corresponding part of the notochord (*iv.,nc.*); and behind, the medulla oblongata is passing into the myelon (*my.*) through the foramen magnum. The part of the investing mass here shown has coalesced with the auditory capsule close inside the rudiment of the cochlea (*cl.*); opposite this sac the end of the columella (*co.*) is seen cut across, and the lower part of the posterior canal (*p.s.c.*) is laid bare. The thick sides of the occipital arch (*e.o.*) are shown coalescing with the auditory capsule (*au.*), and outside the latter the quadrate (*q.*) is displayed in its most hollow part.

Eleventh Section.—A little below the last, parts are seen in the next figure (fig. 5) that help greatly to a true understanding of the skull at this stage. Much of the mouth (*m.*) is shown, with its bordering tissues (*mx.p.*), but the mandible now is seen completely running up to the thick lower part of the quadrate (*q.*).

Behind the quadrate all but the proximal end of the columella (*co.*) is seen; its top was shown in the last section (fig. 4, *co.*); the lower part of the first cleft (*cl.* 1) is seen between the quadrate and the columella; and in the space behind it, and between the floor of the ear-capsule and the occipital arch, the ninth, tenth, and twelfth nerves are shown emerging, and the tenth is cut through at its ganglion. Here we have a nearly perfect section of the occipital arch, the upper part being a little imperfect, and the notochord is seen to be bridged over by cartilage in the occipital condyle (*nc.,oc.c.*).[1]

Sixth Stage. Embryos two-thirds ripe; total length, 3 *inches; length of head,* 7 *lines.*—(*a.*) "Chondrocranium."—The primordial or cartilaginous skull is now quite perfect, and some bony tracts have appeared in it. It is now perfectly Chelonian in every respect, and a certain cartilaginous tract,—viz., the alisphenoidal,—which remains in one form or another in other types, has here been absorbed, and this is correlated with the modification of certain investing bones and visceral bars, such as is seen in no other type.

This type is, indeed, very instructive, for whilst showing its Chelonian nature very early in the embryo, it retains a number of characters throughout the whole embryonic period that are very generalised for a reptile, being such as we see in their perfection in the anamniotic "Anura."

Thus, whilst these shielded types are the most curiously modified of all the cold-blooded Sauropsida, they are built up, so to speak, upon the foundation of the underlying low Batrachian forms, the stigma and stamp of which they, in spite of their higher nature, never lose, yet they are all conformed to a pattern, as new as it is perfect. Another thing to be noted is this, namely, that the Batrachian characters are developed late, after the skull has undergone all its principal metamorphoses; or rather, in metamorphosing, these characters appear, last for a considerable time if they are not permanent, and in some things are life-long.

In like manner the Batrachians themselves, whose descent has to be counted from two lines, namely, from the Lamprey-tribe and the tribe of the Sharks and Skates (Marsipobranchii and Elasmobranchii), in these the suctorial fish is pre-potent and dominates the larval stage; but when the later metamorphosis begins, then the higher Selachian characters appear. These, however, are not retained in their simple uncombined form, nor are they kept to their old functions, but they form unwonted combinations for special purposes in these higher organisms. The "old things" of the Lamprey tribe are partly done away, and partly put to new purposes, in new shapes; partly absorbed, and partly transformed.

And so it is in the Chelonia and in all ascending and improving types; the materials are the same as in low kinds, but "the old order changeth, yielding place to new." Of this we may be certain, that if the structure and development of the extinct types could be known—a thing impossible and only imaginable—every modification of

[1] The reader is asked to compare the three sets of sections together, and these also with the solid sections and dissections. Many things studied by me in the sections were not drawn, and others that are drawn are neither lettered nor described, for I have been careful not to overload the subject; but the chondrocranium, with the most important parts of the nervous centres and nerves, have been selected for portrayal and description. Several such memoirs as the present would be needed for an exhaustive account of the development of all the organs, even of the cephalic region only, to say nothing of the rest of the organism.

the Vertebrate type would be seen to take place in a manner as gentle as, and not essentially different from, the way in which the foliar organs of a single plant vary on the same stem, as they run through the series, from the cotyledons to the carpels.

Here, in this embryo, the occipital arch (Pl. X. figs. 1–5) images the vertebra behind it, but represents, in an undivided form, several vertebræ. The essentials of its composition are the same, but the development is different, for it has been brought under the power of that higher working of the morphological force by which the brain has been developed from the spinal cord, and the special sense-organs from the common sensory tracts.

The sides of the foramen magnum are now bony (Pl. X. fig. 5, *f.m.,e.o.*), for the sides of the exoccipital ossifications nearly reach each other above, and come down almost to the condyle (*oc.c.*); laterally they run far into the paroccipital wings of the skull. The condyle (*oc.c.*) is transversely oval, and contains in its lower part the large notochord. The basioccipital region is mammillate on each side, and in front of the condyle is beginning to be ossified (figs. 3, 11, 12, *b.o.*). This ossification first affects the cartilaginous sheath of the notochord, and then spreads into the paired basi-neural cartilages. At present it is a small lozenge, seen most on the lower side.

The unossified superoccipital region (*s.o.*) sends backwards a thick spine like the spine of a vertebra; it is a large roof, convex without and concave within, and runs below into the auditory capsule (*au.*). This capsule is a swollen or tuberiform mass, quite unossified at present, and confluent with the occipital arch above and below. In the tympanic region (figs. 3 and 5) it grows outwards to form, with the exoccipital, the "paroccipital process"; between it and the occipital arch the ninth and tenth nerves escape, whilst the twelfth (12) perforates the exoccipital wall. Near the middle of the lower third, inside, we see the meatus internus with paired passages (7, 8) for the portio dura and portio mollis. Its anterior margin is notched for the large trigeminal nerve (5); its upper part is a wide tuber, and contains the canals and much of the vestibule; the lower part has in it the rudimentary cochlea. Above the foramen ovale (fig. 1, 5) the capsule is crested; this sharp edge is all that remains of the alisphenoid (*al.s.*); it runs into the superoccipital (*s.o.*) above, but is separated by a wide, flabelliform space from the orbito-sphenoid (*o.s.*) in front. All that part has been absorbed since the last stage, thus the extinction of the alisphenoid is much more perfect than is seen in the Lizard, where it becomes very small. The basisphenoidal region (*b.o.*) is very extensive, having a middle pituitary, a posterior post-pituitary, and an anterior prepituitary region (fig. 1); in this part the three bars are seen to unite. The notochord, which was on a low plane behind, now appears on the inner face of the skull-floor (fig. 12, *nc.*), and here its sheath is enclosed in a cephalostyle, most of which lies free, above the paired cartilages (*iv.*).

The bone ceases behind, where the chord dips into the floor, but in front the bony matter is spreading freely into the post-clinoid wall (*p.cl.*), and besides spreading into the ends of the once free trabeculæ (*tr.*), has begun to ensheath the intertrabecula (*i.tr.*), which is, manifestly, the prochordal homologue of the perichordal sheath, now hardened into the "cephalostyle." The prepituitary part of the basisphenoidal region is marked off from the presphenoidal region by a shallow notch directly in front of the pituitary body (*py.*).

At present, however, the hinder part of the existing wings of cartilage in the orbital region (figs. 1, 2, *o.s.*) are due somewhat to incomplete absorption of the alisphenoids; they are not quite reduced to their minimum development until after hatching; they always exist as a sharp edge to the auditory capsule in front.

From the pituitary space to the frontal wall there is one large plate of unossified cartilage (fig. 1, *p.s.,s.n.*), formed originally from the upgrowing of the trabeculæ and intertrabecula. This plate is thick below and subcarinate, the middle-piece dipping below the side-pieces; an oblique thickening divides the interorbital from the inter-nasal region, and in front the septum nasi—formed in all but its hinder part of the middle cartilage—sends downwards a short "prenasal" spike (*p.n.*). The orbito-sphenoidal wings (*o.s.*) are very large, having as yet an alisphenoidal selvedge behind; they form a trough in which the "hemispheres" lie. In front of these "wings" the olfactory nerves (1) burrow downwards into the nasal sacs, and these latter are covered over with the aliseptal growths of cartilage (fig. 4, *al.sp.*); in fig. 1 this roof is cut away in the part brought into view.

The quadrate (*q.*) is still quite unossified, and the epipterygoid (fig. 7, *e.pg.*) has not been segmented from it, but lies as a sigmoid process of the pedicle (*pd.*) in a groove of the pterygoid bone (*pg.*). The rest of the cartilage (*q.*) from where the base of the pedicle ends, is arched, hollowed, and notched, a thick ridge margining the arched part and running down the middle of the articular part on its outside. The condyle of the articular part (fig. 3, *q.c.*) is bilobate and transversely placed, the thick ridge on its outside passing into the semicircular ridge for the attachment of the "cartilaginous annulus" (fig. 10); between its hind extremity and the articular part there is a large, rounded, inferior notch, which admits the columella into this curious tympanic cavity, formed by the scooping of the huge "otic process" (*ot.p.*) of this cartilage—the mandibular pier. The next "pier" is specialised for auditory purposes, as the columella, and foregoes its hyoidean (or lingual) functions (figs. 2, 3, 5, 8, 9, *co.*).

The dorsal end pushes into the fenestra ovalis (*f.o.*), the membranous operculum of which acquires a cartilaginous character, but its cells are thin, lunate, and concentrically arranged, as in the sheath of the cranial notochord; those of the rod itself are the normal ovoidal corpuscles (fig. 9). Here I find a greater separateness of the stapedial plate from the "mediostapedial" rod (fig. 9, *m.st.,st.*) than in any other "Sauropsidan." The rod itself is ossified largely; the bony matter will reach farther outwards, and the proximal plate also will become ossified. Its Batrachian condition is best seen now.

Further outwards one Batrachian character is effaced, for the "extrastapedial" (*e.st.*) has lost its segmentation from the mediostapedial rod; yet it has become perfectly like that of several of the Batrachia in form, for the distal plate is quite circular, and there is a short suprastapedial process (*s.st.*) arising from it. (See Batrachia, part 2, Phil. Trans., 1876, pls. liv., lix., and lxii.)

I must refer, also, to the same paper to show how Batrachian the rest of the outer ear is, for here we have the old cartilaginous annulus tympanicus (figs. 2, 10, *a.ty.*); this cartilage, like the sheath of the notochord and the stapedial plate, is composed of flat cells, but is truly cartilaginous. It is a nearly perfect oval, the gap being postero-inferior in position, and occupied by the distal part of the columella; postero-superiorly, it has a large, crescentric, concave "flange," imitating the concave part of the "otic process" of the quadrate (fig. 7). Fitting fairly into that part, the annulus serves for the attachment of the "membrana tympani" (*m.ty.*) many of the fibres of which are inserted into the convex outer face of the "extrastapedial." The suprastapedial process, which is directed obliquely backwards, is embedded in a thick ligamentous mass, to which the fibres of the short, thick, "stapedius muscle" are attached.

These structures of the "middle ear" come much closer to those of the Batrachian, and resemble those of the Bird much less, than the corresponding parts do in *Lacerta agilis* and the higher "Lacertilia" generally.

The inferior free arches (figs. 1, 2, and 6) are also very Batrachian; but the mandibles (*mk.*) are fused together in front; they form a cylindroidal condyle in the articular region. The cerato-hyals (*c.hy.*) are long, sigmoid, terete rods, much ossified distally; they are quite distinct below from the "hypo-hyals" (*h.hy.*), which are short unossified rods set on in front of them on the widest part of the basal plate.

The basal plate, "basi-hyo-branchial" (*b.hy.,b.br.*), has a lingual process, it then is wide, narrower, and is widened again, terminally, where it gives off two short "horns" or diverging processes, these, moreover, have articulated to them a pair of thick, shortish, inbent, "hypo-branchials" or thyro-hyals (*h.br.*).

(*b.*) The "Investing bones" are of great interest; they are all present now, but in the last stage they were mere granular tracts. Above (fig. 4), there is still a large "fontanelle" (*fo.*), for the frontals (*f.*) diverge behind, and the parietals (*p.*) are mere lunules of thin bone, as seen from the surface. Within (fig. 1), the frontals have a considerable orbital plate, and the parietals have developed their peculiarly Chelonian wall to the alisphenoidal region; this descending part rests upon the epipterygoid process and pterygoid bone (figs. 1, 2, 7, *p.,e.pg.,pg.*); thus the cartilage is aborted. In front (figs. 1, 2, 4), the nasals and prefrontals are in one piece (*p.f.n.*). This prefronto-nasal is foreshadowed in the huge nasal of the Batrachia, where there is no distinct prefrontal; in them the bone lacks the ingrowing antorbital plate. Here there is a considerable antorbital plate, flanking that of the frontal (fig. 2), and the lachrymal space lies between it, the maxillary, and the palatine; there is no lachrymal bone. The existence of a distinct nasal bone is mentioned by Owen (Report of Brit. Assoc., 1846, p. 224) in the existing *Hydromedusa*, and in the fossil forms—*Chelone planiceps* and *Chelone pulchriceps*).

The premaxillaries (figs. 1–3, *px.*) are remarkable for their direction, which is rather inferior than anterior; they have a sharp dentary margin and short palatine processes. The maxillaries (*mx*) are very large and Mammalian, so to speak, with a high facial, a considerable palatine, and an extended jugal region; their dentary edge is sharp or cultrate, and is denticulated in relation to the large papillæ on which the bony sheath is developed. The single vomer (*v.*) is like what is seen higher up, viz., in the Falcons, having a lower palatine plate, helping to form the hard palate, an ascending ploughshare part, and a thin scooped upper edge for adaptation to the "orbito-nasal septum." The broad flat palate is largely formed by the palatines and pterygoids—membrane bones—but so intimately connected with the endo-skeletal structures as to be worthy to be classed with them. Here, again, the Mammalian skull is being prefigured, for the palatines (fig. 3, *pa.*) have a considerable region on the lower plane that makes the hard palate; this is carried to excess in the *Crocodilia*, where the pterygoids—as in *Myrmecophaga*—also contribute to this lower secondary floor. The upper part of these bones is like the thin shell of a bivalve; the right and left bones are kept apart by the upper limb of the vomer; behind, their sinuous edge articulates with the fore edge of the pterygoids.

The pterygoids (*pg.*) are essentially lunate bones, placed back to back; their broad part is in front, where they meet at the mid-line; behind, they diverge considerably, and each bone, reduced to two-thirds of its front width, clamps the base of the skull, and is applied as a splint to the inner face of the quadrate (*q.*). The outer edge is concave and bevelled, the lower face a little concave, and the upper slightly convex; in the re-entering angle between the two bones, below, the basisphenoid (*b.s.*) is exposed; there is no "parasphenoid" here.

The orbital rim is well formed already, the frontal, prefronto-nasal, and maxillary form the front half, the hind part is nearly all completed by the jugal (*j.*) below, and the post-orbital (*pt.o.*) above; the former is a falcate bone, with a facial and an orbital lamina, and so is the latter, but it is much broader. According to the ancient imbrication of these scales, the maxillary overlaps the jugal, and the jugal the post-orbital; this, in its turn, overlaps the squamosal (*sq.*) behind it, and the jugal overlaps a second plate, the "quadrato-jugal" (*q.j.*), a thin scale of bone, whose concave hinder edge forms the fore margin of the tympanic ring, by lying as a splint exactly on the outer face of the quadrate.

The squamosal does the same for the postero-inferior edge of that space; behind, it is thick and two-edged (figs. 2, 5, *sq.*); there is no additional "supra-temporal" bone here, such as we see in the "Lacertilia."

The free mandible has only five bony plates upon it; the "splenial" is absent; the

" articulare " (*ar.*) is for a long while—as in the Batrachia—distant from the articular end of the cartilage on which it ultimately grafts itself; and this cartilage, as in certain Frogs and Toads, ossifies by itself first, independently.

Hence it is easy to make this mistake, viz., to count six bones in the mandible of a Chelonian, especially in half-grown specimens of this kind, although there is no splenial; the outer and inner bony elements of the articular region being so long before they unite.

Seventh Stage. Ripe embryos; total length, 4 inches; length of head, 11 lines.—The investing bones at this stage scarcely need be described again; they are much more solid, fit better together, and come much nearer to their well-known condition in the adult. The parietals (Pl. XI. fig. 4, *p.*) are now united together, meeting at the sagittal suture, which remains open in this species.

The relative thickness of the outer bones, and the part they take in this organic building, will be seen in the transverse sections (Pls. XII. and XIII.).

The primordial skull is now chondrosteous (Pl. XII. figs. 1–3), and so it remains throughout life; there is but little change seen after hatching. Even in the very large and old adults the synchondroses become relatively narrower, but they are nearly all persistent.

In front of the basisphenoid, the endocranium remains unossified. As to the method of ossification, I note this, namely, that the endosteal growths are late, and show little until after the cartilage has been invested by its ectosteal layer.

What I have just mentioned as to the distinctness of the two bony sources of the " articulare," is the most Batrachian thing, in this respect, in this type; whereas in the Lacertilia the cartilage, as in the Batrachia, is very apt to become calcified independently; in them, however, the deposit is sub-central and not on the surface.

The occipital arch is now composed of its four normal elements, namely, the basi-occipital, the two exoccipitals, and the superoccipital (Pls. XI. and XII., *b.o.,e.o.,s.o.*); The basioccipital (*b.o.*) is now reaching on to the basisphenoid in front, and into the substance of the condyle (*oc.c.*) behind; it is a broad, two-winged bone, bi-convex below, hollow above, and has to carry its own arch and the " opisthotic " part of the auditory capsule (*op.*). The exoccipitals (*e.o.*) are large bones, with a concave inner edge, and an outspreading wing running into the " paroccipital " region; the ninth and tenth nerves run out in front of these bones, but they are pierced by the twelfth (9, 10, 12), behind which a vein runs through the " posterior condyloid foramen." The super-occipital (*s.o.*) is now a case of bone to the crown of the arch, it is wide, from side to side, forms the upper third of the foramen magnum, and is extensively connected with the auditory capsule, through its articulation, and subsequent ankylosis, with the "epiotic" bone (*ep.*). As yet (Pl. XII. fig. 3, *s.o.*), the occipital roof is partly soft in front; this region is apiculated both in front and behind.

The endocranium (seen in Pl. XII. figs. 1–3, cleared of the investing bones, and palatine membrane bones) is a very remarkable structure, extremely large behind, reduced to a vertical plate with alæ in the middle, and enlarging into a pillow-shaped, double pouch in front. This form would not be so remarkable if the eyeballs were retained in the figures, with the capsules of the ears and nose; they are indicated in the sectional views.

There is a large synchondrosial tract, to be lessened afterwards, between the basi-occipital and basisphenoidal regions (*b.o.,b.s.*), and the lateral parts of the latter are still unossified; in the adult there is only this one bone in the posterior sphenoidal sclerotome, and none in the anterior.

The basisphenoid is formed as an ossification of the end of the notochordal sheath, of the contiguous parts of the investing mass, running upwards as the post-clinoid wall, and of the newly-coalesced ends of the trabeculæ and intertrabecula, up the bottom of the deep notch behind the common optic foramen (Pl. XII. figs. 1, 2, 3, *b.s.*). The internal carotid arteries find their way into the "sella" between these outer and middle bars, and the bony substance growing well around them, makes the bone strong beneath the pituitary body, for there is no open space left there; the cupped "sella turcica" (Pl. XII. fig. 3, *py.*) is only imperfect below where the arteries enter.

Below (fig. 2, *b.s.*), the bone is thick and trilobate, growing backwards towards the basioccipital, and outwards towards the quadrate and tympanic cavity; above (fig. 3), the squarish bony mass is notched, right and left, to form the large foramen ovale (5).

Between these two endocranial regions—the occipital and posterior sphenoidal—the large ovoidal auditory organs (*au.*) are imbedded. Seen from the inside (Pl. XI. fig. 2), they present the appearance of a trimerous, syncarpous fruit, the three bony centres—prootic, epiotic, and opisthotic (*pro.,ep.,op.*) giving them this likeness; between these there is a wide triradiate synchondrosis.

The sigmoid crest or selvedge running down in front is the remains of the ali-sphenoid (*al.s.*), a deep chink behind separates the mass from the occipital wall (*e.o.*); a shallower groove divides the capsule from the basal plate, whose sphenio-occipital synchondrosis runs from side to side uniting the right and left stems of the triradiate periotic cartilage.

On account of the large size of the occipital roof, and its far growth forward, the epiotic (*ep.*) forms the upper piece, and the pro otic (*pro.*), which is almost twice as large, lies below as well as in front; this bone is perforated by the branches of the last pre-auditory nerve, the facial (7), with its specialised dorsal branch, the auditory (8), also in front, the prootic is notched by the trigeminal (5).

The opisthotic (*op.*) is intermediate in size between the other two; it is an exactly posterior shell, triangular within, but, behind, growing out into the paraoccipital wing, where it always appears as a large distinct bone when the skull is looked at externally.

At present, it has only half covered this tract, and, at present, the epiotic is separated from the superoccipital by a tract of cartillage; soon, it alone, loses its independence by ankylosis with the superoccipital. The upper surface of the auditory capsule (Pl. XII. figs. 1, 3) is convex and shelving, and is confluent with the chondrocranium, its three canals are seen above the hollow quadrate (*q.*). Below (Pl. XI. fig. 3, and Pl. XII. fig. 2) it is somewhat scooped, and is bifenestrate, for there we find the fenestra ovalis and rotunda (*f.o.*, *f.r.*); the former, filled with the stapedial plate (*st.*), and the latter leading to the rudimentary cochlea.

Behind, a double passage exists for the ninth and tenth nerves (9, 10). The epiotic lies over the junction of the anterior and posterior canals. The prootic takes in part of the horizontal, as well as most of the anterior canal; the opisthotic covers most of the posterior canal, and sends a process downwards between the two fenestræ.

Passing forwards we encounter no more bone (either now or afterwards) in the chondrocranium. The orbito-nasal septum is presphenoidal behind, ethmoidal in the middle, and naso-septal in front. The hinder part, or anterior sphenoid, is as large as the other two together. The orbito-sphenoids (Pl. XII. figs. 1 and 3, *o.s.*) form together a sub-cordate leaf of cartilage, half folded at the mid-rib, and with its base behind. The nasal sacs form a bilobate pouch, each half of which opens into a short lateral tube in front, projecting like the horns of a Snail, half protruded; the tube is a continuous (non-distinct) "outer supero-labial." Below (Pl. XII. fig. 2), the septum nasi is seen as the common bond of the two pouches; it enlarges in front between the two pairs of nerve passages, and there becomes the hooked "prenasal" (*s.n.*,*p.n.*). Above, where the olfactory nerves are entering (fig. 3, 1, *eth.*), there is a triangular flap looking backwards, like that of a Bird's chondrocranium (Phil. Trans., 1869, pl. lxxxiii. fig. 2, *eth.*), which is the rudiment of the "tegmen cranii," so largely developed in fishes. From its point to the projection on the superoccipital, behind, all the roof is a membranous fontanelle, re-roofed with the great membrane bones.

Many of these things will be seen better in the sections yet to be described, which also show some rudiments of what are manifestly pre-oral visceral arches. The hindmost rudiments of this kind are the "epipterygoids" (Pl. XII. figs. 1, 3, *e.pg.*), which are now largely ossified, and quite detached from the pedicle of the quadrate (*q.*,*pd.*); their relation to the pterygoids is shown in fig. 1, where the latter bones are shown, laterally, in outline.

Leaving the antorbital visceral rudiments for the present (there are no "pro-rhinals"), I come, now, to the post-oral arches.

The upper element of the first of these, the quadrate (*q.*), takes up one-third of the side of the skull, and is greatly modified from its primary, simple state, as a supra-mandibular segment or "suspensorium."

The Amphibian regions of this part come out again here, namely, the "pedicle" and the "otic process;" the former (*pd.*) is a mere spike always unossified at its tip, and touching the top of the epipterygoid with which it was continuous.

The latter (*ot.p.*) forms an almost circular dome-like vestibule to the "middle ear," and this part is largely unossified as yet. The main stem of the bone, however, is seen on its inner face to be solid and phalangiform, and largely ossified, the condyloid lower articular facet, and the convex part above, which articulates with the ear-capsule, are still, and indeed, permanently, soft; to the rim of this hollow "porch of the ear," the very Batrachian cartilaginous "annulus tympanicus" is attached, and in its notch the orbicular "extrastapedial" fits (Pl. XII. fig. 1, *a.ty.*,*e.st.*). This latter part is, as I have already shown, the distal end of the "epi-hyal" element, and the proximal end is the "mediostapedial," or stem of the "columella," whose base is the true periotic stapes (*st.*). The axis of each mandible (*mk.*) is still confluent with its fellow of the opposite side, and is wholly unossified. The shaft of the columella (*co.*), and the shaft of the cerato-hyal (Pl. XI. fig. 7, *c.hy.*) are both more extended than in the last, and the hypo-hyal is shorter and more bulbous; the "basi-hyo-branchial" (Pl. XI. fig. 7, *b.hy.*,*b.br.*) gives off an unossified glosso-hyal spike in front, and a pair of hypo-branchials (*h.br.*) are articulated to its projecting lobes behind.

Transversely Vertical Sections of the Head.

A description of these slices will complete what I have to say of this ripe stage.

First Section.—This section (Pl. XII. fig. 4) is made through the fore margin of the thick premaxillaries (*px.*) and the external nostrils (*e.n.*) The alinasal tubes (*al.n.*) are cut through, which are, essentially the same as the separate narial valves of the Frog, formed out of the external segment of the large upper labials. The narrowness of the face downwards is here shown, and the flatness of the face above.

Second Section.—The next section (Pl. XII. fig. 5) takes in the fore part of the nasal capsule (*n.w.*) as well as the alinasal valve (*al.n.*), and on this front part the prenasal (*p.n.*) is shown, growing almost directly downwards. This extension of the skull base serves here as a model for the premaxillaries, as in the Birds, but in these the prenasal soon loses this downward direction, and grows forwards as in Selachians, in both cases the "prorhinals" are either suppressed, or but slightly developed, as a rule.

Third Section.—Here (fig. 6) there are four passages (*e.n.*,*n.c.*), for the nasal pouches lie beneath the alinasal outlets in front. Above, the alinasal has passed into the aliseptal lamina (*al.sp.*); below, the nasal floor (*n.f.*) is seen to bind upon the hinder part of the prenasal spike (*p.n.*). The nasal septum (*s.n.*) does not reach the base at this part, nor is the beginning of the aliseptal lamina continuous with the nasal wall and floor (*n.f.*). The latter cartilage is now protected, externally, by the fore edge of the maxillary (*mx.*); and the hollow of the palate has begun, as shown in the space between the premaxillaries (*px.*).

Fourth Section.—This section (fig. 7) shows the finished nasal pouches, for the laminæ of cartilage are continuous, and below they curl upwards close to the broad base of the steep and thin septum nasi (*s.n.*). The mucous membrane is folded inwards at the upper third. Here we come across the palatine plates of the premaxillaries (*p.px.*), and the maxillaries (*mx.*) are thick, steep, and sharp-edged.

Fifth Section.—The eyelids are first reached in this section (fig. 8), for the large orbital space lies somewhat over the nasal pouches; these are complete tubes at this part, for the lower edge, as it ascends into the inside of the pouch, sends inwards a process that coalesces with the base of the septum nasi (*n.f.,s.n.*); there is an oval space between these cartilages on each side. This structure is seen also in Falcons (Bird's Skull, part 2, Trans. Linn. Soc., ser. 2, Zool., vol. i., pl. xxv. figs. 2–6); those birds likewise have a very Chelonian vomer, a short down-turned face, and a round nostril as in the Chelonian. This section also is in front of the nasal roof-bone; the palatal processes of the premaxillaries (*p.px.*) are thinning out, and the dentary edge of the maxillaries (*mx.*) thickening.

Sixth Section.—This slice (figs. 9, 9^a), is taken from the widest part of the nasal capsules, behind, close in front of the antorbital lamina (see fig. 1), where the wall is dented inwards. This hollow is due to an ingrowth of the wall which becomes a free lamina inside, and reaches almost half across the tube. In the higher "Sauropsida" this is coiled upon itself twice, as a rule, and is the inferior turbinal; here we have only a rudiment (*i.tb.*). The upturned nasal floor (*n.f.*) is now only articulated with the base of the septum nasi (*s.n.*), and the tube of the last section is only a canal at this part. Immediately below the most bulging part of the nasal floor we encounter a cartilage which is common in the "Ichthyopsida," and is a separate piece—for a time at least—in many; this is the "ethmo-palatine" (figs. 9^a, 9^b, *e.pa.*); it becomes, by ossification, the true palatine bone in bony fishes.

Here it is so distant that in neither of its faces, front or behind (figs. 9^a, 9^b, *e.pa.*), could I find any confluence with the nasal capsule; but in *Lacerta* and *Chamæleo*, where it is much larger and pedate below, it is early confluent by its stem with this part of the nasal floor. Its true origin is from the trabecula, but it is pushed aside very early in these types by the intrusion of the nasal pouch. Here the prefronto-nasals (*p.f.n.*, nasals and "ecto-ethmoids" in one piece) are cut through; they are very massive bones. Below, the palatal plates of the premaxillaries have given way to the broad arched vomer (*v.*); this is its antero-inferior part, and forms, as seen in section, the keystone of a very elegant arch, whose sides are formed by the maxillaries (*mx.*).

Seventh Section.—Here (Pl. XII. fig. 10) the eyeballs (*e.*) are cut through, and the fore part of the cranial cavity is exposed, with the proximal part of the olfactory nerves (1). The floor of the skull is made by the narrow fore ends of the orbito-sphenoids (*o.s.*), and the vertical wall is the perpendicular ethmoid (*p.e.*); for those alæ run along in front over the back of the true ethmoidal region. Below the thick base of this wall the upper limb of the vomer (*v.*) is seen, and the broad palatal part lies on the palatal skin. On each side at this part there is a large tube, these are the inner nasal passages (*i.n.*), and they are walled in by the semi-tubular palatines (*pa.*), which are kept apart above and below by the vomerine bars. On each side of the palatines the maxillaries (*mx.*) are seen, each with a considerable palatine plate undergirding the palatine bones.

Above, the narrow fore end of the frontals (*f.*) are notched to receive the sharp inner edge of the naso-prefrontals (*p.f.n.*) in their orbital portion. This section is behind the ascending, and through the jugal, part of the maxillaries.

Eighth Section.—The next section (Pl. XIII. fig. 1) is through the back of the eyeball (*e.*) and the mass of the huge lachrymal gland (*l.g.*); it is behind the posterior nasal openings, and through the narrow fore part of the hemispheres (C 1*a*). The orbito-sphenoids (*o.s.*) here form a trough for the brain, and reach up to the under surface of the frontals (*f.*), which thicken near their edge, and form the orbital eave.

The septum of the orbits now becomes the presphenoid (*p.s.*), and is scarcely lower than in the last section. Below this wall the thin end of the upper limb of the vomer (*v.*) is seen, and on each side of this the broad post-nasal part of the palatine (*pa.*), flanked by the terminal part of the maxillary palatine plate (*mx.*).

Overlapping the frontals are the large post-orbitals (*pt.o.*), and stuck into their lower edge the large jugals (*j.*), which are cut through behind the jugal process of the maxillaries. The floor of the mouth is cut through, showing the tongue (*tg.*), the fore part of the larynx (*lx.*), the top of the basi-hyal (*b.hy.*), and on each side the dentary (*d.*), embracing Meckel's cartilage (*mk.*), which has no "splenial" bone on its inner side.

Ninth Section.—Here (Pl. XIII. fig. 2) the widest part of the hemispheres (C 1*a*) are seen, and the optic nerves (fig. 2) in the common optic passage. The back of the eyeball and the lachrymal gland (*e.,l.g.*) are still in view, and we have still a large orbito-sphenoid (*o.s.*). The vertical cartilage is the presphenoid (*p.s.*) just where it joins the fore end of the basisphenoid. Under it the broad pterygoids (*pg.*) are seen cut across at their front part. Outside, the post-orbitals (*pt.o.*) are fixed into the frontals (*f.*), and are overlapped by the jugals (*j.*).

Tenth Section.—This (fig. 3) is between the orbital and temporal regions; the hinder part of the hemispheres and the fore part of the mid-brain, passing into the fore-brain below (C 1*a*, C 2, C 1), are cut across. Here the infundibulum is seen to pass into the pituitary body (*inf.,py.*), and this rests upon the "sella turcica" or hollow of the basisphenoid (*b.s.*). This cup is flanked by the flat, horizontal pterygoids (*pg.*), which ascend somewhat at this part. The roof and walls here are both made by the parietals (*p.*), which are concave as they descend to rest their inner edge on the pterygoids and their outer edge on the semi-osseous epipterygoids, whose shaft is cut across. The post-orbitals and jugals (*pt.o.,j.*) are still in view. The mandible is cut through near the hinge, and the Meckelian rod is here invested by the surangular, angular, and articular (*mk.,s.ag.,ag.,ar.*);

the back part of the larynx, the basi-hyal, and the cerato-hyals (*lx.*,*b.hy.*,*c.hy.*) are also cut across.

Eleventh Section.—We now reach the auditory region (fig. 4), and from the obliquity of the head the cranial roof cartilage (*s.o.*) is seen, the alisphenoidal selvedge (*al.s.*) running from it into the auditory capsule (*au.*). The anterior canal (*a.s.c.*) is severed near its ampulla, and a little of the general cavity of the vestibule (*vb.*) is also shown. The capsule runs into the basal plate below, the isthmus of cartilage under these parts passes inside the trigeminal nerve (5), the internal carotid (*i.c.*) is also seen in its canal, and both these structures lie on the pterygoid (*pg.*). At the middle of the floor the bony matter of the basisphenoid (*b.s.*) is seen enclosing the cartilage from which the apex of the notochord has shrunk.

The quadrate (*q.*), half bony, is cut through in front of its tympanic cavity exactly at the hinge, so that here the outer "articular" bone is seen to invest the cartilage of the jaw within very closely. Here, exactly in front of the tympanic cavity, the quadrato-jugal (*q.j.*) is severed; between it and the post-orbital (*pt.o.*) there is a mere membranous space. Here the parietal (*p.*) is bifoliate, part going over the temporal muscle (*t.m.*) to the post-orbital, and part going down to protect the sphenotic tract of cartilage.

Below, behind the tongue, the trachea, cerato-hyals, and hypo-branchials (*trc.*,*c.hy.*, *h.br.*) are cut through.

Twelfth Section.—A little further backwards we come across new parts (fig. 5); the brain is shown as retained in the cranial cavity, and the optic lobes (C 2) are seen lying over the fore part of the medulla oblongata (C 3); but the cerebellum does not come into view.

The thick cartilaginous roof is now superoccipital (*s.o.*), and this runs into the widening auditory capsule, in which we see the arch of the anterior, and the ampulla of the horizontal canal (*a.s.c.*,*h.s.c.*); the eighth nerve (8) is seen passing through the meatus internus, and the columella (*co.*) filling the fenestra ovalis (*co.*,*f.o.*), which leads to the large vestibule (*vb.*). This section is directly in front of the small budding cochlea.

The seventh nerve (7) is seen riding over the columella (*co.*), beneath which the pterygoid bone (*pg.*) creeps outside the canal formed by it for the internal carotid artery (*i.c.*); for this bone has a most extraordinary development in the Chelonia, just as the "basi-temporal" plates have in the Bird. These are not homologous parts, but they are vicarious of each other in function in these two types.

Here, in the fore edge of the basioccipital bone, the essentially homologous nature of the inter-segmental vertebræ, and the non-segmented basis cranii in its hind part, is well seen in this section.

The notochord (figs. 5, 5^a) is here pinched, laterally, in a conical mass of true cartilage,—the mesoblastic sheath of the chord,—and embracing these on each side, we see the ossifying lateral or symmetrical cartilages, comparable to the neural arches of the spine, although not broken up into inter-neural segments.

Outside the endocranium we see the parietals and squamosals (*p.,sq.*) finishing the temporal roof, and the latter overlapping the quadrate (*q.*) which is here hollowed out to form the drum (*c.ty.*). The trachea, bony shaft of cerato-hyal and unossified hypo-branchials (*trc.,c.hy.,h.br.*) are seen in section below.

Thirteenth Section.—Here (fig. 6), we have the very vertebral form of the occipital arch; but, besides that it represents a series of vertebræ and not a single joint, it is also ossified somewhat differently. There is a V-shaped centre above the superoccipital (*s.o.*) answering to the upper part of the "atlas," then a centre for each side of the arch, the exoccipitals (*e.o.*); and lastly, an azygous bone, the basioccipital, formed by extension of the substance of the "cephalostyle" into the lower part of the arch, on each side.

All this is curiously like and unlike what is seen in a vertebra; and this one arch is formed in a tract that represents the skeleton of the whole post-auditory part of the head, where the glosso-pharyngeal, the vagus (a sevenfold nerve in the Lamprey), and the hypoglossal, all have their exit—a long region, doubtless—in the skulls of archaic types.

Here, at the back of the skull, we see that the shaft of the cerato-hyals, and the cartilaginous hypo-branchials (*c.hy.,h.br.*) have been cut across; also, outside, the end of the parietal dome, and the bifoliate part of the squamosals (*p.,sq.*), are seen in section.

If these figures and descriptions be compared with those of the dissected skull (Pls. XI. and XII.), they will help to a clear understanding of the matter.

Eighth Stage. The skull of the adult.—Whilst the formed embryo, at about twenty days after deposit in the sand, is scarcely at all larger than one at the same stage in the Snake (*Tropidonotus natrix*), or of the nimble Lizard (*Lacerta agilis*), this type goes on growing until it is of a huge size, and yet its metamorphosis is complete before it leaves the egg.

After that the changes are scarcely more than long continued increase in bulk; that which is bone at birth is bône in old age, and that which is cartilage at birth is cartilage in old age; the structures become more solid and compact, relatively, but there is scarcely any change of importance.

In front of the basisphenoid all the endocranium remains cartilaginous; a little selvedge of cartilage running down the front of the auditory capsule still represents the alisphenoid, and the three-rayed periotic synchondrosis narrows somewhat, but is permanent.

The epiotic coalesces on each side with the superoccipital, but the opisthotic, ossifying the large paroccipital bar, remains like the prootic, permanently free of all surrounding bones. The old sutures and synchondroses remain, the parietals remain distinct, a line of sutures running from the nose to the superoccipital. In the mandible an important change takes place, for the articular part of the cartilage becomes ossified, endosteally, and then coalesces to some considerable degree with the ectosteal "articulare."

This determines the name of that outer plate, what might in younger specimens be thought to be a mere splint like the others in this part; so also in highly-ossified Batrachia, as the "Aglossa," the bone, which was taken for the "angulare" by Huxley, coalesces with the endosteally ossified articular region of the free mandible.

The post-mandibular arches merely increase in size, and not in character.

The rapidity with which this type undergoes its metamorphosis, even in an early period of its life within the egg, is very remarkable as compared with what is seen in the Batrachia with their large larvæ.

But in *Pipa*, which scarcely shows a trace of even external gills, the metamorphosis is nearly if not quite as rapid, and, at extrusion, the young are as perfect as newly-hatched Turtles; in *Dactylethra* we may see that, as to the skull, there is but a step between a Batrachian and a Chelonian.

There is one thing to be noted of great importance in the development of the Turtle, and that is the number of its body-segments at various stages, their rapid increase at first, and then the suppression or extinction of several, afterwards.

In embryos a little more than a quarter of an inch in length (first stage), there are about twenty-seven muscle-plates or somatomes.

In embryos ranging from $6\frac{1}{2}$ to 9 lines (a little more than half, to three-quarters of an inch), there are fifty-one of these divisions of the body visible externally.

Now in the adult I can only find forty-one developed vertebræ, viz., 8 cervical, 10 dorsal, 2 sacral, 21 caudal—41 in all.

But in the third and fourth stages there are at least 15 somatomes in the cervical region, in the dorso-lumbo-sacral 12 (as in the adult), and 24 in the caudal—51 in all (see Pl. I. figs. 3 and 7); thus we miss in the adult 7 in the cervical and 3 in the caudal—10 in all.

This free suppression of segments suggests a great secular modification by shortening of a form not unlike a *Plesiosaur*.

Summary.

First Stage. $3\frac{1}{2}$ *lines long.*—In this stage there is nothing to distinguish the embryo from that of a Snake, Lizard, or Bird. There are twenty-seven somatomes; the heart is looped; there are four clefts, of which the fourth is scarcely open; the limbs are appearing as thickenings; the rudiments of the sense-capsules are very distinct, that of the ear being especially remarkable for the clearness of its lipped opening; there is a slight rudiment of the maxillo-palatine fold (Pl. I. fig. 1).

Second Stage. 6 *lines* ($\frac{1}{2}$ *inch*) *long*.—The number of somatomes has greatly increased; the three divisions of the heart are fairly formed; the rudiments of the sense-capsules are more distinct, that of the ear still showing the opening; the maxillo-palatine fold is seen in the form of a sessile pointed leaf, the base of which is attached to the top of the mandibular fold, the latter being more than twice the size of the former; the naso-frontal process is not yet formed; the pituitary involution is beginning (Pl. I. fig. 2).

Third Stage. $6\frac{1}{2}$ *lines long*.—The number of somatomes has now increased to about fifty-one, there being only about forty-one vertebræ in the adult, which thus aborts seven segments in the cervical region, and three in the caudal, there being the same number in the dorsal, lumbar, and sacral regions, both in these embryos and in the adult. In the latter parts, the somatomes form a sharp inferior edge above the upper margin of the limbs, which is the rudiment of the carapace. The limbs are rounded paddles, attached to a broad base, and the pectoral member is midway between the nose and the tail. The ear opening is covered with skin; rudiments of the naso-frontal process are seen; the maxillo-palatine has increased fourfold, and has, like each of the post-oral folds, a distinct opercular fold projecting over the cleft behind. Head cavities can be seen in the visceral folds; the pituitary involution is more distinct; the notochord reaches nearly to the top of the fold of the mid-brain (middle trabecula), and is curved over and enlarged at the end (Pl. I. figs. 3–6).

Fourth Stage. 9 *lines long*.—The number of somatomes is the same as in the last stage; the rudiment of the carapace is very distinct; the head is larger than the whole thoracic region of the body, and rudiments of the hemispheres are apparent in front of the pineal elevation; the mid-brain is very outstanding, and the hind-brain is much hidden by lateral growths; the maxillo-palatine, is twice as large as the post-oral, folds, which are now contracting upon all the clefts; the Eustachian openings are wide apart. The quadrate is already sickle-shaped, enclosing the bulbous distal end of the columella in the rudimentary membrana tympani, which closes up the upper part of the cleft. There are distinct lachrymal and nasal clefts, and between the latter a dilated, rounded naso-frontal process is seen, on the centre of which is the rudiment of the rostrum for breaking the shell. The racemose pituitary body has not yet united with the infundibulum; the olfactory lobes are quite distinct from the solid olfactory nerves, and the optic nerves are hollow. A chondrocranium is already formed, and the basis cranii runs high into the fold of the mid-brain, forming the post-clinoid wall, the notochord runs nearly as high as this latter, and is clubbed, and turned downwards. From the pituitary region are seen the broad trabeculæ segmented from the investing mass, and a long intertrabecular bar ending in the prenasal rostrum; from the trabeculæ grow the large orbito-sphenoids, which lie low down; the orbito-nasal septum is not developed (Pls. I. and II.).

Fifth Stage. $1\frac{1}{3}$ *inch long.*—The carapace and limbs are now well formed, but the abdominal region is still membranous. The large head is rapidly approaching the adult form, but the mid-brain still projects. The mandibles now fill in the triangular space between the maxillo-palatines, which have converged to form the upper jaw ; above their junction is a median nasal passage. The chondrocranium is well formed, but is at present only an open trough, except in the superoccipital region ; the orbito- and alisphenoids are continuous with each other, with the post-clinoid wall, and with the auditory capsules. The notochord is only half as high as the post-clinoid wall, and curves over, having an elongated cartilaginous sheath, which passes down beyond it, behind the pituitary body ; the latter is closely applied to the infundibulum, but not united with it. The orbito-nasal septum is now developed. There is no ossification in the chondrocranium, but osteoblasts are quite evident in the pterygoids, and the other investing bones appear as granular tracts. The epipterygoid is continuous with the pedicle of the quadrate. Meckel's cartilages are confluent, and the columella is in two segments, as in the Batrachia (Pls. III.–IX.).

Sixth Stage. 3 *inches long, head* 7 *lines long.*—The general form of the head is like that of the adult ; ossification has commenced in the exoccipitals, basioccipital, and basisphenoid, and the investing bones are all present. There is no distinction between the nasal and prefrontal, and the parietal has grown down between the second and fifth nerves, so as to abort nearly the whole of the alisphenoid ; it reaches the pterygoid. The pituitary body and the infundibulum are now united. There is a distinctly cartilaginous annulus tympanicus, as in the Batrachia ; the stapedial plate is distinct from the bar of the columella, and the extrastapedial is discoid, and has a suprastapedial lobe, as in the Toad. The epipterygoid is not ossified, and is continuous with the pedicle of the quadrate. The parietal fontanelle is wide open (Pl. X.).

Seventh Stage. Nearly ripe.—The parietal fontanelle is now filled in, and almost everything is in the same condition as in the adult, except that the synchondroses are larger. The chondrocranium is largely ossified from the pituitary region, backwards, but unossified in front. The epiotic has not coalesced with the superoccipital, and the opisthotic has only ossified half the cartilage belonging to it. The notochord is flattened in the occipital condyle, but is surrounded by a solid sheath of cartilage. Now, and for a long time afterwards, there is no ossification of the articular cartilage, but its long plate closely embraces it. The nasal capsules form two pouches, closed above and below, and continuous with the septum nasi ; the prenasal rostrum is short and descending. There is a distinct ethmo-palatine cartilage, and a rudiment of the inferior turbinal ; the epipterygoid is ossified and segmented from the unossified pedicle of the quadrate ; the quadrate is ossifying, and is hollowed out to form the drum (Pls. XI.–XIII.).

General Conclusions.

The Turtle agrees with the Lizards in having a large orbito-nasal septum and an epipterygoid, and in the mode of ossification of the occipital arch and auditory capsules; it differs from them in having the alisphenoid quite aborted, and the opisthotic permanently distinct.

It agrees with the Chamæleon in having a single vomer, but differs from it in having an epipterygoid, a tympanic cavity, a functional columella, a rudimentary cochlea, and a fenestra rotunda; in which characters it agrees with the typical Lizards.

It agrees with *Hatteria* and the Crocodile in having a quadrato-jugal, and in this character differs from the other Lizards and Snakes. Although forming in the adult condition so great a contrast to the Snakes in their outward form, it agrees with them and differs from other reptiles in having neither sternum nor sternal ribs, the whole plastron and much of the carapace being formed of membrane bones.

The Turtles, like the Batrachia, are remarkable for the fewness of their investing bones; the nasals and prefrontals are ossified as one tract, and there are no super-orbitals, no second temporal bone, and no splenials.

One of the most remarkable things in the early embryo is the large number of somatomes, in the neck especially, and also in the tail, as compared with what is seen in the intercalary bony segments (vertebræ) of the adult; thus, the embryo suggests an ancestry having a longer neck and tail than the existing forms. As some of the Cretaceous Chelonia certainly possessed teeth, and as a few forms, both fossil and existing, have the nasal bones distinct from the prefrontals, it is evident that the modern Chelonia are forms that have become separated from their nearest reptilian relations by specialisation. A long necked ancestry with a feebly-developed carapace, and many feeble bones of the plastron arranged triserially, would bring us very near to the Plesiosaurs. The great and close conformity of the Turtles, even now, to the Lacertilia, suggests a common parentage.[1]

[1] The magnificent skeleton of the Leathery Turtle (*Sphargis coriacea*), recently added to the treasures in the British Museum, has its ribs distinct from each other, as in young embryos of the ordinary kind, and as in the extinct Plesiosaurs.

LIST OF ABBREVIATIONS.

The Numbers indicate Nerves or their Foramina.

ag.	angulare.
al.n.	alinasal.
al.s.	alisphenoid.
al.sp.	aliseptal cartilage.
aq.v.	aqueductus vestibuli.
ar.	articulare.
ar.c.	articular condyle.
a.s.c.	anterior semicircular canal.
at.	atlas.
a.ty.	annulus tympanicus.
au.	auditory capsule.
b.a.	basilar artery.
b.br.	basi-branchial.
b.hy.	basi-hyal.
b.o.	basioccipital.
br.	branchial arch.
b.s.	basisphenoid.
C 1	fore-brain.
C 1*a*	cerebral hemispheres.
C 1*b*	rhinencephalon.
C 2	mid-brain.
C 3	hind-brain.
C 3*a*	cerebellum.
c.br.	cerato-branchial.
c.hy.	cerato-hyal.
cl.	cleft.
co.	columella.
c.ty.	cavity of tympanum.
d.	dentary.
e.	eye.
e.n.	external nostril.
e.o.	exoccipital.
ep.	epiotic.
e.pa.	ethmo-palatine.
e.pg.	epipterygoid.
e.r.m.	external rectus muscle.
e.st.	extrastapedial.
eth.	ethmoid.
eu.	Eustachian aperture.
f.	frontal.
f.m.	foramen magnum.
fo.	fontanelle.
f.o.	fenestra ovalis.
f.r.	fenestra rotunda.
g.cl.	ganglion cochleare.
g.g.	Gasserian ganglion.
g.gc.	ganglion geniculatum.
h.	heart.
h.br.	hypo-branchial.
h.c.	head-cavity.
h.hy.	hypo-hyal.
h.s.c.	horizontal semicircular canal.
hy.	hyoid arch.
i.c.	internal carotid.
if.r.	inferior rectus muscle.
i.n.	internal nostril.
inf.	infundibulum.
in.r.	internal rectus muscle.
i.tb.	inferior turbinal.
i.tr.	intertrabecula.
iv.	investing mass.
j.	jugal.
l.cl.	lachrymal cleft.

l.g.	lachrymal gland.
l.p.	lachrymal passage.
l.s.	lateral sinus.
lx.	larnyx.
m.	mouth.
m.cl.	mandibular cleft.
m.i.	meatus internus.
mk.	Meckel's cartilage.
mn.	mandible.
m.n.p.	middle nasal passage.
m.st.	mediostapedial.
m.tr.	middle trabecula.
m.ty.	membrana tympani.
mx.	maxillary.
mx.p.	maxillo-palatine.
my.	myelon.
n.a.	neural arch.
nc.	notochord.
n.c.	nasal cavity.
n.f.	nasal floor.
n.f.p.	naso-fronal process.
n.p.	nasal passage.
n.w.	nasal wall.
oc.c.	occipital condyle.
ol.	olfactory capsule.
op.	opisthotic.
o.s.	orbito-sphenoid.
ot.p.	otic process.
p.	parietal.
pa.	palatine.
pal.	palate.
p.b.c.f.	posterior basi-cranial fontanelle.
pcd.	pericardium.
p.cl.	posterior clinoid.
pc.m.	pectoral member.
pd.	pedicle of quadrate.
p.e.	perpendicular ethmoid.
p.f.n.	prefronto-nasal.
pg.	pterygoid.
p.n.	prenasal cartilage.
pnl.	pineal gland.
p.px.	palatine process of premaxillary.
pr.o.	prootic.
p.s.	presphenoid.
p.s.c.	posterior semicircular canal.
pt.o.	post-orbital.
pv.m.	pelvic member.
px.	premaxillary.
py.	pituitary body or space.
q.	quadrate.
q.c.	quadrate condyle.
q.j.	quadrato-jugal.
r.sp.	rostral spine.
rt.	retina.
s.ag.	sur-angulare.
s.n.	septum nasi.
s.nc.	sheath of notochord.
s.o.	superoccipital.
s.ob.	superorbital.
sq.	squamosal.
s.r.m.	superior rectus muscle
s.st.	suprastapedial.
st.	stapes.
tg.	tongue.
t.m.	temporal muscle.
t.hy.	thyro-hyal.
tr.	trabecula.
trc.	trachea.
ty.	tympanum.
ty.c.	tympanic cavity.
ty.s.	tympanic space.
u.v.	umbilical vessels.
v.	vomer.
vb.	vestibule.

EXPLANATION OF THE PLATES.

Plate.	Fig.		No. of Times Magnified.
I.	1.	*First Stage.*—Embryo of *Chelone viridis*, $3\frac{1}{2}$ lines long,[1]	$13\frac{2}{3}$ diam.
,,	2.	*Second Stage.*—Another embryo, 6 lines long,	$13\frac{2}{3}$,,
,,	3.	*Third Stage.*—Embryo, $6\frac{1}{2}$ lines long; side view,	$13\frac{2}{3}$,,
,,	4.	Head of same; lower view, with only two post-oral arches shown, and those partly cut away on one side,	$13\frac{2}{3}$,,
,,	5.	Upper view of same head,	$13\frac{2}{3}$,,
,,	6.	A vertical section of the same,	$13\frac{2}{3}$,,
,,	7.	*Fourth Stage.*—Side view of embryo, three quarters of an inch long,	$13\frac{2}{3}$,,
II.	1.	Head of same embryo as fig. 7 in Pl. I., upper view,	$13\frac{2}{3}$,,
,,	2.	The same; lower view,	$13\frac{2}{3}$,,
,,	3.	The same; lower view; the object seen when tilted back slightly, and with the post-oral bars cut away,	$13\frac{2}{3}$,,
,,	4.	The same stage; vertical section of head,	$13\frac{2}{3}$,,
,,	5.	The same stage; head dissected from above to show cranial basin,	$13\frac{2}{3}$,,
,,	6.	Part of the same object; fore part of basis cranii, lower view,	$27\frac{1}{3}$,,
,,	7.	The same; upper view,	$27\frac{1}{3}$,,
,,	8.	Part of fig. 7,	$54\frac{2}{3}$,,
,,	9.	Same stage; transversely vertical section of basal region, below the eyeballs,	$41\frac{1}{3}$,,
,,	10.	A similar section made a little in front of the pituitary space,	$27\frac{1}{3}$,,
III.	1.	*Fifth Stage.*—Embryo, $1\frac{1}{4}$ inch long; side view,	8 ,,
,,	2.	Head of same; upper view,	8 ,,

[1] The entire length of each embryo is given, measured along the curve, in inches and lines (or twelfths of an inch).

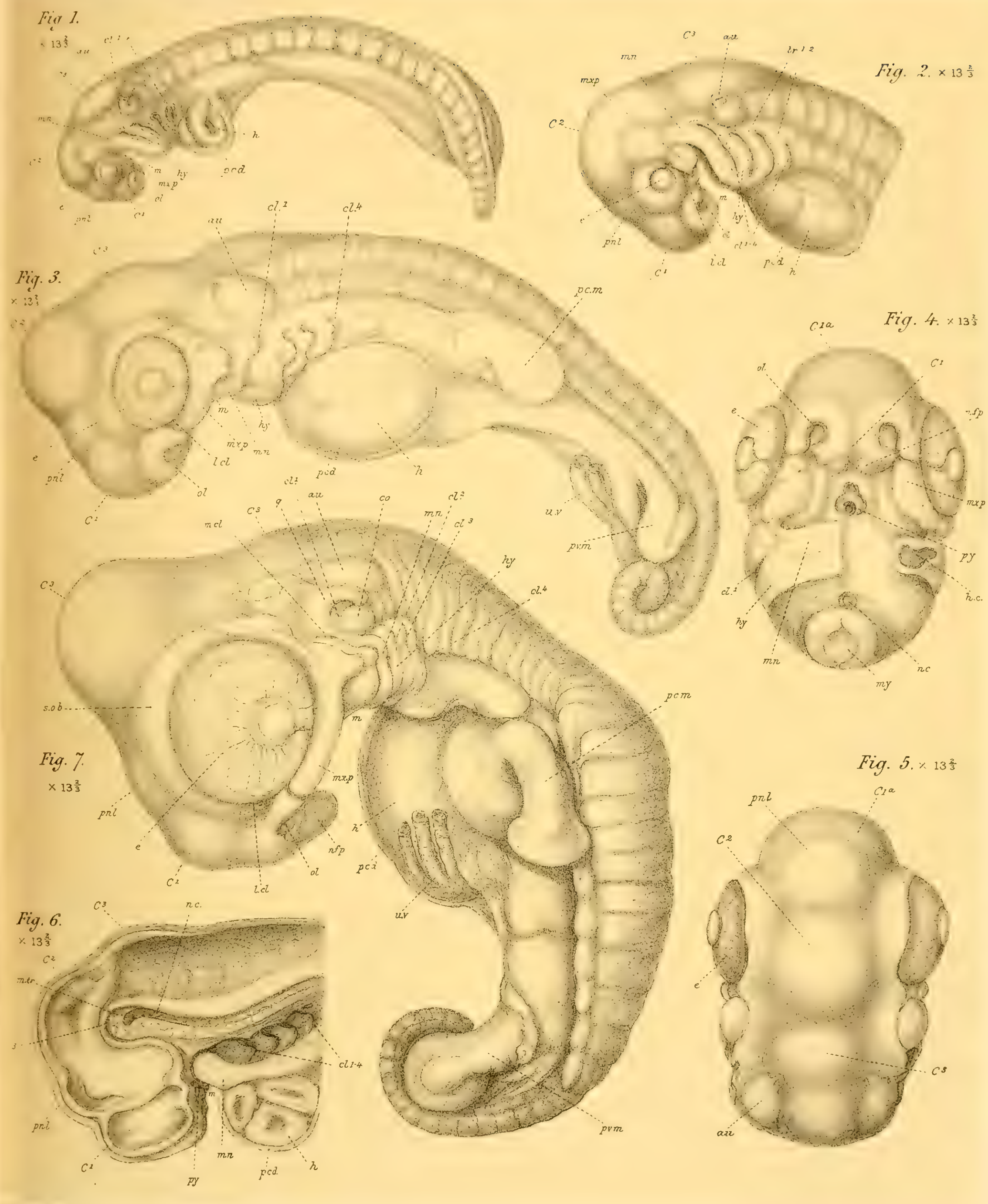
Plate.	Fig.		No. of Times Magnified.
III.	3.	The same object; lower view, ...	8 diam.
,,	4.	The same stage; vertical section of head, with brain *in situ*, .	8 ,,
,,	4*a*.	Part of same object, ...	16 ,,
,,	5.	The same, with brain removed, ...	8 ,,
,,	6.	Same stage; post-oral arches, upper view, ...	8 ,,
,,	7.	Same stage; First Section of a series made through the head at this stage, in a vertically-transverse direction, . .	$13\frac{2}{3}$,,
,,	8.	Second Section of the same series, ...	$13\frac{2}{3}$,,
IV.	1.	*Fourth Stage.*—Third Section. A transverse section through anterior third of orbital region, ...	$27\frac{1}{3}$,,
,,	2.	Fourth Section.—This displays the post-clinoid region, and is sub-parallel with the hind part of basis cranii, because of the sudden bend of the head, ...	$27\frac{1}{3}$,,
,,	3.	Fifth Section.—This is through the pituitary region, . .	$27\frac{1}{3}$,,
,,	4.	Sixth Section.—This shows the relation of the pituitary "acini" to the infundibulum and fore brain, ...	$27\frac{1}{3}$,,
,,	5.	Seventh Section.—Pituitary region still lower down, . .	$27\frac{1}{3}$,,
,,	6.	*Fifth Stage.*—Upper view of head, with cranial basin laid open,	$7\frac{1}{4}$,,
,,	7.	The same head; lower view, showing basis cranii, . . .	$7\frac{1}{4}$,,
,,	8.	Third of a series of transverse sections (begun in the last Plate); this is through the fore part of the nasal cavity, .	12 ,,
,,	9.	Fourth Section of the same series, just catching the eyelids, .	12 ,,
,,	10.	Fifth Section.—Through back of nasal cavity and fore part of eyeballs, ...	12 ,,
,,	11.	Sixth Section.—This section is through the olfactory lobes and first third of eyeballs, ...	12 ,,
V.	1.	Seventh Section.—In this section the hemispheres shown are cut through, ...	12 ,,
,,	2.	Eighth Section.—Through the internal nares, ...	12 ,,
,,	3.	Ninth Section.—Through middle of eyeballs, ...	12 ,,
,,	4.	Tenth Section.—Through wide part of hemispheres, . . .	12 ,,
,,	5.	Eleventh Section.—Through wide part of hemispheres and thalamencephalon, ...	12 ,,
,,	6.	Twelfth Section.—Through optic nerves, ...	12 ,,

Plate.	Fig.		No. of Times Magnified.
V.	7.	Thirteenth Section.—Through thalamencephalon and infundibulum, ...	12 diam.
,,	8.	Fourteenth Section.—Through pituitary body, ...	12 ,,
VI.	1.	Fifteenth Section (of same series as last Plate).—Through pituitary space, mouth, and larnyx, ...	12 ,,
,,	2.	Sixteenth Section.—Through hind part of pituitary space and post-clinoids, ...	12 ,,
,,	2*a*.	Part of same, ...	36 ,,
,,	3.	Seventeenth Section.—Through mid-brain, ...	12 ,,
,,	4.	Eighteenth Section.—Through hind-brain and fore part of ear capsule, ...	12 ,,
,,	5.	Nineteenth Section.—Through fore part of tympanic cavity, .	12 ,,
,,	6.	Twentieth Section.—Through middle of ear-capsule and back of tympanic cavity, ...	12 ,,
,,	6*a*.	Part of same, ...	24 ,,
,,	7.	*Same Stage* (*Fifth*).—First of a series of sections made in a longitudinally vertical direction—through outer face of quadrate cartilage and temporal muscle, ...	12 ,,
,,	8.	Second Section.—Further in, with tympanic cavity laid open, .	12 ,,
,,	9.	Third Section.—Auditory capsule laid open in its outer part, .	12 ,,
VII.	1.	Another section (Twenty-first), taken in a vertically transverse direction of same stage (*Fifth*), through occipital condyle,	12 ,,
,,	2.	Twenty-second Section.—Through hind part of skull and fore part of spine, ...	12 ,,
,,	3.	Fourth Section (of longitudinal series begun in last Plate).—Through middle of ear-capsule, ...	12 ,,
,,	4.	Fifth Section.—Through deeper part of ear-capsules and fenestra ovalis, ...	12 ,,
,,	5.	Sixth Section.—Through roots of cranial nerves, . . .	12 ,,
,,	6.	Seventh Section.—A similar slice made on the other side of the mid-line, ...	12 ,,
,,	7.	Eighth Section.—Near mid-line, showing orbital septum, and notochord, &c., ...	12 ,,
,,	7*a*.	Part of same, ...	24 ,,

Plate.	Fig.		No. of Times Magnified.
VIII.	1.	*Fifth Stage, continued.*—First Section of a series taken horizontally; this, the uppermost, shows the cavity of the cranium up to the post-clinoid region, and the fore part of the hind skull, with the medulla oblongata in section; in front, the rhinencephala are cut across over the nasal cavities, ...	12 diam.
,,	2.	Second Section.—Here, the olfactory nerves are cut across, and the sides of the great post-pituitary wall, ...	12 ,,
,,	3.	Third Section.—This shows the whole width of the hinder cranial region, and the roof of the nasal labyrinth is removed below the fore part of the cranial cavity, . .	12 ,,
,,	4.	Fourth Section.—Here the nasal cavities are fully laid open, .	12 ,,
,,	5.	Fifth Section.—This section runs through the external nostrils in front, and the upper part of the ear-capsules behind, .	12 ,,
,,	6.	Sixth Section.—This is so far down as to cut across the notochord in the post-clinoid wall; only the hind part is drawn,	12 ,,
,,	6*a*.	Part of the same, ...	36 ,,
IX.	1.	Seventh Section.—This is so low down as to reach the palatal skin at one part in front, and behind to lay open the "meatus internus,"	12 ,,
,,	1*a*.	Part of same, ...	36 ,,
,,	2.	Eighth Section.—In this half-section the pterygoids and epipterygoids are reached, ...	12 ,,
,,	2*a*.	Part of same, ...	36 ,,
,,	3.	Ninth Section.—This section opens the lower mouth of the pituitary space, the median nasal passage, and internal nares, ...	12 ,,
,,	3*a*.	Part of same, ...	72 ,,
,,	4.	Tenth Section.—Here the floor of the mouth is shown, and the foramen magnum is seen at its middle part, . . .	12 ,,
,,	5.	Eleventh Section.—This last section shows the mandibles *in situ*, and the occipital condyle enclosing the notochord, .	12 ,,
X.	1.	*Sixth Stage.*—Sectional view of skull, seen from the inside, .	$5\frac{1}{3}$,,
,,	2.	Side view of skull, ...	$5\frac{1}{3}$,,

Plate.	Fig.		No. of Times Magnified.
X.	3.	Lower view of the same,	$5\frac{1}{3}$ diam.
,,	4.	Upper view of the same,	$5\frac{1}{3}$,,
,,	5.	End view of the skull,	$5\frac{1}{3}$,,
,,	6.	Lower arches; upper view,	$5\frac{1}{3}$,,
,,	7.	Side view of quadrate and epipterygoid,	$10\frac{2}{3}$,,
,,	8.	Inner view of columella auris,	16 ,,
,,	9.	End view of columella,	32 ,,
,,	10.	Annulus tympanus and extrastapedial; outer view,	16 ,,
,,	11.	Hind part of basis cranii; lower view,	16 ,,
,,	12.	The same; upper view,	16 ,,
XI.	1.	*Seventh Stage, Ripe Young.*—Section of head with brain *in situ*,	4 ,,
,,	2.	The same, with brain removed,	4 ,,
,,	3.	Under view of skull,	4 ,,
,,	4.	Upper view of skull,	4 ,,
,,	5.	Side view of skull,	4 ,,
,,	6.	End view of skull,	4 ,,
,,	7.	Lower arches; upper view,	4 ,,
XII.	1.	*Seventh Stage, continued.*—Endocranium (the investing bones removed); side view,	4 ,,
,,	2.	The same; lower view,	4 ,,
,,	3.	The same; upper view,	4 ,,
,,	4.	First Section of a series taken in a vertically transverse direction; this is through the external nostrils,	$6\frac{2}{3}$,,
,,	5.	Second Section.—Through prenasal cartilage,	$6\frac{2}{3}$,,
,,	6.	Third Section.—Through fore part of nasal pouches and nasal entrance,	$6\frac{2}{3}$,,
,,	7.	Fourth Section.—Through the fore part of the nasal pouches behind the nostrils,	$6\frac{2}{3}$,,
,,	8.	Fifth Section.—Through most perfect part of nasal floor,	$6\frac{2}{3}$,,
,,	9.	Sixth Section.—Through nasal roof and rudiments of inferior turbinals,	$6\frac{2}{3}$,,
,,	9*a*.	Part of same, showing ethmo-palatines,	$26\frac{2}{3}$,,
,,	9*b*.	Part of same from other side of section,	$26\frac{2}{3}$,,

Plate.	Fig.		No. of Times Magnified.
XII.	10.	Seventh Section.—Through fore part of eyeballs, . . .	$6\frac{2}{3}$ diam.
XIII.	1.	*Same series continued.*—Eighth Section.—Through hind part of eyeballs, ...	$6\frac{2}{3}$,,
,,	2.	Ninth Section.—Through back of orbits, ...	$6\frac{2}{3}$,,
,,	3.	Tenth Section.—Through pituitary space, ...	$6\frac{2}{3}$,,
,,	4.	Eleventh Section.—Through fore part of ear-sacs, . . .	$6\frac{2}{3}$,,
,,	5.	Twelfth Section.—Through widest part of ear-sacs and tympanic cavity, ...	$6\frac{2}{3}$,,
,,	5*a*.	Part of same, ...	$26\frac{2}{3}$,,
,,	6.	Thirteenth Section.—Through occipital arch, ...	$6\frac{2}{3}$,,

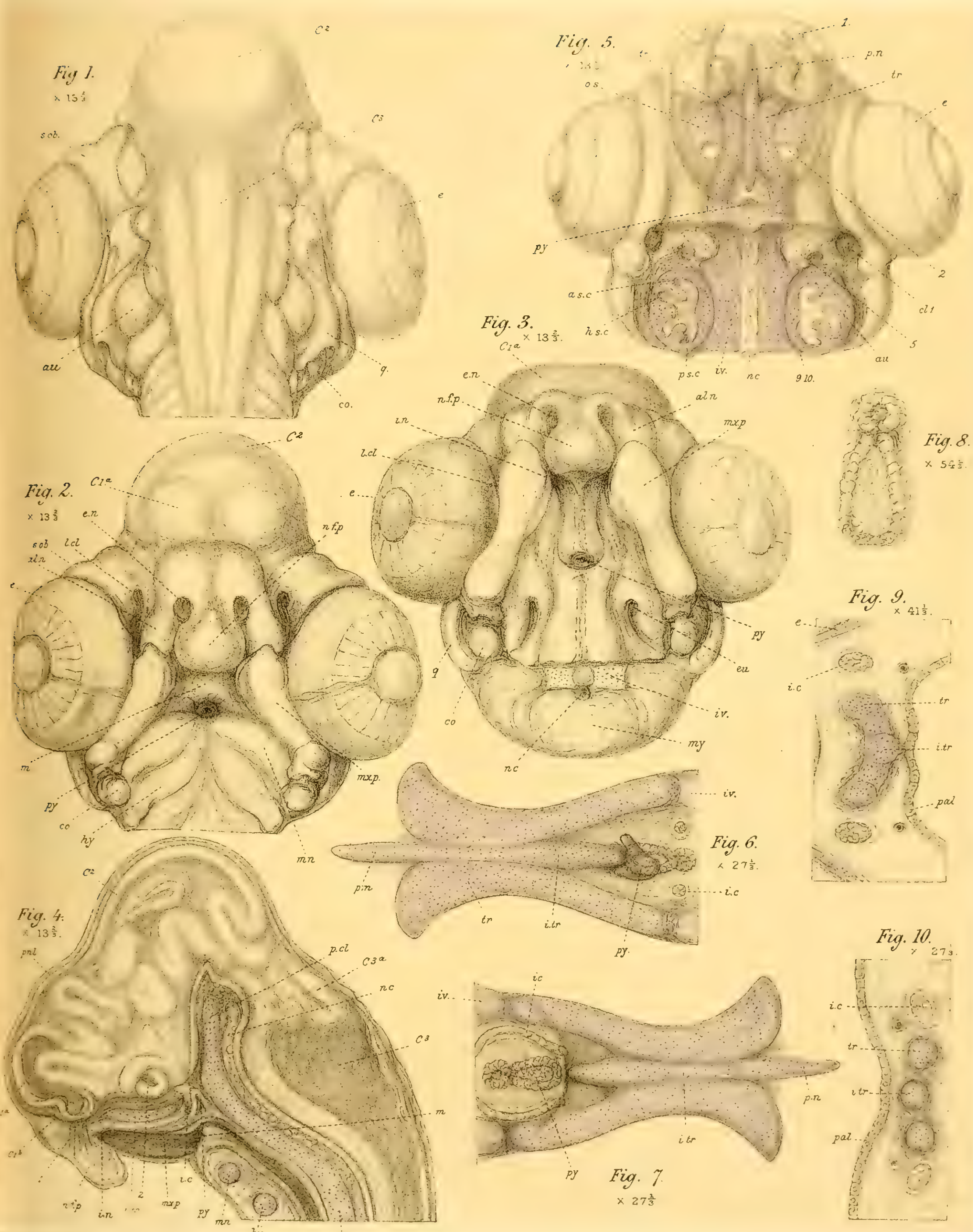


W. K. P. del. ad nat.

F. Huth, Lith. Edin.

CHELONE VIRIDIS.

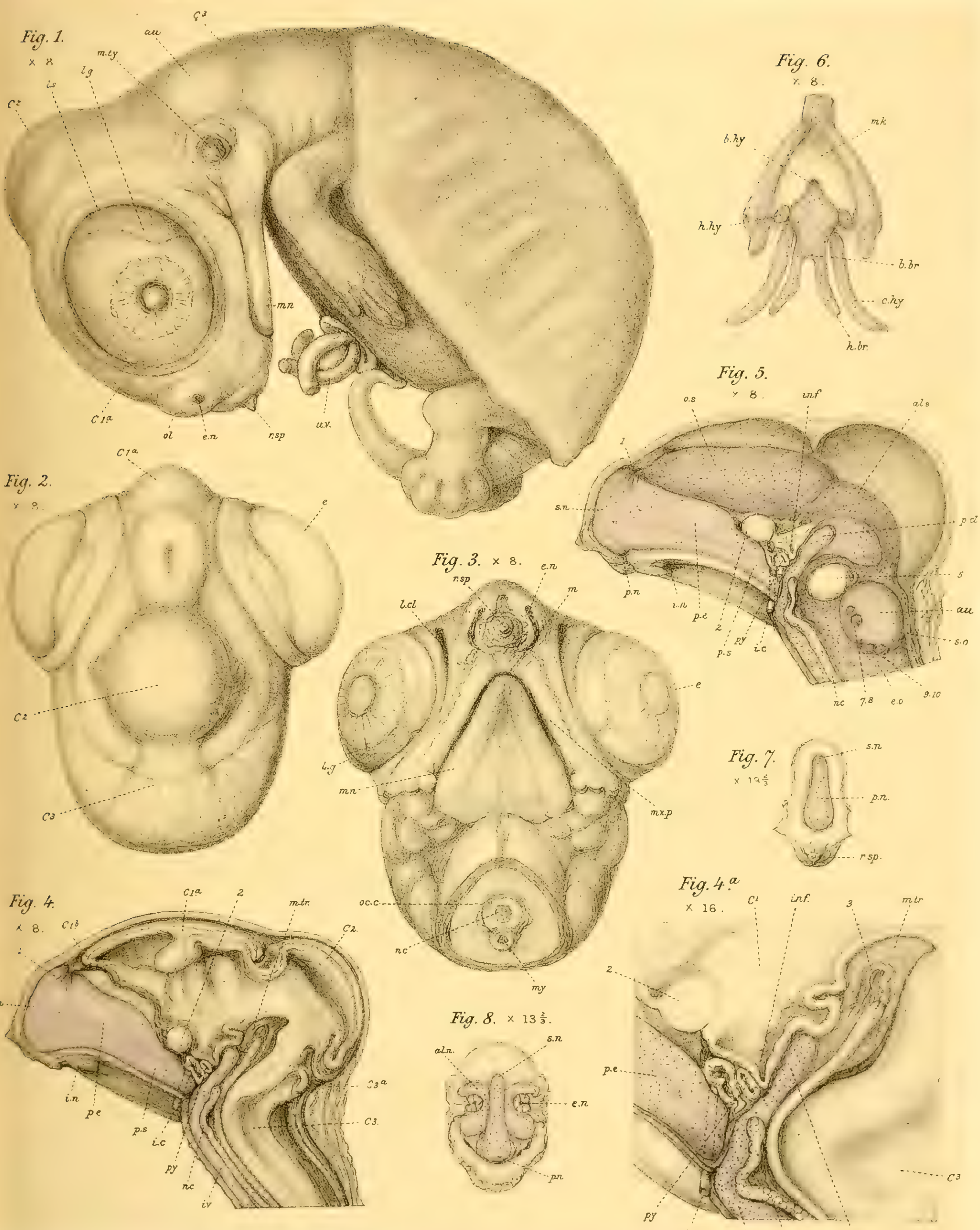
Fig. 1. 1st Stage. 2. 2nd Stage. 3 – 6. 3rd Stage. 7. 4th Stage.



P. Huth, Lith.r Edin.r

CHELONE VIRIDIS.

4.th Stage.

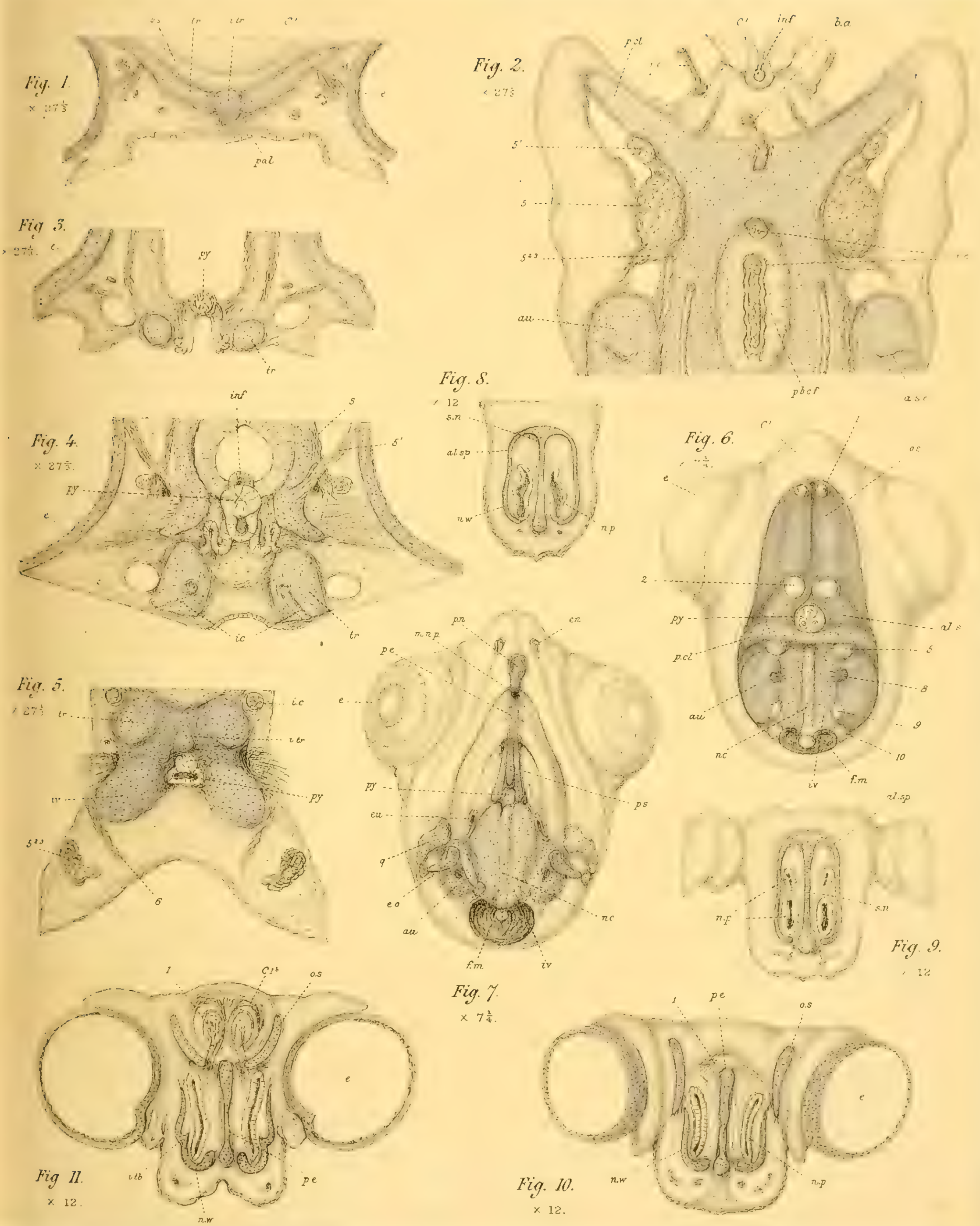


W. K. P. del. ad nat.

F. Huth, Lith^r Edin^r

CHELONE VIRIDIS.

4th Stage.

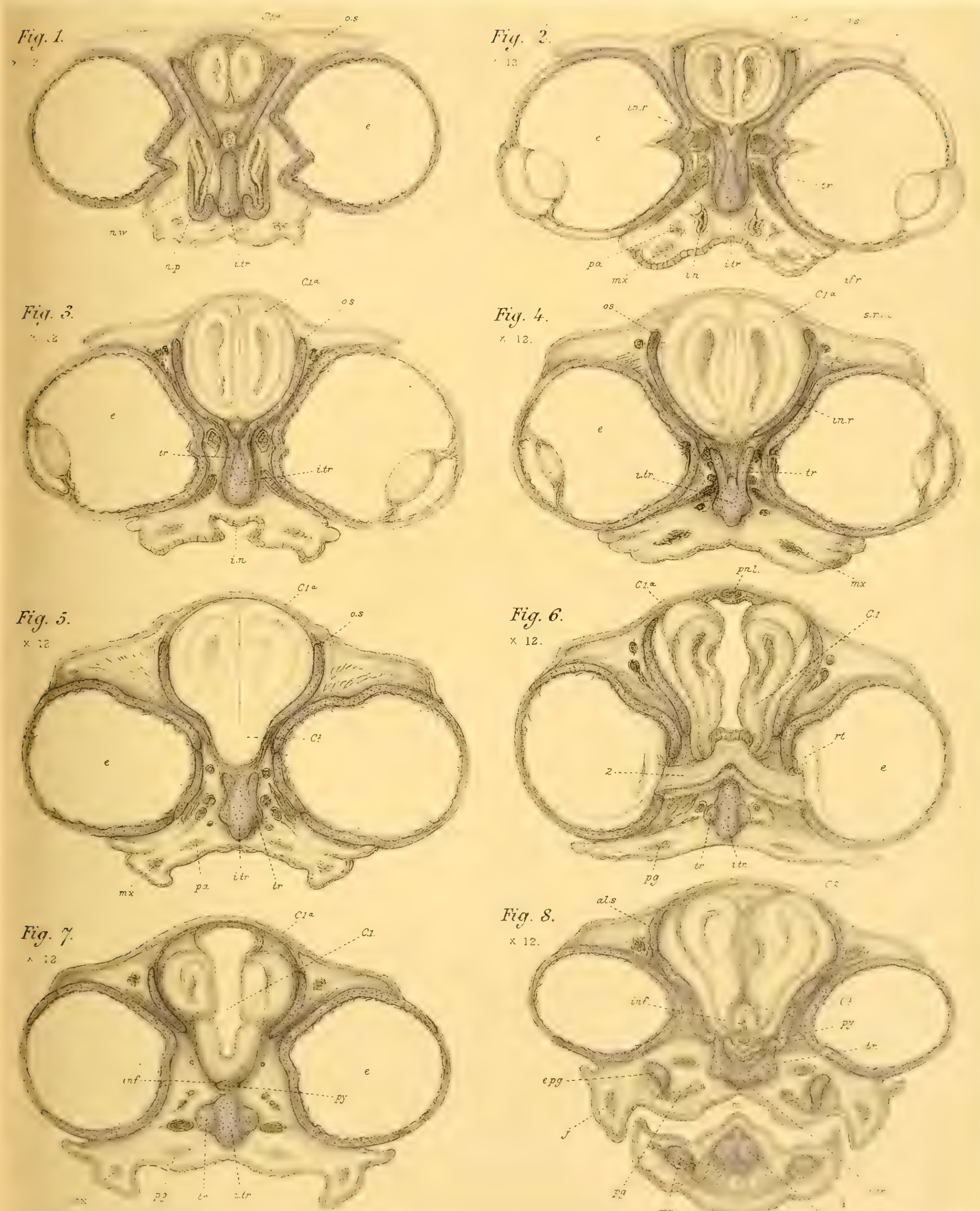


W.K.P. del ad nat

F. Huth, Lith^r Edin^r

CHELONE VIRIDIS.

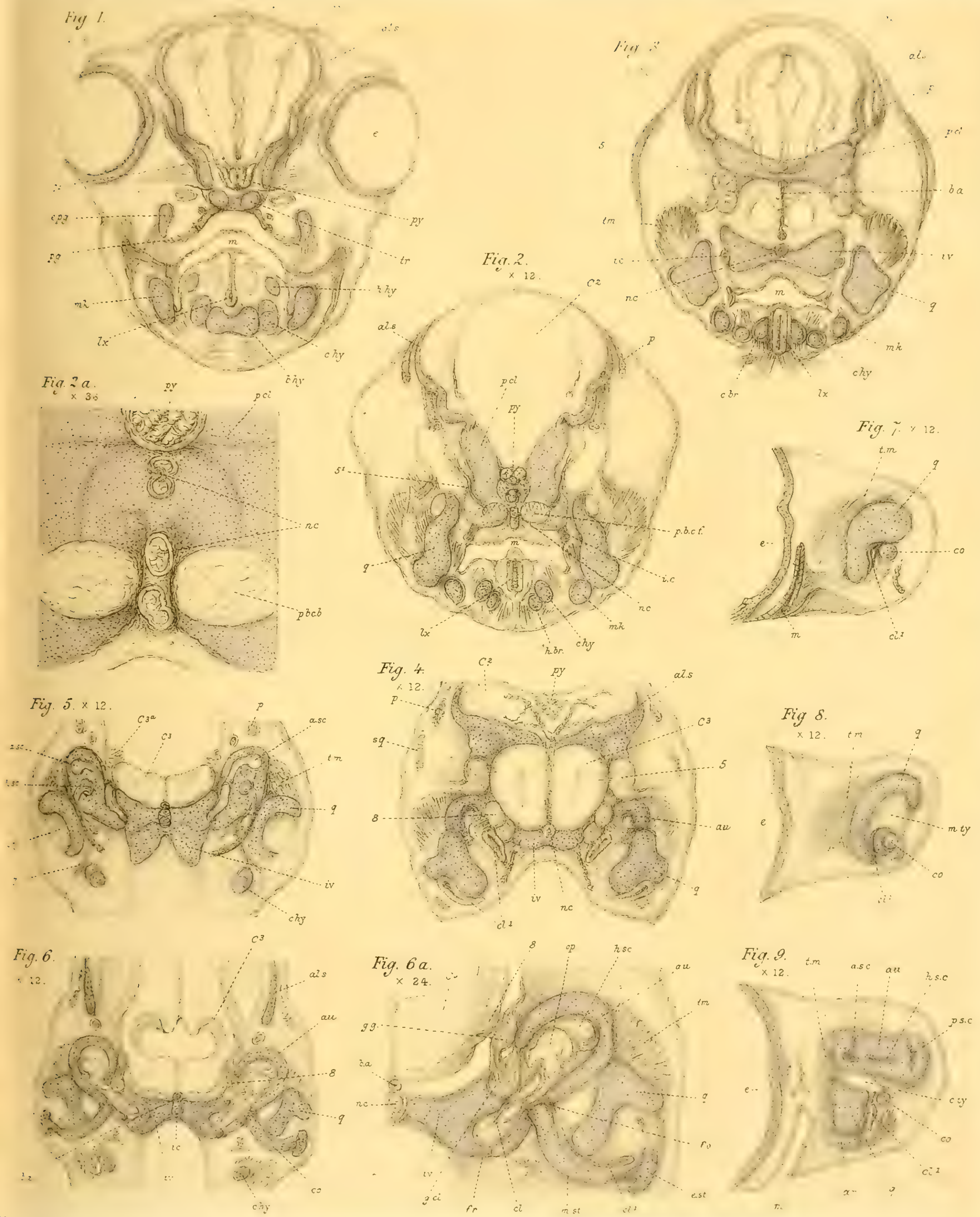
Fig.^s 1-5. 4^th Stage. 6-11. 5^th Stage.



W. K. P. del. ad nat.

CHELONE VIRIDIS.

5th Stage.

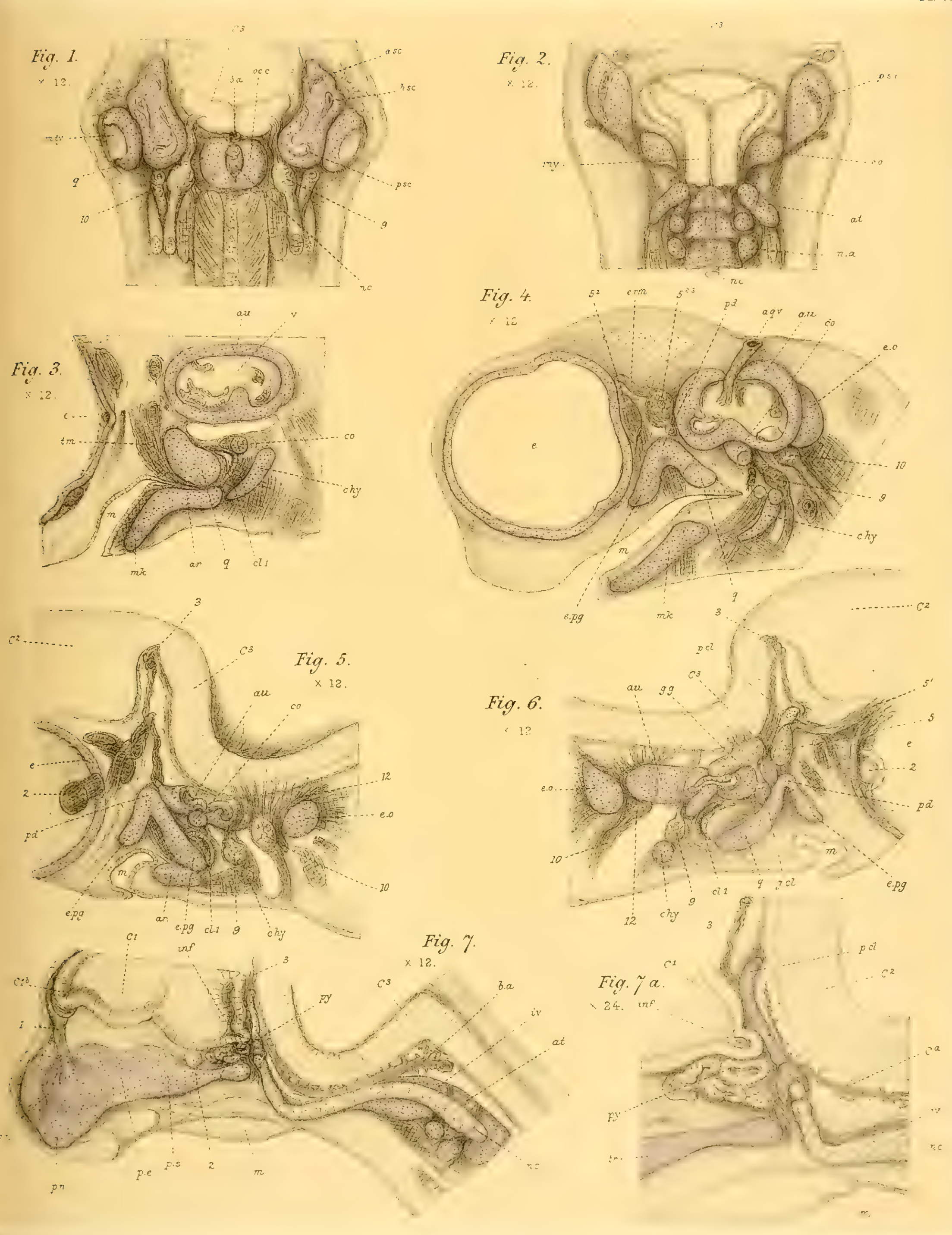


W.K.P. del. ad nat.

F. Huth, Lith.r Edin.r

CHELONE VIRIDIS.

5th Stage.



W.K.P. del. ad nat.

F. Huth, Lith.r Edin.r

CHELONE VIRIDIS.

5th Stage.

Fig. 1.
× 12

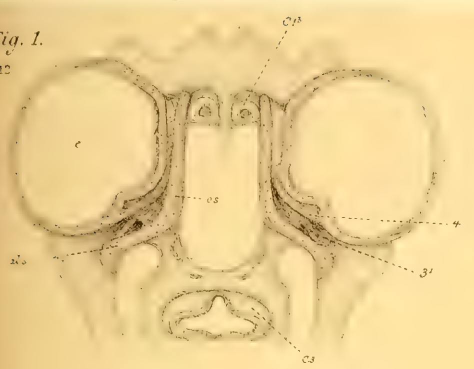


Fig. 2.
× 12.

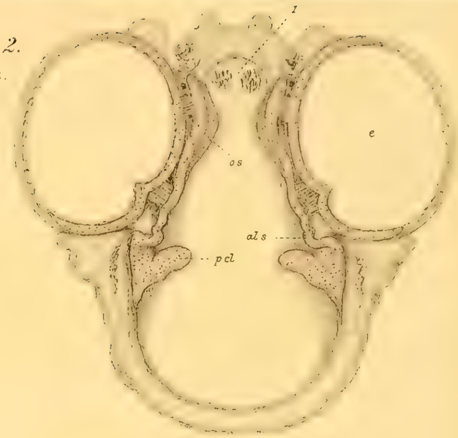


Fig. 3.
× 12

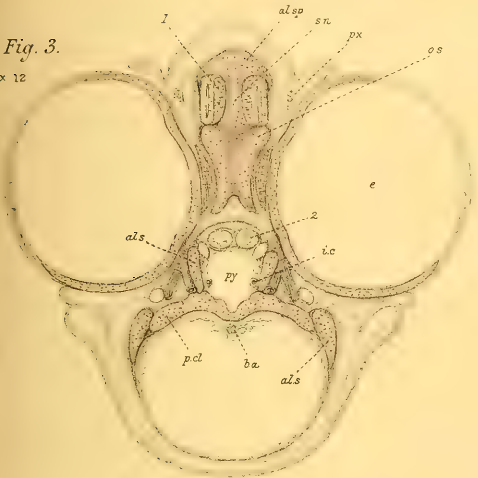


Fig. 4.
× 12.

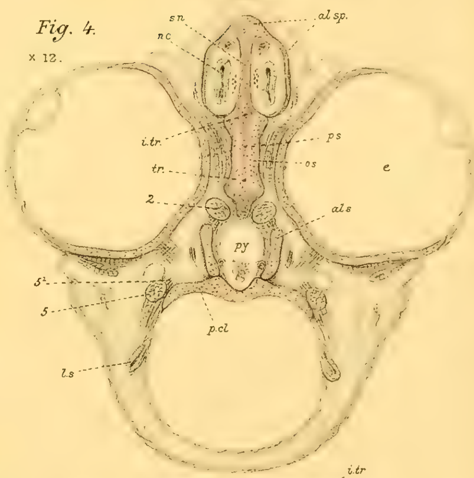


Fig. 5.
× 12.

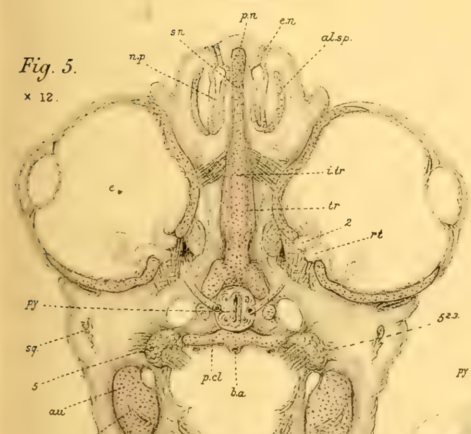
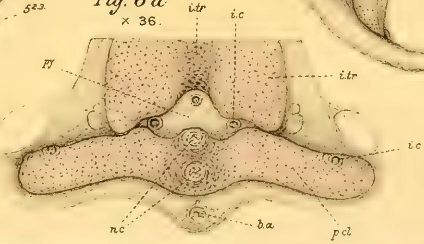


Fig. 6.
× 12.

Fig. 6 a
× 36.

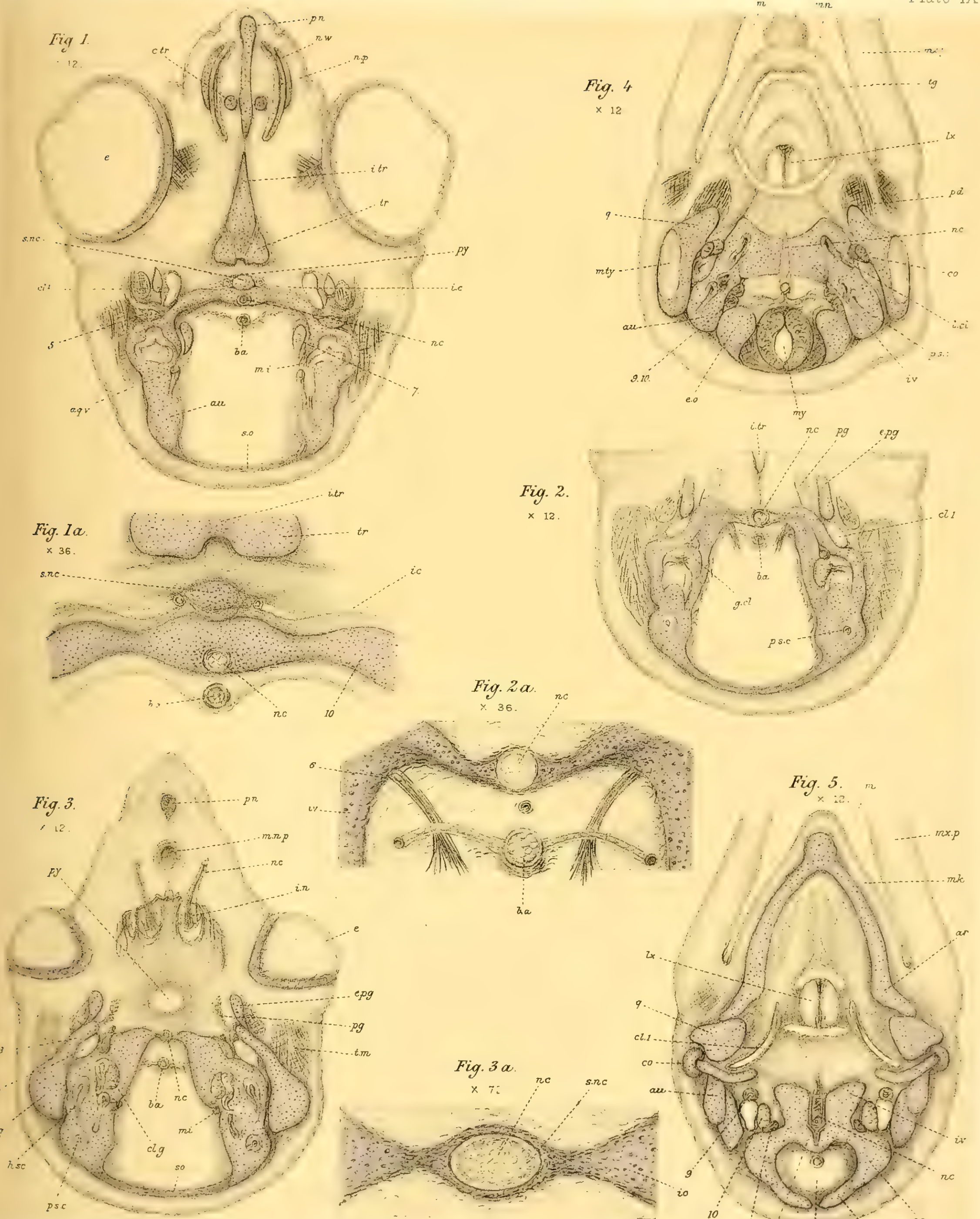


K.P. del. ad nat.

F. Huth, Lith. Edin.

CHELONE VIRIDIS.

5th Stage.

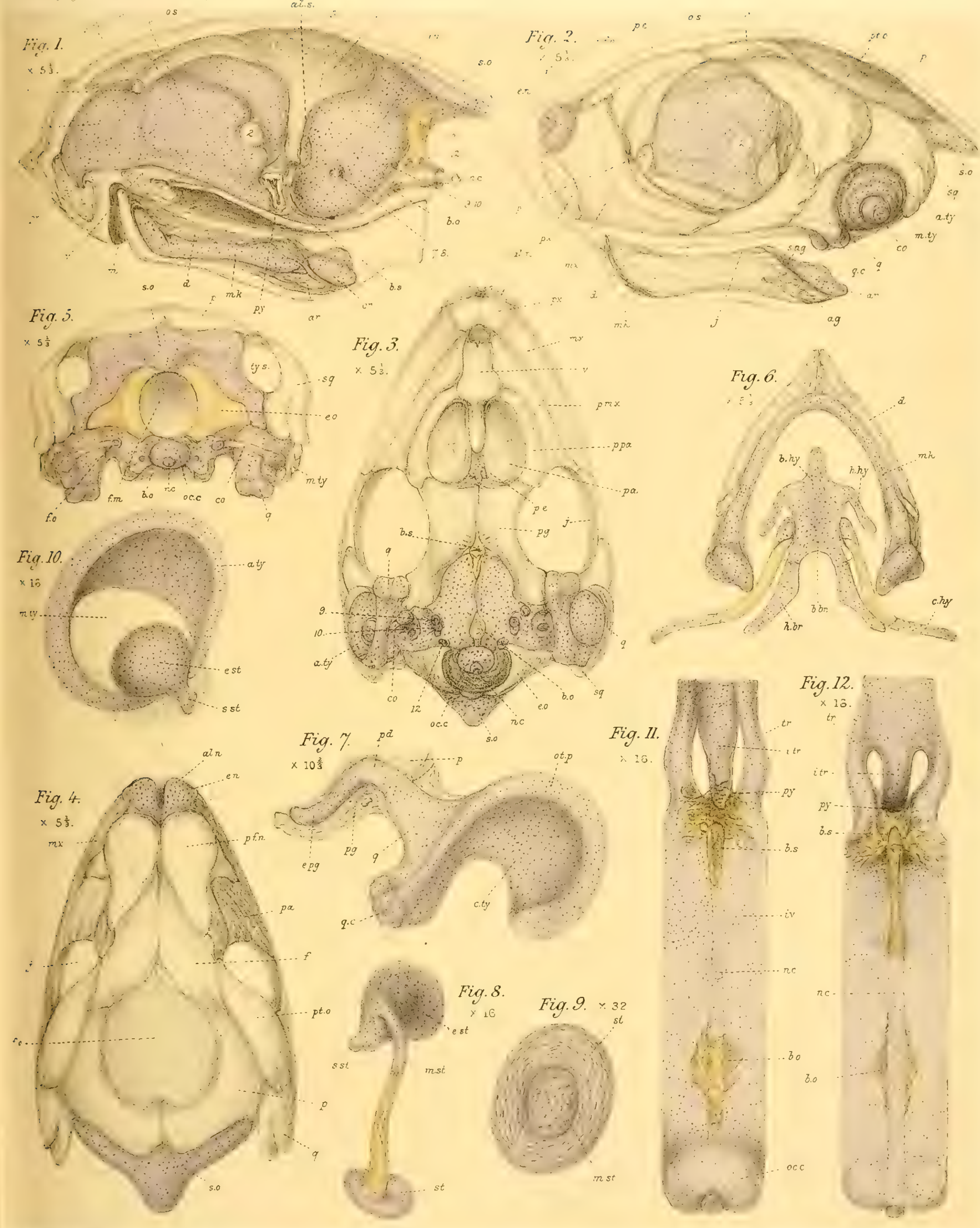


W. K. Parker, del. ad nat.

F. Huth, Lith.r Edin.r

CHELONE VIRIDIS.

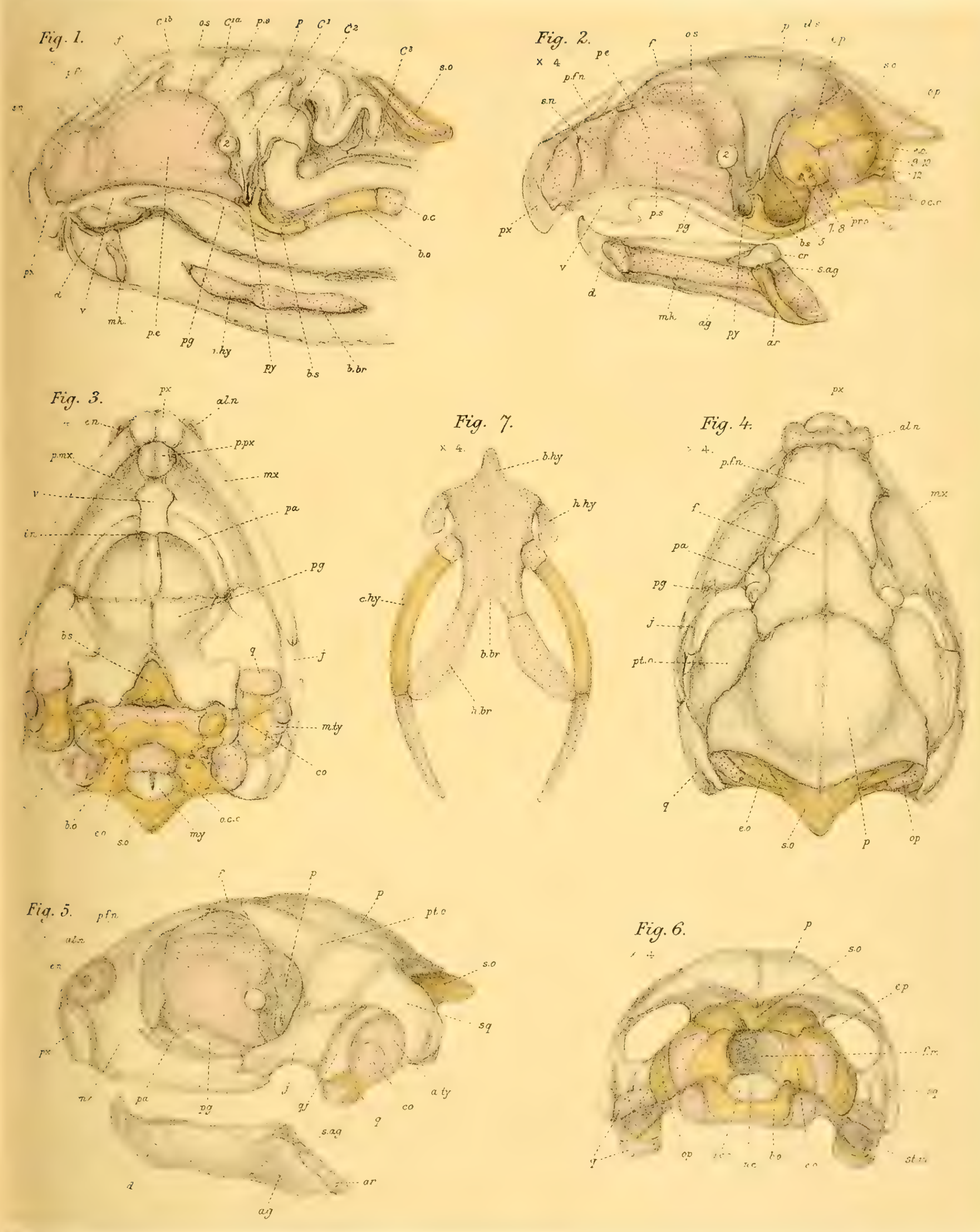
5th. Stage.



F. Huth, Lithʳ Edinʳ

CHELONE VIRIDIS.

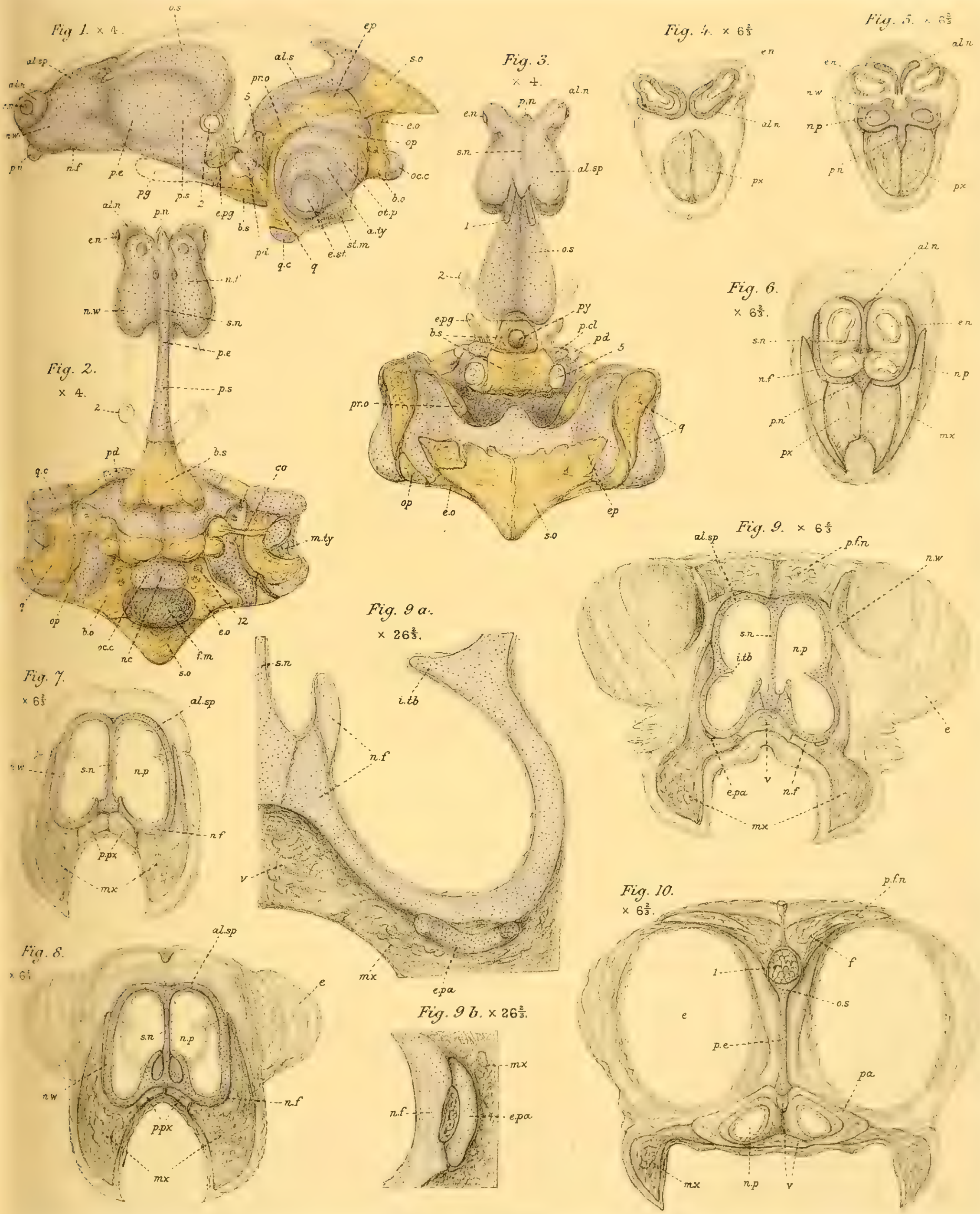
6.ᵗʰ Stage.



F. Huth, Lith^r Edin^r

CHELONE VIRIDIS.

7th Stage

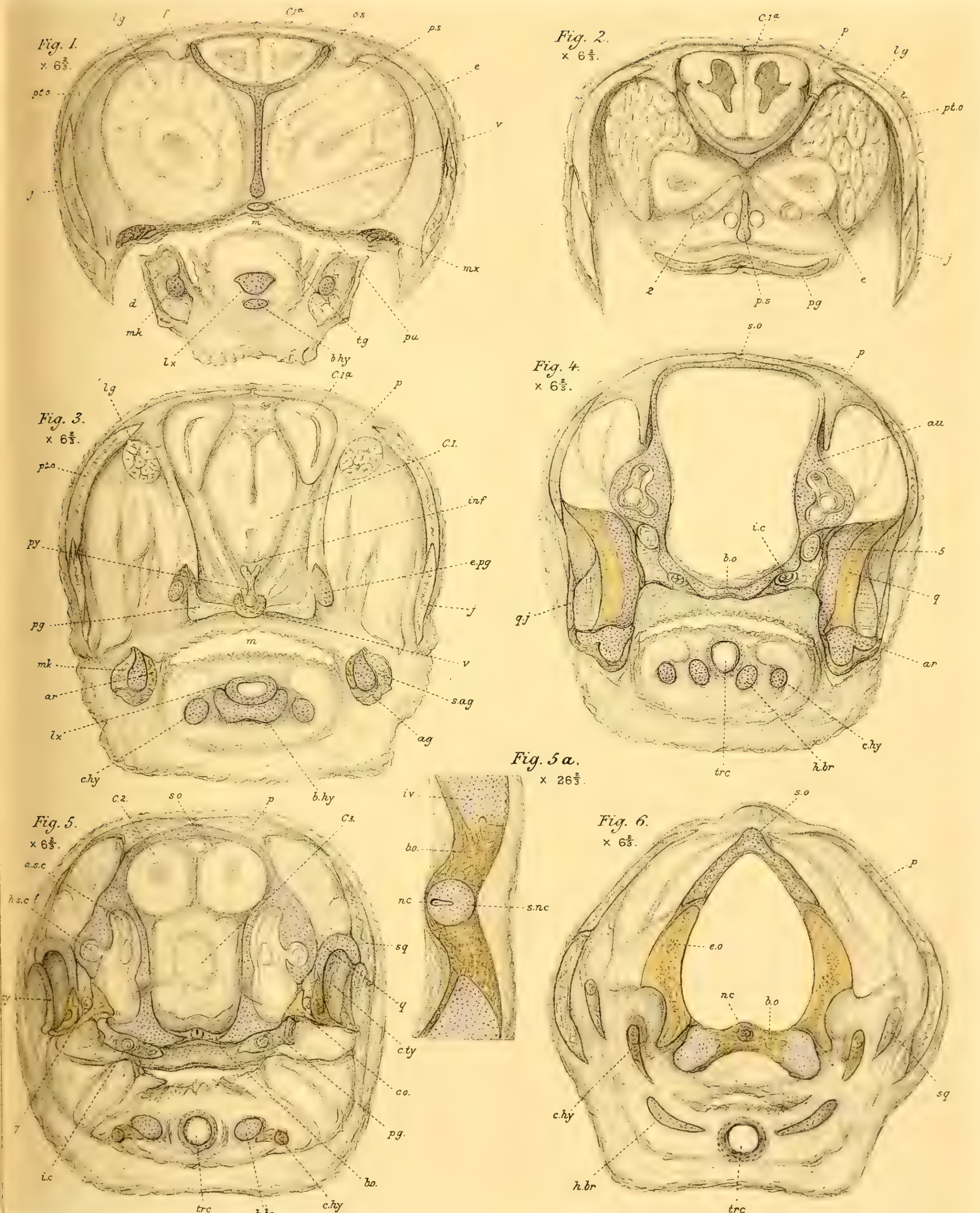


W. K. P. del. ad nat.

F. Huth, Lith^r Edin^r

CHELONE VIRIDIS.

7^th Stage.



W. K. P. del. ad nat.
F. Huth, Lith^r Edin^r

CHELONE VIRIDIS.

7th Stage.

THE

VOYAGE OF H.M.S. CHALLENGER.

ZOOLOGY.

REPORT on the SHORE FISHES procured during the Voyage of H.M.S. Challenger in the Years 1873–1876. By ALBERT GÜNTHER, M.A., M.D., Ph.D., F.R.S., Keeper of the Department of Zoology in the British Museum.

THE collection of Fishes procured during the voyage of H.M.S. Challenger has been divided into two distinct series. The first consists of the specimens collected near the coast at the various localities at which the Expedition landed: they are littoral forms, to which a few obtained from fresh waters have been added. The second consists of the specimens obtained in the open sea, either from the surface or from the bottom; these are the Pelagic and Deep-sea forms.

The present part treats of the fishes of the first series only. Care has been taken to enumerate all the species collected, with a statement of the localities where they were captured; but descriptions of a part only are given—viz., of those which proved to be new or but imperfectly known. This series consists of 1400 specimens, representing 520 species, of which 94 are new to science; and, throughout, bears evidence of having been collected with judgment and discrimination; the specimens being carefully labelled, and, with but few exceptions, in an excellent state of preservation.

The opportunities of collecting shore fishes were dependent on many circumstances, and, consequently, the faunæ of the various localities are very unequally represented in this collection, as must needs be the case in all voyages of discovery.

Therefore it seemed to me far more useful to students of ichthyology, as well as to travellers, to arrange the materials geographically, than to follow a strictly systematic order. Indeed, in adopting this plan I have found a precedent in J. R. Forster's Descriptiones Animalium, which contains the zoological results of Cook's Voyage

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round the Globe in 1772–1774; to facilitate reference, however, to any particular species, I have added a separate systematic list of all the species collected.

The proportion of new species is larger than could have been anticipated, as most of the localities visited had been previously well searched by naturalists, and is much larger than is found in the majority of similar miscellaneous collections. The localities which yielded the most important results by the discovery not only of undescribed species, but also of those to which particular faunistic interest is attached, are, in the Atlantic, St Paul's Rocks, Ascension, and the mouth of the Plate River; in the Southern Ocean, Magellan Straits, Juan Fernandez, and Kerguelen Island; in the Pacific, Twofold Bay, the Arafura Sea, the Admiralty, Sandwich Islands, and Japan.

In accordance with the instructions received, a complete set of the series, including 661 specimens, especially the typical examples from which descriptions and figures have been taken, has been deposited in the British Museum.

CONTENTS.

I. THE FISH-FAUNA OF THE SHORES OF THE ATLANTIC.

A. TEMPERATE ZONE OF THE NORTH ATLANTIC.

Some shore fishes were collected by the Expedition at Madeira, and at two of the Cape Verde Islands, viz., St Vincent and St Jago. The Expedition stayed at the former place from February 2 to February 6, and on July 9; at St Vincent from July 27 to August 5; and at St Jago from August 7 to August 9, 1873; and on the return voyage in 1876 at St Jago on April 16, and at St Vincent from April 18 to April 26. The species collected at these places are comparatively few in number, and none of them of special interest; so that their simple enumeration will suffice. The shore fauna of the temperate zone gradually merges into that of the tropical zone, so that, whilst the Madeira fishes are almost purely Mediterranean, those of the Cape Verde Islands show a great admixture of West Indian species.

A single more northern species, obtained south of Halifax, Nova Scotia, is included in this series.

Anthias sacer, Bl., Madeira.
Sebastes kuhli, Bowd., Madeira.
Scorpæna scrofa, L., St Vincent.
Rhypticus saponaceus, Bl. Schn., St Vincent.
Beryx splendens, Lowe, Madeira.
Dactylopterus volitans, L., St Vincent.
Lichia glauca, L., St Jago.
Caranx crumenophthalmus, Bl., St Jago.
Argyriosus setipinnis, Mitch., Porto Praya, St Jago.
Galeoides polydactylus, Vahl., St Jago.
Sphyræna vulgaris, C. V., St Jago.
Mugil cephalus, Cuv., St Jago.
Blennius sanguinolentus, Pall., St Vincent.
Lepadogaster gouani, Barnev., St Vincent.
Scarus chrysopterus, Bl., St Vincent.
Hippoglossoides dentatus, Mitch., South of Nova Scotia. Station 49; 83 fathoms.
Rhomboidichthys podas, De la Roche, St Vincent.
Hemirhamphus vittatus, Val., St Jago.
Balistes forcipatus, Gm., St Vincent.
Monacanthus setifer, Benn., St Vincent.

B. TROPICAL ATLANTIC.

1. Surface Fishes collected at St Paul's Rocks.

The Expedition landed on these craggy rocks of the Mid-Atlantic on August 27, 1873, and the ship remained moored to the rocks till the 29th. The sea round them is described as abounding in fish, as is usual at such isolated localities. The fauna is composed of West Indian forms, with some of the species hitherto found at Ascension and St Helena; and I have thought it instructive to enumerate them separately, although evidently many more species might have been collected during a longer stay. It is not surprising that a distinct, and apparently undescribed, species of the widely spread genus *Holocentrum* should prove to be peculiar to this isolated locality.

Holocentrum sancti pauli, n. sp. (Pl. I. fig. A).

D. $\frac{11}{15}$, A. $\frac{4}{10}$, L. lat. 48, L. transv. $3\frac{1}{2}/8$. The height of the body is two-fifths of the total length (without caudal), the length of the head one-third; the interspace between the eyes is 5 in the latter (opercular spine included). The length of the snout is equal to the diameter of the eye, which is one-fourth of the length of the head; the maxillary does not reach to the vertical from the centre of the eye. Operculum, with a strong and thick triangular spine, and with denticulations beneath; præopercular spine broad, flattened, and cleft, or bifurcate at its extremity; its length is contained $3\frac{1}{2}$ times in that of the posterior edge of the præoperculum. The third and fourth dorsal spines are the longest, a little less than half the length of the head; soft dorsal rather elevated, more than half the height of the body; caudal deeply forked, the upper lobe much longer than the lower; third anal spine very strong, one-third of the height of the body. Ventral fins about three-fourths of the length of the head, terminating at a great distance from the anus; pectoral shorter than the ventrals. Uniform red. Length of specimen 16 inches.

Caranx ascensionis, Forst.
Glyphidodon saxatilis, L.
Cossyphus rufus, L.
Platyglossus cyanostigma, C. V.
Enchelycore nigricans, Bonnat.
Balistes buniva, Lac.

2. Surface Fishes collected at the Island of Ascension.[1]

On the return journey (April 1876) the Expedition remained several days at this locality, so that the naturalists succeeded in obtaining a rather interesting series of its

[1] [Many of the fishes in this list were collected by Dr Drew, R.N., and sent home to Mr Murray after the Challenger left.—C. Wy. T.]

surface fishes, adding to its fauna several forms which had escaped the notice of previous observers; the occurrence of *Blennophis webbi*, so far south, is a curious fact. Ascension, like St Helena, has several fishes which hitherto have not been found elsewhere ; but their distinctive characteristics are merely specific, not generic.

Carcharias obscurus, Les.
Serranus impetiginosus, M. and T.
Sargus argenteus, C. V.
Holocentrum longipinne, C. V.
Lichia glauca, L.
Caranx ascensionis, Forst.
Blennophis webbi, Val.
Antennarius multiocellatus, C. V.
Glyphidodon saxatilis, L.

Julis ascensionis, Q. and G.,

In specimens 3 inches and 4 inches in length, the sides are of very light colour, and traversed longitudinally by a dark purplish band proceeding from behind the operculum, above the pectoral fin to the root of the caudal. Dorsal with a black spot between the first three spines; the rest of the fin greenish along its basal portion, and with a blackish intramarginal band, the tips of the rays being whitish (in spirits). Anal greenish, with a bright coloured longitudinal band; caudal uniform light yellowish. In a specimen $5\frac{1}{2}$ inches long, there is a darker shade on the upper parts of the body, and no trace of the longitudinal band on the side; the coloration generally is much darker, and there is a vertical dark line on most of the scales; in other respects the coloration of the four specimens is similar.

Belone trachura, C. V.
Muræna moringa, Cuv.
Monacanthus scriptus, Osbeck.
Balistes vetula, L.
Balistes buniva, Lac.

3. St Thomas (West Indies) and the Coast of Brazil.

The naturalists of the Expedition had only a few opportunities of collecting shore fishes in this part of the Tropical Atlantic, viz., at St Thomas (March 24, 1873); off Pernambuco (September 10); and Bahia (September 14). Of these localities, the sea off Pernambuco, described in the List of Stations as No. 122, yielded some interesting novelties; the fishes were obtained by means of the trawl in depths varying from 32 to 400 fathoms, so that the exact depth could not be accurately ascertained for every species. However, as some of the species obtained on that occasion belong, or are closely allied, to well known genera of shore fishes, I have considered it safer to include these at least in the present series than to enumerate them among the deep-sea forms.

Bathyanthias, n. gen. (Percidæ).

Form of the body similar to that of *Anthias*. One dorsal fin with nine spines; anal with three; caudal truncated. Teeth in villiform bands, in the jaws, on the vomer and palatine bones, without canines. Tongue smooth. Præoperculum finely serrated, without projection. Scales of moderate size, very finely ciliated. Branchiostegals seven. Coast of Brazil.

Bathyanthias roseus, n. sp. (Pl. I. fig. B).

D. $\frac{9}{14}$, A. $\frac{3}{8}$, L. lat. 58, L. transv. $\frac{2}{18}$. The length of the head is nearly equal to the depth of the body, and one-third of the total length (without caudal). Eye as long as the snout, and two-sevenths of the length of the head; interorbital space flat, but much narrower than the orbit; maxillary extending to below the middle of the eye; the vomerine teeth form a triangular patch, the palatine bands being very narrow. Six series of scales on the cheek. Præoperculum very finely serrated on its posterior margin and with the angle rounded; operculum without spine. Caudal and anal fins scaly, but the soft dorsal scaleless. Dorsal spines rather feeble, the third being the longest, and about one-third of the length of the head; pectoral fin falciform, extending to the anal, and not quite so long as the head; ventrals only half as long. The lateral line ascends rapidly from its origin towards the spinous dorsal, and runs close to the upper profile, descending again behind the dorsal to the middle of the tail. Colour, uniform rose-coloured, with two faint lighter longitudinal bands. Length of specimen $4\frac{1}{2}$ inches. Station 122; 30 or 350 fathoms.

Centropristis annularis, n. sp. (Pl. I. fig. C).

D. $\frac{10}{12}$, A. $\frac{3}{7}$, L. lat. 60. Margin of the præoperculum rounded, without stronger spines at the angle; operculum with three spines. Reddish, with two incomplete black rings behind the eye, with a large, saddle-shaped spot on the back of the trunk, and with some small black dots on the dorsal fin. Off Pernambuco. Length of specimen 2 inches. Station 122; 30 or 350 fathoms.

Serranus apua, Bl., St Thomas.
Rhypticus arenatus, C. V., Bahia.
Mesoprion chrysurus, Bl., St Thomas.

Hæmulon chrysargyreum, Gthr., Fernando Noronha.
Priacanthus, sp., Station 126.
Pomacanthus paru, Bl., St Thomas.
Scorpæna plumieri, Bl., St Thomas.
Holocentrum longipinne, C. V., St Thomas.

Peristethus truncatum, n. sp. (Pl. II. fig. A).

D. $\frac{7}{19}$, A. 20, L. lat. 32. The length of the præorbital processes is contained twice and three-fourths in the distance between their extremities and the anterior margin of the orbit. Interorbital space deeply concave, with a depressed smooth groove along the middle; a minute spine on the base of each præorbital process, but no other on the upper surface of the snout; lower jaw with numerous barbels, the longest being fringed. The præopercular ridge does not extend beyond the hind margin of the bone, and is not produced into a spine; also the opercular ridge terminates in a short and truncated projection. Each scute of the body with a hooked spine. Each of the bony plates between the ventral fins is not quite twice as long as broad. Rose-coloured, with small irregular brownish spots on the upper parts. Length of specimen $6\frac{1}{2}$ inches. Coast of Pernambuco. Station 122; 30 or 350 fathoms.

Malthe vespertilio, L. Station 122; 30 or 350 fathoms.

Heliastes flavicauda, n. sp. (Pl. XXX. fig. D).

D. $\frac{13}{12}$, A. $\frac{2}{11}$, L. lat. 27, L. transv. $2\frac{1}{2}/9$. The height of the body is contained twice and one-third in the total length (without caudal); the diameter of the eye is a little more than one-third of the length of the head or than the width of the interorbital space. Dorsal spines of moderate strength and nearly equal in length; the length of the second anal spine is one-half of that of the head; caudal fin emarginate, with the lobes rounded. Sky-blue (in spirits) with purple reflexions; abdomen purplish; end of the tail and caudal fin yellow; a deep black spot superiorly on the axil of the pectoral. Length of specimen 3 inches. Coast of Pernambuco. Station 122; 30 fathoms.

Romboidichthys cornutus, n. sp. (Pl. II. fig. B).

D. 78, A. 62, L. lat. 48. This species differs from all the other species of the genus in having the lateral line anteriorly with a very slight obliquity only; there is no curve. The height of the body is one-half of the total length (without caudal), the length of the head a little less than one-third. Head higher than long, with the anterior profile straight; snout only half as long as the large eye, the diameter of which is two-fifths of the length of the head. Cleft of the mouth of moderate width; the maxillary extending beyond the front margin of the eye, which it equals in length. Interorbital space concave, scaly, its width being one-half of the longitudinal diameter of the eye. Lower eye a little in advance of the upper. Snout with three pointed projections in front of the upper eye (at least in the adult). None of the fin rays produced. Pectoral of the coloured side as long as the head, without snout. A series of distant large blackish spots along the basal half of the dorsal and anal fins; one or two similar spots on the basal half of the caudal, and on the terminal portion of the tail. Pectoral with two or three blackish transverse bands. In two very young specimens which appear to belong to the same species the eyes are very close together, and there are no tentacles on the snout. Length of specimen $1\frac{5}{8}$ to $3\frac{1}{2}$ inches. Coast of Brazil. Station 122; 30 or 350 fathoms.

Hippocampus guttulatus, Cuv. Station 122; 30 or 350 fathoms.

Hippocampus villosus, n. sp. (Pl. I. fig. D).

Dorsal fin with sixteen rays. Tubercles well developed, rather pointed, the most prominent provided with bundles of filaments; the whole upper surface, and especially the top of the trunk, covered with similar filaments; supraorbital spine slightly truncated, and with its anterior portion slightly detached; coronet of moderate height; the length of the snout is equal to the distance between the centre of the orbit and the gill-opening. Uniform light coloured. Length of specimen $2\frac{1}{4}$ inches. Off Bahia, in 7 to 20 fathoms. The figure represents the specimen twice its natural size.

Monacanthus occidentalis, Gthr. Station 122; 30 or 350 fathoms.
Ostracion quadricornis, L. Station 122; 30 or 350 fathoms.

4. Bermuda.

The marine fish fauna of Bermuda does not exhibit any peculiarity, by which it may be distinguished from that of the tropical Atlantic generally. No naturalist has paid more attention to it than Mr J. Matthew Jones, who has collected the fishes round this island for many years, and who has recently succeeded in obtaining several which hitherto had escaped observation. Mr G. Brown Goode has published (1876) a Catalogue of the Fishes of Bermuda, based chiefly upon the collections of the United States National Museum. Probably in the course of years all the species found round the West Indian Islands will be found to occur, at least occasionally, near Bermuda.

In the following list those recently observed by Mr Jones are enumerated with those collected by the naturalists of the Challenger:—

Carcharias obscurus.
Mustelus lævis.
Ætobatis narinari.
Holocentrum longipinne.
Serranus undulosus.
Serranus coronatus.
Rhypticus saponaceus.
Mesoprion chrysurus.

Apogon imberbis.
Priacanthus macrophthalmus.
Hæmulon xanthopterum.
Hæmulon macrostoma.
Gerres lefroyi.
Gerres gula.
Gerres jonesi.
Sargus capensis.
Sargus argenteus.
Pimelepterus bosci.
Chætodon capistratus.
Holacanthus tricolor.
Scorpæna plumieri.
Caranx caballus.
Caranx dentex.
Caranx carangus.
Caranx chrysos.
Trachynotus ovatus.
Trachynotus goreensis.
Acanthurus chirurgus.
Thynnus thunnina.
Coryphæna pelagica.
Coryphæna hippurus.
Nomeus gronovii.
Thyrsites prometheus.
Sphyræna picuda.
Mugil brasiliensis.
Malacanthus plumieri.
Gobius soporator.
Blennius crinitus.
Salarias vomerinus.
Regalecus gladius.
Fistularia serrata.
Aulostoma coloratum.
Pomacentrus rectifrænum.
Glyphidodon cœlestinus.
Platyglossus bivittatus.
Scarus catesbyi.
Pseudoscarus psittacus.
Pseudoscarus sanctæ crucis.
Brotula barbata.
Hemirhombus soleæformis.
Rhomboidichthys lunatus.
Saurus myops.
Saurus intermedius.
Saurus fœtens.
Fundulus bermudæ.
Belone hians.
Belone jonesi.
Exocœtus lineatus.
Exocœtus furcatus.
Albula conorhynchus.
Engraulis chærostomus.
Clupea macrophthalma.
Clupea thrissa.
Ophichthys acuminatus.
Myrophis punctatus.
Muræna miliaris.
Muræna maculipinnis.
Muræna sanctæ helenæ.
Syngnathus pelagicus.
Syngnathus jonesi.
Diodon maculatus.
Tetrodon rostratus.
Tetrodon spengleri.
Ostracion triqueter.
Ostracion trigonus.
Balistes maculatus.
Monacanthus aurantiacus.

Gerres lefroyi, Goode, Bermuda.

Diapterus lefroyi, G. Brown Goode, Am. Jour. Sc. and Arts, 1874, p. 123; Bull. U. S. Nat. Mus. No. 5, 1876, p. 39.
Gerres productus, Poey, Ann. Lyc. N. York, 1876, vol. xi. p. 59; O'Shaughnessy, Zool. Rec., 1877, vol. xiii. Pisc. p. 12.

Gerres jonesi, Gthr. (Ann. and Mag. Nat. Hist., 1879, vol. iii. pp. 150, 389).

D. $\frac{9}{10}$, A. $\frac{3}{7}$, L. lat. 49, L. transv. $5\frac{1}{2}/10$. The height of the body is two-sevenths of the total length (without caudal). Præorbital and præoperculum entire, the latter with the angle slightly rounded. The groove for the processes of the intermaxillaries does not extend to the vertical from the centre of the eye, is elongate, and entirely free from scales. The snout is as long as the eye, and equals the width of the interorbital space. The spines of the fins are slender, the second of the dorsal slightly exceeding half the length of the head, and being more than twice as long as the second of the anal fin, which is stoutish and shorter than the eye. Uniform silvery, from 6 to 9 inches long.

Sargus capensis, Smith, Bermuda.
Pimelepterus bosci, Lac., Bermuda.

Caranx caballus, Gthr., Panama, Bermuda.

Trachurus boops, Girard, U. S. Pac. R. R. Route, Fish., p. 108.
Caranx caballus, Gthr., Zool. Trans., vol. vi. p. 431.

This species is new to the West Indian fauna.

Fundulus bermudæ, Gthr. (Ann. and Mag. Nat. Hist., 1874, vol. xiv. p. 370), (Pl. XXXII. fig. B).

D. 14, A. 12, L. lat. 35, L. transv. 13. The height of the body is one-fourth of the total length (without caudal), the length of the head rather less than two-sevenths. Snout short, not longer than the eye, with the lower jaw ascending and projecting beyond the upper. The width of the interorbital space is contained twice and one-third in the length of the head, the diameter of the eye four times. The origin of the dorsal fin is opposite to the sixteenth scale of the lateral line, and midway between the root of the caudal and the præopercular margin. The first anal ray corresponds to the fourth or fifth of the dorsal fin. Anal fin much higher than long. Brownish-olive, with numerous indistinct dark greenish cross bands (in the male).

Of this species, of which the original specimen was sent by J. Matthew Jones, Esq., the Challenger collection contains a second. $2\frac{2}{3}$ inches in length. Brackish water, Bermuda.

Belone jonesi, Goode (Goode, Amer. Journ., April 1879, p. 340; Gthr., Ann. and Mag. Nat. Hist., 1879, vol. iii. pp. 151, 390).

D. 25, A. 22. The free portion of the tail is rather depressed, somewhat broader than deep, the lateral line terminating in a black-coloured keel. The length of the head is less than one-third of the total (without caudal); its upper surface is broad, flat, striated; frontal bones diverging behind, leaving a broad space between them which is covered by skin; this space tapers in front, and is closed between the orbits. Maxillary entirely hidden by the præorbital. Jaws and teeth strong; vomerine teeth none; tongue rough. The diameter of the eye is two-thirds of the width of the interorbital space, and two-fifths of the length of the postorbital portion of the head. Body stout, not much compressed. Pectoral fin as long as the postorbital portion of the head. Ventral fin midway between the root of the caudal and the eye. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a considerable distance from the root of the caudal. Caudal fin deeply lobed. Scales very small, irregular, and adherent. A single specimen, 3 feet long.

Syngnathus pelagicus, Osbeck. Gulf weed, South of Bermuda.

C. TEMPERATE ZONE OF THE SOUTH ATLANTIC.

1. Mouth of the Rio de la Plata.

The fishes of this river, as well as of the shores near its mouth, are very incompletely known, more so than those of the southernmost extremity of the Continent. Therefore, we may well expect considerable additions to be made by future explorers of this fauna; one-half of the species collected by the Challenger Expedition at this locality, on its homeward journey (February 25 and 26, 1876), have proved to be undescribed.

Raja platana, n. sp. (Pl. III.).

Snout long, produced, pointed, the width of the interorbital space being a little more than one-third of the distance of the eye from the end of the snout. The anterior profile (from the snout to the angle of the pectoral fin) is undulated. Width of the interorbital space less than the length of the eye and spiracle together. Mouth strongly curved. Teeth pointed, in about forty-eight series in the upper jaw. Distance between the nostril and the angle of the mouth two-thirds of the inter-nasal space. The outer pectoral angle is a right one. Distance between the two dorsal fins rather more than the length of the base of the first. Bands of minute asperities along each side of the snout, and along each superciliary edge. The remainder of the upper side is smooth, with the exception of the claw-like spines on the pectoral fin which are peculiar to the male sex. A series of small spines along the median line of the tail. Lower parts with large black pores symmetrically arranged. Upper parts uniform brownish, lower whitish.

Distance from the vent to the extremity of the snout, $13\frac{1}{2}$ inches; distance from the vent to the extremity of the tail, $11\frac{1}{2}$ inches; greatest width of the disk, 21 inches.

A single adult specimen has been obtained. 25 inches in length. Station 321. Riode la Plata; 13 fathoms.

Raja microps, n. sp. (Pl. IV., $\frac{2}{3}$ natural size).

A short-snouted species. The angle formed by the margins of the snout is obtuse, and the extremity does not project. The width of the interorbital space is much more than the length of the orbit together with the spiracle, and is contained twice and two-thirds in the distance between the eye and the end of the snout. Mouth very slightly curved; teeth obtuse, in about forty series in the upper jaw. The outer pectoral angle is rounded, but the margins would meet at a right angle. The two dorsal fins close together, separated by a spine only. Minute roughnesses on the snout, the interorbital space, along the median line of the back, and along the front margin of the pectoral fin. A single spine in the middle of the back, and a series of spines along the median line of the tail. The muciferous tubes behind the head are very conspicuous, and arranged like a fan on each side of the occiput; each opens by a pore. Uniform brown above, white below.

Distance of the vent from the extremity of the snout, $7\frac{1}{4}$ inches; distance of the vent from the extremity of the tail, $8\frac{1}{2}$ inches; width of the disk, 11 inches. Length of specimen, $15\frac{3}{4}$ inches.

The single specimen examined is a young male.

Rio de la Plata. Station 321; 13 fathoms.

An adult female (disk, 23 inches wide) received lately by the British Museum, from Buenos Ayres, has a single curved spine, with a broad base on each side, near the front margin, on a level with the spiracles.

Ancylodon atricauda, n. sp.

D. $\frac{8}{31}$, A. 12. The height of the body is somewhat less than the length of the head, which is one-third of the total (without caudal). Eye of moderate size, equal to the width of the interorbital space, and shorter than the snout. The maxillary does not extend to the posterior margin of the eye. Lower jaw projecting beyond the upper, the mandibular teeth being outside the upper lip. The canine teeth are comparatively smaller than in *Ancylodon jaculidens*. Vertical fins scaly. The middle caudal rays prolonged into a narrow pointed lobe. Scales small, silvery, with the caudal lobe black. Length of specimen, 5 inches. Mouth of the Rio de la Plata. Station 321; 13 fathoms

Otolithus guatucupa, C. V. Station 321; 13 fathoms.

Micropogon ornatus, n. sp. (Pl. VII. fig. A).

D. $9/\frac{1}{32}$, A. $\frac{2}{8}$, L. lat. 63. The height of the body is one-third of the total length (without caudal), the length of the head one-fourth. Dorsal profile very concave on the neck. Diameter of the eye two-thirds of the length of the snout, two-elevenths of that of the head, and rather more than one-half of the width of the interorbital space. A series of small barbels from the interoperculum to the lower lip, where they are most crowded. Præoperculum without spines at the angle. Dorsal and anal spines very feeble. Pectoral as long as the head. There are eight or nine scales in a transverse series between the first dorsal and the lateral line. A large, round, black spot at the origin of the lateral line. Body with six alternately broad and narrow blackish cross-bands. Pectoral blackish along the middle. Length of specimen, $8\frac{3}{4}$ inches. Mouth of the Rio de la Plata. Station 321; 13 fathoms.

Micropogon undulatus, L., Monte Video.
Percophis brasilianus, Q. and G. Station 322; 21 fathoms.
Prionotus punctatus, Bl. Station 322; 21 fathoms.

Læmonema longifilis, n. sp. (Pl. VII. fig. B).

D. $\frac{6}{55}$, A. 45. Head, and particularly the snout, depressed; the latter with the upper jaw much projecting, not quite twice as long as the eye, the diameter of which is nearly one-sixth of the length of the head. The head is one-fourth of the total length (without caudal). Cleft of the mouth rather wide, the maxillary not quite extending to the hind margin of the eye. Teeth of the jaws in villiform bands; vomer, with two groups of teeth, separated in the middle by a toothless interspace. Barbel about as long as the eye. Interorbital space wider than the eye. Operculum without spine. Scales very small. Fins naked. The first dorsal commences above the root of the pectoral, and is narrow and high, the third ray being prolonged into a long filament. The second dorsal rather high, but lower than the body. Caudal rounded. Pectoral nearly as long as the head, without snout. Ventral reduced to a bifid filament, the lower ray being much longer than the upper, almost half as long as the body. Body brownish; the dorsal filament, the outer margins of the vertical fins, and the long ventral filament black. Length of specimen, $7\frac{1}{2}$ inches. Mouth of the Rio de la Plata. Station 321; 13 fathoms.

Aphoristia ornata, Lac. Station 321.
Arius commersoni, Lac., Monte Video.
Engraulis olida, Gthr. Station 321.

2. Cape of Good Hope.

The few fishes collected at the Cape do not offer any particular interest.

(a.) *Marine Species.*

Chorisochismus dentex, Pall., Simon's Bay.
Tetrodon honckeni, Bl., Cape of Good Hope (the poison-fish of Simon's Bay).
Bdellostoma cirrhatum, Forst., Simon's Bay.

(b.) *Fresh-water Species.*

Spirobranchus capensis, C.V., Rivers at Wellington and Cape Town.
Barbus afer, Ptrs., Rivers at Wellington and Cape Town.
Barbus, sp. (?), in bad state; River at Cape Town.

II. THE FISH-FAUNA OF THE ANTARCTIC OCEAN AND OF SHORES ABUTTING ON IT.

The study of the Antarctic surface fish-fauna, and its comparison with that of the Arctic Regions, is one of the most instructive portions of zoogeography. The abundance of fish-life appears to decrease in the same proportion towards both Poles. The forms peculiar to the Antarctic are analogous to those of the North; thus the Cottoids of the North are represented by the *Notothenicæ*, *Chænichthys*, &c., of the South, the Salmonoids by the *Haplochitonidæ;* yet there is no such relation between the representative forms as might be considered to be genetic. The resemblance is rather an external one, indicated by the general form of the body, structure and development of the fins, presence of an adipose fin, &c. Beside those fishes which are peculiar to the Antarctic, some other forms well developed in the North, but nearly or entirely disappearing between the Tropics, reappear, as *Sebastes*, *Agonus*, *Spinax*, *Myxine*, differing but little from their northern congeners.

The Expedition obtained the fishes belonging to this fauna at two points.

A. KERGUELEN ISLAND AND PRINCE EDWARD'S ISLAND.

Except a flat fish from Prince Edward's Island, the specimens were collected on the north-eastern side of Kerguelen Island, between the 7th and 31st of January 1874. Nearly all we know of the fishes of this island is due to the Naturalists of the Antarctic Expedition under Captain Ross, and to those of the "Transit of Venus" and Challenger Expeditions. The number of species known is very small, the following three only having been described, besides those obtained on the present Expedition :—

Notothenia coriiceps, Richards (Voy. "Erebus" and "Terror").
Notothenia purpuriceps, Richards (Voy. "Erebus" and "Terror").
Notothenia antarctica, Peters (Berl. MB., 1876, p. 837).

Raja eatoni, Gthr. (Phil. Trans., vol. clxviii. p. 166).

Of this species a female has been found by the naturalists of the Challenger. It differs very little from the male found by Mr Eaton; but, of course, the claw-like spines on the pectoral fin are absent. The lower part of the body is entirely white, that of the tail blackish.

Raja murrayi, n. sp. (Pl. V.).

The angle formed by the margins of the snout slightly obtuse, with the extremity somewhat projecting. The width of the interorbital space equals the length of the orbit. The distance between the outer margins of the nostrils is rather less than their distance from the extremity of the snout. Teeth pointed in both sexes, more so in the male than in the female. Outer pectoral angle obtusely rounded. A curved spine in front and behind on the superciliary edge. From four to six similar spines placed in a triangle in the middle of the back. Tail with a median series of from sixteen to eighteen spines, but with only very small ones on the sides. The spines, as far as described at present, are found in both sexes, in the old as well as in the young. In the male the greater part of the upper side of the body is smooth, with the usual patch of recurved spines near the pectoral angle. In the female the whole of the upper surface is covered with scattered small stellate asperities, which, in young specimens, are still more numerous than in the old. The caudal series of spines is, in the young, generally continued forward to the dorsal spines. Upper parts brown, with rounded darker and lighter spots. A large yellowish ocellus edged with blackish on each side of the back of the male.

Two adults (male and female) and three young specimens were collected. The former are $17\frac{1}{2}$ inches long, the tail measuring 9 inches. The greatest width of the disk is 11 inches. Kerguelen Island.

Zanclorhynchus, n. gen. (Scorpænidæ).

Body compressed, oblong, without scales, covered with minute asperities. Bones of the head armed with spines; præorbital not armed. Snout pointed; mouth very protractile, lateral, narrow, toothless. Two dorsal fins. Ventral far behind the pectoral, the pubic bones being much prolonged. Gill-opening reduced to a narrow slit above the root of the pectoral.

Zanclorhynchus spinifer, n. sp. (Pl. VIII. fig. A).

D. $\frac{9}{12}$, A. 10, P. 9, V. $\frac{1}{5}$. The height of the body is somewhat less than the length of the head, which is one-third of the total (without caudal). A great part of the surface of the head is bony. Spines are developed, (1) above the nostril, (2) above the hinder half of the eye, (3) above the præoperculum, (4) on the suprascapula, (5) below the hinder half of the orbit, (6) on the humerus, above the base of the pectoral. Of these spines the second, fourth, and fifth are the strongest. Eye large, two-sevenths of the head, and rather shorter than the snout.

The dorsal fin commences on the neck with a short spine. All its spines are strong, the third being the longest, as high as the body. The soft dorsal is well separated from, and lower than, the spinous. Caudal subtruncated. Pectoral with narrow base, somewhat shorter than the head. Ventral inserted midway between the vent and root of the pectoral, extending beyond the vent, and with the spine two-thirds as long as the longest ray. All the soft rays of the fins are simple. Body and vertical fins yellowish, broadly marbled with black. Length of specimen, $3\frac{1}{2}$ inches. Kerguelen Island (in trawl).

Chœnichthys rhinoceratus, Rich., Kerguelen.

Notothenia cyaneobrancha, Richards (Voy. "Erebus" and "Terror," Fish., p. 7, pl. iv.; Gthr., Fish., vol. ii. p. 261). Obtained by dredge.

Notothenia mizops, n. sp. (Pl. VIII. fig. D).

D. 4–5/35, A. 34, L. lat. 60. The length of the head is one-fourth of the total (without caudal); the height of the body two-ninths. The crown of the head is covered with minute scales to between the eyes, the snout and præorbital being scaleless. Eye large, one-third of the length of the head in young specimens, and two-sevenths in adults. Interorbital space extremely narrow; operculum with a short spine behind. Ventral long, extending sometimes as far back as the fourth anal ray. Body with two series of large irregular partly confluent blackish spots; cheek with two oblique streaks. First dorsal with a black spot. Vertical fins with bands of blackish dots, oblique on the dorsal and anal, and transverse on the caudal.

This species is distinguished from all its congeners from Kerguelen Island by having an eye of the same large size as *Notothenia squamifrons*. Length of specimens, $1\frac{1}{2}$ to 6 inches. Off Christmas Harbour, and Howes Foreland; 120 fathoms.

Notothenia squamifrons, n. sp. (Pl. VIII. fig. C).

D. 5/35, A. 32, L. lat. 70. The length of the head is two-sevenths of the total (without caudal); the height of the body two-ninths. The upper surface of the head to the foremost part of the snout and the præorbital are entirely covered with scales, but in the smaller specimen the scales on the præorbital are less distinct than in the adult. Eye large, two-sevenths of the length of the head; interorbital space flat, scaly, rather narrow, one-half of the vertical diameter of the eye. Ventral long, extending to the third or fourth anal ray. Body with irregular broad brown transverse bands; cheek with two oblique streaks. First dorsal nearly entirely black; caudal immaculate. This species is distinguished from *Notothenia tessellata* by the much greater size of its eye. Length of specimens, 4 to 6 inches. Kerguelen Island. Obtained by the dredge.

Notothenia acuta, n. sp.

D. 6/31, A. 30, L. lat. ca. 75. Head low, elongate, with pointed snout, its length being two-sevenths of the total (without caudal); the height of the body one-sixth. Head covered above with small scales nearly to the nostrils, the snout and præorbital being scaleless. Eye large, two-sevenths of the length of the head; interorbital space extremely narrow. Ventral extending to vent. Head and body marbled with blackish; cheek without streaks. Dorsal rays with blackish dots; caudal with cross-bands of blackish spots; anal white. Length of specimen, 2½ inches. Kerguelen Island. Obtained in trawl.

Notothenia marionensis, n. sp.

D. 7/29, A. 25, L. lat. 50. Head rather low, with pointed snout, its length being two-sevenths of the total (without caudal); the height of the body is two-elevenths of the same. Scales strongly ctenoid. Head covered above with small scales nearly to the nostrils; the snout, the præorbital, and the lower half of the cheek and operculum being naked. Eye of moderate size, equal to the length of the snout, and a little more than one-fourth of the length of the head; interorbital space narrow. Ventral not extending to the vent; pectoral reaching the third or fourth anal ray. Upper parts greenish, with subtessellated blackish spots along the side of the body; fins indistinctly dotted with greyish, a blackish spot at the base of the upper pectoral rays. Length of specimen, 3⅓ inches. Marion Island; 50 to 75 fathoms.

Harpagifer bispinis, Forst. Off Marion Island; 50 to 75 fathoms.
This species occurs also at Kerguelen Island, Cape Horn, and Falkland Islands.

Murænolepis, n. gen. (Gadidæ).

Body compressed, elongate, covered with epidermoid productions which are lanceolate, intersecting each other at right angles, like those of a fresh-water eel. Vertical fins confluent, no caudal fin being discernible; an anterior dorsal fin is represented by a single filamentous ray; ventral fins narrow, composed of several rays. A barbel. Jaws with a band of villiform teeth; palate toothless. Gill-openings rather narrow, extending from the lower part of the root of the pectoral round the isthmus, the gill-membranes being confluent and not attached to the isthmus. Gills four. Air-bladder in the posterior half of the abdominal cavity, with a pneumatic duct, with rather stiff walls, and glandular internal surface. Peritoneum deep black. Kerguelen Island.

Murænolepis marmoratus, n. sp. (Pl. VIII. fig. B).

Body compressed, its height equals the length of the head, and is contained five and a half to five and three-quarter times in the total length. Head compressed like the body, higher than broad, its greatest width being three-fifths of its length. Interorbital space slightly convex, equal in width to the diameter of the eye, which is rather less than one-fourth of the length of the head. Snout obtuse, rounded, as long as the eye, the upper jaw overlapping the lower. Cleft of the mouth rather oblique, the maxillary extending to the vertical from the centre of the eye. Barbel shorter than the eye. No teeth on the vomer. Nostrils immediately before the eye. Operculum rounded, without point. Branchiostegals five, the second with a process anteriorly at its root, directed downwards. Dorsal filament as long as the eye. Vertical fins continuous, of uniform height, and enveloped in a membrane on to which the epidermoid productions extend; the dorsal filament is just above the root of the pectoral, immediately before the commencement of the fin. Pectoral rounded, longer than the postorbital portion of the head. Ventral fins narrow, composed of five rays, the two outer ones much the thickest, and produced into filaments, the second ray being the longest, and about two-thirds the length of the head. The distance of the vent from the head exceeds the length of the latter. Reddish, finely marbled with brown; fins of a lighter colour and with a transparent margin. Length of specimen, $3\frac{1}{4}$ and 6 inches.

Lepidopsetta, n. gen. (Pleuronectidæ).

Mouth rather narrow; jaws and dentition very feeble, but nearly equally developed on both sides. Eyes well developed, on the left side, the lower somewhat in advance of the upper. The dorsal fin commences in front of the eye. Pectorals none, or quite rudimentary. Lateral line single, straight. Scales very small. The entire head, and even the eyelids, are covered with minute scales.

Lepidopsetta maculata, n. sp. (Pl. XXX. fig. C).

D. 118, A. 98. The height of the body is contained twice and one-sixth in the total length (without caudal), the length of the head thrice and two-thirds. The eyes are large, one-third of the length of the head. The feeble maxillary extends to below the front margin of the eye. Teeth minute, apparently in a single series. Scales strongly ctenoid on both sides of the body. All the fin-rays are scaly. Dorsal and anal fins low. Pectoral entirely absent on the blind side, and represented by a small rudiment only on the coloured; ventrals separate from each other and from the anal fin. Brown, body and fins covered with rounded irregular darker spots. Length of specimen, $5\frac{1}{4}$ inches. Off Prince Edward's Island. Station 145; 310 fathoms.

B. MAGELLAN STRAITS AND FALKLAND ISLANDS.

The Fish-Fauna of Magellan Straits, to which must be joined that of the Falkland Islands and of the littoral archipelago on the western side of the extremity of the South American continent, bears a thoroughly antarctic character, closely resembling that of Kerguelen Island. Although it has been well worked as lately as the year 1867 by Dr R. O. Cunningham in his "Notes on the Natural History of the Strait of Magellan," it is still very far from being completely known, as may be seen from the large proportion of novel forms discovered by the Naturalists of the Challenger Expedition, who dredged at thirteen stations (Stations 304 to 316), between December 31, 1875, and February 3, 1876.

Scyllium chilense, Guich.

Having examined some specimens preserved in spirits in the Challenger collection, I am able to correct two errors in my former description, which was drawn up from dried specimens. The nasal valve is provided with a cirrus which, however, does not extend to the lip; and the teeth of the lower jaw have more or less distinct lateral cusps. Gray's Harbour, Messier Channel.

Spinax granulosus, n. sp. (Pl. II. fig. C).

This species is distinguished especially by the structure of its skin, which is finely granulated, the granules being serially arranged on the tail, where they appear rather in the form of minute spinelets than in that of granules. The space between the nostrils and the median line of the lower side of the snout, the circumference of the mouth, the base of the fins, and the back of the tail, are naked. The snout is much produced, the symphysis of the lower jaw being midway between the end of the snout and the root of the pectoral; snout very obtuse in front, with the front nostril opening forward. The first dorsal fin shorter than the second, midway between the second and the spiracle. Second dorsal spine three times the size of the first, not much lower than the fin. The length of the base of the second dorsal is one-third of the distance between the two fins. Pectoral truncated behind, extending backwards nearly to the first dorsal. Ventral extending to below the middle of the second dorsal. Black; hind margins of all the fins white. South-west coast of South America. Length of specimen (male), $10\frac{1}{2}$ inches. Station 305; 120 fathoms.

Raja brachyura, n. sp. (Pl. VI.).

A short-snouted species. The angle formed by the margins of the snout is slightly obtuse, and the extremity does not project. The width of the interorbital space is more than the length of the orbit together with the spiracle, and but little less than one-half of the distance between the eye and the end of the snout. Mouth nearly transverse. Teeth pointed, in about thirty-five series in the upper jaw. Tail remarkably short and stout. The outer pectoral angle is rounded, and the margins would meet at an obtuse angle. The two dorsal fins are very close together. The upper part of the head and of the pectoral, and the back are covered with minute spines. A series of conical spines along the median line of the back and tail, the spines on the back being smaller and less constant than those on the tail. Brown, marbled with darker and lighter.

	Male.	Female.
Distance of the vent from the extremity of the snout, .	$14\frac{1}{2}$ inches.	18 inches.
Distance of the vent from the extremity of the tail, .	$12\frac{3}{4}$,,	$14\frac{1}{2}$,,
Width of the disk, ...	$18\frac{1}{2}$,,	25 ,,
Total Length, ...	$27\frac{1}{4}$,,	$32\frac{1}{2}$,,

Magellan Straits and west of them. Station 313; 55 fathoms. Station 314; 70 fathoms.

Psammobatis rudis, Gthr. (Pl. X.).

(?) *Raja scobina*, Phil. Wiegm. Arch., 1857, p. 270.

This species, described by me from a very young example, attains a much more considerable size, a male, $11\frac{1}{2}$ inches long, being still far from being mature. With age the disk ceases to be as perfectly circular as is observed in young specimens, its anterior margins becoming more rectilinear. A very short and thin rostral appendage in front of the disk is present in all examples. Beside the median series of small thorns on the tail of very young examples, there are developed two other similar series on each side of the back of examples more advanced in age, and they are continued along each side of the tail, which thus is armed with a triple series. The tail of the larger specimens shows a distinct terminal fin, which, however, is small and confluent with the second dorsal. Beside the dark spots, white spots are more or less numerous on the disk and upper parts of the ventrals; they are more numerous in very young than in older examples.

Figures A and B represent our largest male, and C the typical specimen of the natural size. Length of specimens $3\frac{1}{2}$ to $11\frac{1}{2}$ inches. Off Cape Virgins. Station 313; 55 fathoms.

Sebastes oculatus, C. V. Station 306; 345 fathoms. Station 307; 147 fathoms. Porto Bueno.

Agonus chiloensis, Jen., Port Famine; 10 to 15 fathoms.

Aphritis gobio, Gthr. (Pl. IX.).

Dr Cunningham has already had the opportunity of examining fresh examples (Trans. Linn. Soc., vol. xxvii. p. 469), and supplemented my original description (Ann. and Mag. Nat. Hist., 1861, vol. vii. p. 88), which was drawn up from dry skins. In the large, beautifully-preserved specimens collected by him and the naturalists of the Challenger, there is especially noticeable the great height of the dorsal fins, which exceeds that of the body. A short stout tentacle, which is often fringed, occupies the supero-posterior angle of the orbit, and other smaller tentacles are arranged in a series along the lower part of the side of the trunk and tail. Dr Cunningham states the colours, when fresh, to be—above, dusky brown; sides paler, blotched with brown and orange-yellow; under surface of head, breast, and belly orange-yellow. Length of specimens, 6 to $18\frac{1}{2}$ inches. Porto Bueno Station 307; 147 fathoms. Tom Bay, Messier Channel. Port Famine, Station 312; 10 to 15 fathoms.

Eleginus maclovinus, C. V. Gray Harbour, Messier Channel. Port Stanley.

Notothenia longipes, Steindachner (Wien. S. B., 1876, vol. lxxii. p. 70, fig. 7).

The following specimens agree well with the description and figure given by Steindachner, but I count from 67 to 70 scales along the lateral line:—Length of specimens 3 to 7 inches. Station 306, Messier Channel; 345 fathoms. Station 312, Port Famine; 10 to 15 fathoms. Station 313, off Cape Virgins; 55 fathoms.

Notothenia elegans, n. sp. (Pl. XI. fig. C).

D. 6/33, A. 31, L. lat. 53. The length of the head is one-fourth of the total (without caudal), the height of the body one-seventh. The entire head is scaleless. Snout shorter than the eye, which is two-sevenths of the length of the head; interorbital space very narrow. Ventrals rather longer than the pectorals, and as long as the head, without snout, extending to the second anal ray. There are only two series of scales between the lateral line and the dorsal fin. Light brownish, with large transverse dark spots; the second dorsal with four series of small blackish spots; the first dorsal with the top salmon coloured; the other fins without distinct ornamentation. Length of specimen, $3\frac{5}{8}$ inches. Off Cape Virgins; 55 fathoms.

Lycodes macrops, n. sp. (Pl. XI. fig. B).

The length of the head is a little more than that of the trunk and a little less than one-fifth of the total. Eyes large, two-sevenths of the length of the head, and longer than the snout which is broad, with the upper jaw overlapping the lower. Teeth in bands of moderate width, subequal in size; a small patch of teeth on the vomer and a few teeth anteriorly on the palatine bones. More or less shallow grooves along the infraorbital and the mandible. Gill-opening of moderate width. The dorsal commences above the posterior portion of the pectoral; length of the pectoral one-half of that of the head; each ventral reduced to a short simple filament. Yellowish, with nine broad dark brown bands across the upper half of the fish, separated from one another by very narrow interspaces of the ground colour. The cross-bars are lighter in the centre, subocellated, and extend on to the dorsal fin. A brown band runs from the snout through the eye to the end of the operculum; throat and abdomen blackish. Length of specimen, 5 inches. Station 309; 40 to 140 fathoms.

Merluccius gayi, Guich.

Merlus gayi, Guichen. in Gay, Chile, vol. ii. p. 328; Ichth., lam. 8, fig. 2.
Merluccius gayi, Gthr., Fish., p. 346.
Merluccius australis, Hutton.

D. 10/43-44, A. 43. New Zealand, Coast of Chile to Straits of Magellan. Gray Harbour, Messier Channel.

Macruronus novæ-zealandiæ, Hect.

Coryphænoides novæ-zealandiæ, Hect., Trans. N. Z. Inst., vol. iii. p. 136, pl. xviii. fig. 1.
Macruronus novæ-zealandiæ, Gthr., Zool. Record, vol. viii. p. 103; Hutton, Fish. New Zealand, fig. 79.

This species was hitherto known from New Zealand and Tasmania; its reappearance at the southern extremity of the American continent, therefore, is quite what may have been expected. Tom Bay, Messier Channel.

Thysanopsetta, n. gen. (Pleuronectidæ).

Body oblong; head small; cleft of the mouth of moderate width, the length of the maxillary being more than one-third of that of the head. Dentition nearly equally developed on both sides; teeth villiform, in bands; palatine and vomerine teeth none. Dorsal fin commencing above the front margin of the eye. Eyes on the left side, the upper but little in advance of the lower, both separated from each other by a narrow, flat, scaly interspace. Margin of the gill-opening of the coloured side fringed. Scales small, adherent, ctenoid, more distinctly so on the coloured side than on the blind. Lateral line straight. Straits of Magellan.

Thysanopsetta naresi, n. sp. (Pl. XI. fig. A).

D. 87, A. 59. The height of the body is two-fifths of the total length (without caudal), the length of the head one-fifth; snout rather shorter than the eye, the diameter of which is two-sevenths of the length of the head; mouth oblique, the maxillary of the left side not quite extending to below the middle of the eye. The dorsal fin terminates at a short distance from the caudal, the rays being rather short. Caudal rounded. The left pectoral is scarcely longer than the right, and as long as the postorbital portion of the head; the left ventral is opposite to the right; a conspicuous fleshy lobe behind the left ventral, opposite to the commencement of the anal. Brown, indistinctly mottled with darker, all the rays of the vertical fins finely dotted with brown. Length of specimens, 6 and 7 inches. Off Cape Virgins; 55 fathoms.

Haplochiton zebra, Jen., Stream at Gray Harbour, Messier Channel. Lake at Porto Bueno. Port Stanley, Falkland Islands.

Myxine australis, Jen., Grapler Harbour, Messier Channel. Port Chirrucha, Straits of Magellan.

III. THE FISH FAUNA OF THE TEMPERATE ZONE OF THE SOUTH PACIFIC.

A. VALPARAISO AND JUAN FERNANDEZ.

During the month (November to December, 1875) the Challenger stayed at these localities, several undescribed shore fishes were obtained. The fishes of Juan Fernandez have scarcely been touched, and those known are chiefly such as are caught for food. Dr Steindachner has recently described several in a paper which will be quoted hereafter. The fauna of Chile and Juan Fernandez might be described, without much exaggeration, as a mixture of European and New Zealand forms; of the fishes mentioned here two being identical with, and four representative of, European species.

Acanthias blainvilli, Risso.

This common species of the Mediterranean seems to be widely spread in the temperate seas of the Southern Hemisphere. The British Museum possesses specimens from the Cape of Good Hope, Tasmania, and New Holland.

Specimens from Juan Fernandez have been noticed as *Squalus fernandinus* in Molina (Hist. Chile, p. 194), and as *Spinax fernandezianus* in Gay's Chile (Zool., vol. ii. p. 365); Dr Steindachner has described it as *Acanthias fernandinus* in Wien. S. B., 1875, vol. lxxi. p. 466. The distinctive characters given by the latter author are, in my opinion, quite insufficient for the specific discrimination of the Juan Fernandez specimens.

Female with fœtus, preserved in salt. Juan Fernandez.

Polyprion kneri, Steindachner (Wien. S. B., 1875, vol. lxxi. p. 443).

D. 10 $\frac{1}{12}$, A. $\frac{3}{8}$. The height of the body is contained four and a half, the length of the head nearly three times in the total length. Snout pointed, the lower jaw projecting beyond the upper; head entirely covered with scales, with the exception of the lips which are naked. Intermaxillary band of teeth broader than that of the lower jaw, and interrupted in the middle. An oval patch of villiform teeth on the tongue. Operculum with two points, the lower of which is the termination of the straight, moderately raised, and smooth opercular ridge. A median rough bony ridge on the hinder part of the head superiorly. Dorsal spines moderately strong, shorter than the rays, the eighth the longest. Caudal emarginate. Scales small. Juan Fernandez. Length of specimen, 24 inches.

Scorpæna thomsoni, n. sp. (Pl. XII.).

D. 11 $\frac{1}{9}$, A. $\frac{3}{5}$, P. 16, L. lat. 42. The height of the body is contained twice and two-thirds in the total length (without caudal), the length of the head, twice and a half. Head nearly entirely naked; interorbital space very concave and narrow, the two ridges at its bottom being slightly prominent, divergent behind, and passing into the anterior nuchal spines; nuchal fossa shallow, square; supraorbital tentacles moderately developed; spines of the head strong and compressed. The third and fourth dorsal spines are the longest, and nearly as long as the second of the anal, about two-fifths of the length of the head. A band of palatine teeth. Reddish, marbled with darker; all the fins light coloured, scantily spotted. Length of specimen, 10½ inches. Juan Fernandez.

Haplodactylus punctatus, C. V., Valparaiso.
Chilodactylus monodactylus, Carmich., Juan Fernandez.
Thyrsites atun, Euphrasen., Valparaiso.
Trachurus trachurus, L., Valparaiso.

Caranx georgianus, C. V., Juan Fernandez.

Caranx chilensis, Gay; Steindachner, Wien. S. B., 1875, vol. lxxi. p. 459.

Latilus jugularis, C. V., Valparaiso.

Trigla picta, n. sp. (Pl. XIII. fig. A).

D. 7/11, A. 12. Scales exceedingly small. Præorbital spines short, only half as long as the eye; humeral spines extremely long and strong, as long as the eye; præopercular spines rudimentary, the others of medium size. Interorbital space concave, equal in width to the diameter of the eye. Dorsal spines strong, of moderate length; the pectoral reaches to the seventh anal ray. Lateral line not spiny. The whole body (with the exception of the abdomen) and all the fins with deep black round drops. Length of specimen, $10\frac{3}{4}$ inches. Juan Fernandez.

Umbrina reedi, n. sp. (Pl. XIII. fig. B).

D. $9/\frac{1}{24}$, A. $\frac{2}{9}$, L. lat., 60 *ca*. The height of the body is one-third of the total length (without caudal), and somewhat more than the length of the head; the diameter of the eye is two-thirds of the length of the snout, which equals the width of the interorbital space which is very convex; the intermaxillary extends beyond the middle of the orbit; barbel very short. Dorsal spines rather strong; anal spine very strong, one-third of the length of the head. The pectoral fin does not extend to the vent, and is two-thirds the length of the head. Scales very thin, covered with minute scales on the base. Undulated black lines follow the series of the scales; pectoral, ventral, and anal blackish, with broad whitish margin.

The skin of a specimen, 23 inches long, from Juan Fernandez, was presented to the British Museum some years ago by Edwin C. Reed, Esq. It agrees in every respect with the following specimen from the same locality. Length of specimen, $20\frac{1}{2}$ inches. Juan Fernandez.

Porichthys porosus, C. V., Valparaiso.
Clinus microcirrhis, C. V., Valparaiso.

Atherinichthys brevianalis, n. sp.

D. 6/11, A. 15, L. lat. 67, L. transv. 16. The origin of the anterior dorsal fin is opposite to the middle or posterior third of the ventral fins, and nearer to the base of the caudal than to the end of the snout. The distance between the origins of the two dorsal fins is less than one-half of that between the origin of the posterior and the caudal. The height of the body is somewhat less than one-fifth of the total length (without caudal), the length of the head one-fourth. Scales with two or three incisions. Pectoral shorter than the head. The silvery streak occupies the eighth series of scales and a part of the adjoining one. Length of specimen, 5 inches. Valparaiso.

Genypterus chilensis, Guich., Valparaiso.
Merluccius gayi, Guich., Valparaiso.
Clupea sagax, Jen., Valparaiso.
Ophichthys dicellurus, Rich., Valparaiso.

Muræna porphyrea, Guich., Juan Fernandez.

Murænophis porphyreus, Guichen. in Gay, Chile, Zool., p. 342, lam. xi. fig. 2.
Muræna porphyrea, Steindachner, Wien. S. B., 1875, vol. lxxi. p. 464.

Bdellostoma polytrema, Girard, Valparaiso. Fourteen gill-openings on each side.

B. NEW ZEALAND.

During the short stay of the Challenger in New Zealand (June 28 to July 7), only a few shore fishes were collected, and these do not add to our knowledge of its fauna, which has been so well worked out by the indefatigable resident naturalists of that colony. Some of the species, like *Halargyreus johnsoni, Coryphænoides denticulatus,* and *Photichthys argenteus,* might be assigned to the deep-sea series; but they seem to frequently approach the surface, as we may judge from their being so often included in collections of shore fishes.

Sebastes percoides, Rich., Port Hardy, D'Urville Island.

Scorpæna cruenta, Sol. (dry), New Zealand.

Trachichthys intermedius, Hector (Trans. N. Z. Inst., vol. vii. p. 245, pl. xi.). Station 166; 275 fathoms.

Chilodactylus macropterus, Forst., Port Hardy, D'Urville Island.

Cyttus abbreviatus, Hect. Station 166; 275 fathoms.

Platystethus abbreviatus, Hector, Trans. N. Z. Inst., vol. vii. p. 247, pl. xi.

Percis colias, Forst. (= *P. nyctomerus,* C. V.), Wellington Harbour; Port Hardy D'Urville Island.

Hemerocœtes acanthorhynchus, Forst., Wellington Harbour.

Notacanthus sexspinis, Rich. (dry), Cook's Straits.

Labrichthys celidota, Forst. (See Gthr., Ann. and Mag. Nat. Hist., 1876, vol. xvii. p. 398), Wellington Harbour.

Labrichthys bothryocosmus, Rich., Port Hardy, D'Urville Island.

Halargyreus johnsoni, Gthr. (dry), New Zealand.

Pseudophycis bacchus, Forst., Port Hardy, D'Urville Island.

Coryphænoides denticulatus, Rich. (dry), Cook's Straits.

Pseudorhombus boops, Hect. (Trans. New Zealand Inst., vol. vii. p. 249, pl. xi.).

D. 117, A. 89, L. lat. 78. The dorsal commences above the nostrils. The height of the body is two-fifths of the total length (without caudal), the length of the head nearly one-fourth. Scales ciliated; those on the head and on the anterior part of the body smaller than those on the tail. Interorbital ridge very narrow and naked. No spines or tubercles along the lateral line or the base of the fins. The curve of the lateral line is strong, but flat above. Snout rather shorter than the eye, the diameter of which is two-sevenths of the length of the head. Lower jaw scarcely prominent when the mouth is shut. The maxillary extends beyond the front margin of the eye and is two-fifths of the length of the head. Lower eye considerably in advance of the upper. Vertical fins of moderate height, extending nearly to the root of the caudal. Left pectoral more developed than the right and rather more than one-half of the length of the head. Brownish; fin-rays indistinctly punctulated with brown. New Zealand. Length of specimens, 6 inches. Station 167; 150 fathoms.

Photichthys argenteus, Hutt. (dry), Cook's Straits.
Monacanthus convexirostris, Gthr., Queen Charlotte Sound.
Bdellostoma cirrhatum, Forst., Queen Charlotte Sound.

C. COASTS OF SOUTHERN AUSTRALIA.

The fishes were collected principally at two places: close to Twofold Bay and at Sydney, at which place the ship remained from April 6 to June 8, 1874.[1]

Raja nitida, n. sp. (Pl. XIV. fig. A).

The angle formed by the front margins of the snout is obtuse, with a very thin median papillary projection. The width of the interorbital space is a little less than the length of the orbit, and the distance between the outer margins of the nostrils is likewise less than their distance from the extremity of the snout. Teeth with very small points, almost obtuse. Outer pectoral margin obtusely rounded, the greatest width of the disk being equal to the distance of the snout from the extremity of the ventral. All the upper parts covered with minute asperities; one or two curved spines in front and behind the orbit; one in the middle of the back, and a series along the median line of the tail. Upper parts light brownish, marbled with dark brown, the dark brown blotches being ornamented by small, round yellowish ocelli.

The single young specimen is a male; it is 8 inches long, the tail being 4½ inches; greatest width 5 inches. Off Twofold Bay; 120 fathoms (?).

Etelis, sp.

Partly from the want of a larger series of examples, partly from the indifferent state of preservation of the two very young examples obtained near Twofold Bay, I am unable to say whether the latter are the young of *Etelis carbunculus* or of a distinct species. These fishes evidently inhabit not inconsiderable depths. Length of specimens, 2½ inches. Off Twofold Bay; 120 fathoms (?).

Enoplosus armatus, White, Botany Bay.
Chætodon nesogallicus, C. V., Botany Bay.

[1] [Off Twofold Bay a sounding was taken in 2200 fathoms. The ship then moved in towards the shore; the dredge was put over and we sounded again in 120 fathoms. As, in this instance, the dredge was dragged for a considerable distance up an irregular slope, it is impossible to say at what depth each particular species was taken.—C. Wy. T.]

Sebastes percoides, Rich., Twofold Bay; 120 fathoms (?). Port Jackson; 30 fathoms.

Scorpæna cruenta, Sol., Twofold Bay; 120 fathoms (?).

Centropogon australis, White, Port Jackson.

Lepidotrigla phalæna, C. V., Victoria; 38 fathoms. Bass Straits; 38 fathoms.

Percis allporti, Gthr. (Ann. and Mag. Nat. Hist., 1876, vol. xvii. p. 394), Bass Straits; 38 fathoms. Twofold Bay; 120 fathoms (?).

Gobius brevifilis, Day, Port Jackson.

Gobius albopunctatus, C. V., Port Jackson.

Callionymus calauropomus, Rich., Bass Straits; 38 fathoms.

Callionymus phasis, n. sp. (Pl. XV. fig. C).

D. 4/9, A. 7, C. 10. Præopercular spine considerably shorter than the eye, terminating in three curved spines, of which the two anterior are the larger, and directed upwards. Dorsal spines prolonged; second dorsal high; caudal long; the ventral fin extends somewhat beyond the origin of the anal. Gill-opening reduced to a small foramen on the upper side of the neck; lateral line single. The length of the head is one-third of the total length without caudal, or one-fourth with that fin. Eye very large, a little longer than the snout, one-third of the length of the head. Reddish-white with irregular broad blackish cross-bands on the back; first dorsal blackish, with some whitish zig-zag lines; second variegated with greyish; the other fins white. Length of specimen, 4 inches. Twofold Bay; 120 fathoms (?).

Callionymus lunatus, Schleg., Port Jackson; 6 to 8 fathoms.

Blennius tasmanianus, Rich., Port Jackson.

Brachionichthys hirsutus, Lac.

D 1/2/16, A. 9. Off Twofold Bay; 120 fathoms (?).

Tripterygium, sp., Port Jackson.

Pseudophycis bacchus, Forst., Twofold Bay.

Gadus bacchus, Forst., Descr. Anim., p. 120.
Lota breviuscula, Rich., Voy. "Erebus" and "Terror," Fish., p. 61, pl. xxxviii. fig. 1.
Pseudophycis breviusculus, Gthr., Fish., vol. iv. p. 350.

Lophonectes, n. gen.

Body oblong, head small, cleft of the mouth very narrow, with the jaws and dentition nearly equally developed on both sides; teeth small, in single series; palatine and vomerine teeth none. Dorsal fin commencing above the nostrils, with the anterior rays produced. Scales of moderate size, thin, and deciduous. Lateral line with a strong curve anteriorly. Eyes on the left side. Bass Straits. Off Port Jackson.

Lophonectes gallus, n. sp. (Pl. XV. fig. B).

D. 87, A. 71, L. lat. 68. The height of the body is two-fifths of the total length (without caudal), the length of the head two-ninths; the snout is short, shorter than the eye, the diameter of which is a little less than one-fourth of the length of the head. Eyes separated by a very narrow ridge, the lower somewhat in advance of the upper, the upper not encroaching upon the upper profile. The mouth is obliquely directed upwards; the maxillary extending to the front margin of the eye and equalling it in length. Adult males with pointed tubercles on the snout; two on the sides, and one at the mandibular symphysis. The dorsal fin commences opposite the anterior nostril, and is continued to nearly the root of the caudal. In the adult the five anterior rays are prolonged into more or less long filaments. Left pectoral longer than the right, or as long as the head without snout. Ventrals separate: the rays of the left are arranged in the same line as the anal, the right ventral being shorter. The curve of the lateral line is sub-semicircular and short. Brownish, marbled with darker. Vertical fins irregularly and finely dotted with black. Ventrals with a black spot. Length of specimens, $2\frac{1}{2}$ to $5\frac{1}{2}$ inches. Station 162; 38 fathoms. Off Port Jackson; 30 fathoms.

Læops, n. gen.

Body oblong; head small; cleft of the mouth very narrow, with the dentition much more developed on the blind side than on the coloured. Teeth villiform, in narrow bands; palatine and vomerine teeth none. Dorsal fin commencing above the front margin of the eye. Scales small, thin, deciduous. Eyes on the left side. This genus appears to represent *Pleuronectes* in the Southern Hemisphere. Arafura Sea. South-Eastern Australia.

Læops parviceps, n. sp. (Pl. XV. fig. A).

D. 104, A. 86. The height of the body is contained twice and two-thirds in the total length (without caudal), the length of the head five times and one-third. The snout is very short. The eye rather large; its diameter being contained thrice and one-third in the length of the head. A very narrow ridge, longitudinally grooved, separates the two eyes, the lower being conspicuously in advance of the upper. The mouth is directed upwards, and the maxillary of the left side extends scarcely to below the anterior margin of the eye. The dorsal fin commences opposite to the front margin of the upper eye and is continued to the root of the caudal, the rays being of moderate length. Caudal rounded. The left pectoral rather longer than the right and as long as the postorbital portion of the head. The rays of the left ventral are arranged in the same line as the anal, the right ventral being entirely on the right side. The lateral line makes a very short semicircular curve anteriorly, and is straight for the remainder of its course. The colour appears to have been uniform brown. Arafura Sea. South-Eastern Australia.

Length of specimens, $2\frac{3}{8}$ to $5\frac{1}{2}$ inches. Station 190; 35 to 49 fathoms Station 163, off Twofold Bay; 120 fathoms (?).

Cnidoglanis megastoma, Rich., Port Jackson.
(?) *Muræ nichthys gymnotus*, Blkr., Port Jackson.

Syngnathus superciliaris, n. sp.
D. 23. Osseous rings 20 + 38. Snout as long as the postorbital part of the head, with a median ridge above, terminating on the interorbital space; neck compressed into a trenchant ridge; operculum without a keel, and with fine radiating striæ. Shields without spines; lateral line passing into the lower caudal edge; base of the dorsal fin not elevated, standing on three body and three caudal rings. Tail twice as long as the trunk. A very conspicuous filament above each eye. Pectoral and caudal fins well developed. Brownish-grey, with indistinct darker cross-bands, and finely marbled with darker and lighter spots; snout and lower half of the head with oblique vermiculated brown lines. Length of specimens, 3 to $6\frac{3}{4}$ inches. Port Jackson; 4 to 6 fathoms.

Urocampus cœlorhynchus, Gthr., Port Jackson.

Solenognathus fasciatus, n. sp. (Pl. XIV. fig. B).
D, 41. Osseous rings 27 + 55. This species is most closely allied to *Solenognathus spinosissimus*, having the same rough and spiny scutes, but the forehead is somewhat broader, the dorsal longer and composed of more numerous rays, and the back of the trunk ornamented with seven narrow blackish cross-bars. Also the præanal region is blackish. Length of specimen, 12 inches. Off Twofold Bay; 120 fathoms. (Tail, $5\frac{1}{2}$ inches long.)

Ostracion cornutus, L., Botany Bay.

IV. THE FISH-FAUNA OF THE TROPICAL ZONE OF THE INDO-PACIFIC.

A. FISHES FROM THE RIVER MARY, QUEENSLAND.

Geographically only a portion of Queensland belongs to the Tropics; but among its fishes so thoroughly a tropical character predominates, that no one will associate them with the fauna of the more southern temperate parts. This refers to the fresh-water fishes as well as to those inhabiting its coasts. The Challenger did not touch in

Southern and Middle Queensland, and the fishes enumerated here were obtained chiefly during an excursion made by Sir W. Thomson.[1] All the species obtained are known to enter freely brackish and fresh water.

[1] [There seemed to us, from what we heard at Sydney, to be a chance of making valuable additions to the knowledge of the natural history of South-East Australia, by examining carefully the fauna of some of the rivers. Those in which *Ceratodus* had lately been discovered had the greatest interest for us, for we hoped that, besides getting a good supply of *Ceratodus* in all stages, we might by effective netting and other means find some additional forms of the Dipnoi.

Accordingly a little party, consisting of Lieutenant (now Commander) Aldrich, who afterwards commanded the sledge which ran westwards from the "Alert's" winter quarters along the coast of Grinnel's Land, Mr Murray, and myself, with Pearcey and a couple of blue-jackets in attendance, was organised to go to Brisbane during the stay of the ship at Sydney, with the view of pushing on, if time permitted, to the upper reaches of the Mary or the Burnet.

We got information and introductions from Dr Bennett, Mr Hill, and others. We prepared a stock of trammel nets, lines, and other fishing appliances, a box of dynamite cartridges, fowling pieces, and collecting gear of all kinds, and we arranged to leave Sydney by the "City of Brisbane" on Tuesday the 29th of April 1874; the vessel was, however, detained by bad weather till the 4th of May. We arrived at Brisbane on the morning of the 7th. An intimation of our intended trip had preceded us, and we found a kind invitation from the Marquis of Normanby to Government House awaiting us at the club, of which we had already been made honorary members.

We stayed a few days at Brisbane seeing all that was to be seen. The governor's A.D.C. tried to make arrangements to send us on to Gympie in carriages, but we found it more convenient to go by a coasting steamer to Maryburgh. The departure of the "Lady Bowen," the regular trading packet, was hurried to give us more time, and on Sunday the 10th we were steaming past a monotonous undulating coast-line, the low hills crowned with dusky woods of sombre gum-trees, past Fraser Island, one of the districts given up entirely to the natives, many of whom we saw in the distance, with a fine walk and gait, but absolutely unclothed. We were disappointed that none of them swam off to the steamer as they often do.

We reached Maryburgh on the morning of the 11th, and introduced ourselves to Mr Sheridan, the Collector of Customs, to whom we had been referred by Lord Normanby. We found Mr Sheridan a most pleasant companion, and a man of great intelligence and considerable special knowledge of natural science. He most kindly placed himself at our disposal during our stay, and he afterwards took the trouble to collect and send home to us a valuable collection of such species as we had not an opportunity of procuring in sufficient quantity during our short visit.

We went on in the evening in a couple of buggies through the bush of scattered gum-trees, to a little group of wooden shanties called Tiaro, about twenty miles above Maryburgh, on a pretty bend of the river Mary, with a good long stretch of open river, succeeded by some irregular rapids and deep pools, and overhanging woods farther up. The influence of the tide was slightly felt for a considerable distance beyond Tiaro, and some of the fishes had consequently an estuarine character.

We got the loan of a boat from a contractor who was deepening the river a little below Tiaro for the Queensland Government, and on the following day we were joined by Mr Sheridan with his boat and servant. We heard on all hands that the Barramunda (the native name for *Ceratodus*) was to be found occasionally in the neighbourhood, and we determined to spend the short time at our disposal in exploring the fauna of the river for a few miles up stream.

Lieutenant Aldrich and Mr Murray, with our escort and one or two natives whom we had secured, camped a little way up the river, and Mr Sheridan and I, as the seniors of the party, slept at Tiaro, rowing up the river in the morning, and usually reaching the camping-ground in time to supply the materials of stew for luncheon, of cockatoos, wallaby, ducks, &c., which we had shot by the way. For about ten days the river was fished day and night with net and rod, and fishes of several species were taken in large numbers, but we found no trace of *Ceratodus* or of any allied form. We had taken with us a number of powerful dynamite cartridges, and these were thrown, with a few feet of Bickford's fuse attached, into the deeper pools, and in a minute or so a shock like a blow from a heavy wooden mallet was felt on the bottom of the boat, one could see a slight rise on the surface of the water, and perhaps a hundred fishes of different sorts and sizes rose to the surface and floated on their backs or sides. Those we required were taken into the boat with a landing-net, and the rest recovered from their shock in a few minutes and swam away. The number of individual fishes taken in this way was very large, but it is somewhat singular that *Ceratodus* never occurred among them. At the end of about ten days three specimens of *Ceratodus* were taken, one by Lieutenant Aldrich with hook and bait, and two others afterwards, one by a native.

As our leave of absence was nearly exhausted, we now returned to Maryburgh, and after waiting for a few days to catch a return steamer, we rejoined the Challenger at Sydney.

Ceratodus miolepis, Gthr.

Irregularities in the arrangement of scales do not appear to be scarce in both species of this genus, and occur chiefly in the median line of the back or abdomen, some of the scales of the median series being either subdivided or confluent with those of the adjoining series. The specimens collected by the naturalists of the Challenger Expedition belong to the smaller-scaled species, which, as far as is known at present, is confined to the Mary River. In some twenty specimens from that river, which passed through my hands, the normal number of longitudinal series was found to be twenty-one, although in a few of them, as also in one of the specimens of the Challenger collection, one more or less may be counted on account of the irregularity mentioned. The Burnett Ceratodus (*Ceratodus forsteri*) is more rarely brought to Europe. I have seen three specimens only, which had eighteen rows of scales; but Dr A. B. Meyer mentions a specimen in which he counted twelve scales below the lateral line, or nineteen altogether (Ann. and Mag. Nat. Hist., 1875, vol. xv. p. 368).

Oligorus macquariensis, C. V., River Mary, near the village of Tiaro.

Ctenolates ambiguus, Rich., Queensland, lat. 27° 9′ long. 144° 0′.

Datnia ambigua, Richards, Voy. "Erebus" and "Terror," Fish., p. 25, pl. xix.
Ctenolates macquariensis, Gthr., Proc. Zool. Soc., 1871, p. 320, pl. xxxiii.

Therapon unicolor, Gthr., Queensland, lat. 27° 0′ S., long. 144° 0′; River Mary, near the village of Tiaro.

Ambassis marianus, n. sp.

D. $7/\frac{1}{10-11}$, A. $\frac{3}{11}$, L. lat. 28. The height of the body is two-fifths, or in young specimens less than two-fifths of the total length (without caudal), the length of the head one-third. The diameter of the eye is two-sevenths of the length of the head and two-thirds of that of the postorbital portion. Præorbital strongly serrated. Scales on the middle of the trunk much larger, and those on the nape much smaller than the remainder. Lateral line interrupted below the end of the spinous dorsal, the pores of the posterior portion being rather indistinct. The second dorsal spine is as long as, or sometimes a little longer than, the third, and one-fourth of the total length (without caudal). The third anal spine is longer than the second, but considerably shorter than the second of the dorsal. A narrow, silvery, longitudinal streak along the middle of the tail; the membrane between the second and third dorsal spines blackish. Caudal fin not coloured.

We had altogether some fair sport, and a good opportunity of seeing the natives and making ourselves familiar with the character of Australian scenery and the Australian fauna. I am sure all our party will long remember our months' excursion with pleasure.

Most of the fishes in the Queensland list were procured during this trip. Those marked lat. 27° 9′ long., 144° 0′ E., were collected by Mr Lyon at his station about 400 miles inland of Brisbane, and was sent by him to Mr Murray. —C. Wy. T.]

Queensland. Length of specimens, $1\frac{1}{2}$ to $3\frac{1}{4}$ inches. River Mary, near the village of Tiaro.

Chrysophrys australis, Gthr., River Mary, near the village of Tiaro.
Centropogon robustus, Gthr., River Mary, near the village of Tiaro.
Platycephalus insidiator, Forsk., River Mary.

Corvina australis, n. sp.

D. $10/\frac{1}{28-29}$, A. 2/7, L. lat. 49, L. trans. $\frac{8}{16}$. The height of the body is a little more than the length of the head, which is nearly one-fourth of the total (without caudal). Snout convex, with the upper jaw overlapping the lower, longer than the eye, the diameter of which is two-ninths of the length of the head. Dorsal spines very slender; anal spine rather strong, about one-half of the first ray and one-third of the length of the head. Margin of the præoperculum very finely crenulated. Coloration uniform silvery; upper half of the first dorsal blackish. Queensland. Length of specimens, 10 and 11 inches. River Mary, near the village of Tiaro.

Periophthalmus schlosseri, Pall., Cardwell, Queensland.
Eleotris compressa, Krefft, River Mary, near the village of Tiaro.
Eleotris macrolepidota, Bl., River Mary.
Mugil cephalotus, C. V., River Mary, near the village of Tiaro.
Myxus elongatus, Gthr., River Mary, near the village of Tiaro.
Atherinichthys nigrans, Rich., Queensland, lat. 27° 9′ S., long. 144° 0′; River Mary, near the village of Tiaro.
Copidoglanis tandanus, Mitch., River Mary, near the village of Tiaro.

Copidoglanis hyrtli, Steind., Queensland, lat. 27° 9′ S., long. 144° 0′.

Mosilurus hyrtli, Steindachner, Wien. S. B., 1867, vol. lv. p. 14.

Arius australis, Gthr., River Mary, near the village of Tiaro.
Arrhamphus sclerolepis, Gthr., River Mary, near the village of Tiaro.
Chatoëssus erebi, Gthr., River Mary, near the village of Tiaro.
(?) *Chatoëssus erebi*, Gthr., Queensland, lat. 27° 9′ S., long. 144°.
Megalops cyprinoides, Brouss., River Mary.
Anguilla mauritiana, Benn., River Mary.

B. THE FIJI ISLANDS.

The Challenger stayed at this group from July 25 to August 10, 1874, and a considerable number of species were collected; but, with one exception, they belong to the common Polynesian forms of this well-known fauna.

Serranus hexagonatus, Forst., Levuka.
Plectropoma maculatum, Bl. (Probably = *Plectropoma leopardinum*, Lac.), Levuka, Fiji.
Mesoprion bengalensis, Bl., Kandavu.
Mesoprion fulviflamma, Forsk., Kandavu, Levuka.
Mesoprion marginatus, C. V., Levuka.

Mesoprion semicinctus, Q. and G., Levuka.

Lutjanus semicinctus, Quoy and Gaim.
Mesoprion semicinctus, Cuv., vol. ii. p. 485; Gthr., Fisch. d. Südsee, p. 15, pl. xvii.

Apogon savayensis (Gthr. Fisch. Südsee, p. 22, taf. xix. fig. B), Levuka.
Therapon servus, L., Levuka, Kandavu.
Therapon oxyrhynchus, Schleg., Ovalau.[1]
Dules rupestris, Lac., Ovalau.
Dules marginatus, C. V., Ovalau.
Diagramma pardale, C. V., Ovalau.
Diagramma pictum, Thunb., Ovalau.
Scolopsis bilineatus, Bl., Levuka, Ovalau.
Scolopsis temporalis, C. V., Kandavu.
Gerres oyena, Forsk., Kandavu.
Lethrinus nebulosus, Forsk., Levuka.
Lethrinus ramak, Forsk., Levuka.
Lethrinus moensi, Blkr. (Bleeker, Nat. Tyds. Ned. Ind., 1855, vol. ix. p. 435; Gthr., Fisch. Südsee, p. 64, pl. xlvi. fig. A), Kandavu.
Lethrinus hæmatopterus, Schleg., Kandavu.
Sphærodon grandoculis, Forsk., Kandavu.

Scorpæna zanzibarensis, Playfair, in Fish. Zanz., p. 47, pl. viii. fig. 2.
This species has hitherto been known from Zanzibar only. Levuka.

Pterois zebra, C. V., Levuka.
Synanceia verrucosa, Bl., Ovalau.
Chætodon rafflesi, Benn., Ovalau.
Chætodon vagabundus, L., Ovalau.
Holacanthus cyanotis, (Gthr. Fish., vol. ii. p. 517; and Fisch. d. Südsee, p. 52, taf. xl., fig. B), Kandavu.
Heniochus macrolepidotus, L., Ovalau.
Myripristis murdjan, Forsk., Ovalau.

[1] [The fishes in this list from Ovalau, were collected and presented to the Expedition by Mr Boyd, Fiji.—C. Wy. T.]

Upeneus indicus, Shaw, Kandavu.
Upeneoides vittatus, Forsk., Ovalau.
Percis hexophthalma, C. V., Levuka.

Plesiops corallicola, Blkr. (Bleeker, Nat. Tyds. Ned. Ind., 1853, p. 280; Gthr. Fisch. d. Südsee, p. 87, taf. lviii. fig. B.).

A specimen obtained at Levuka is remarkable for having ten dorsal spines only. As I cannot detect any other marked difference from a specimen with eleven or twelve dorsal spines, I consider this specimen for the present as an individual variety. Length of specimen, $2\frac{1}{2}$ inches, Levuka.

Caranx speciosus, Forsk., Levuka.
Platax orbicularis, Forsk., Kandavu.
Psettus argenteus, L., Levuka.
Equula fasciata, Lac., Ovalau.
Acanthurus triostegus, L., Ovalau.
Acanthurus blochi, C. V., Ovalau.
Acanthurus gahm, Forsk., Kandavu.
Acanthurus rhombeus, Kittl., Levuka.
Naseus marginatus, C. V., Ovalau.
Teuthis marmorata, Q. and G., Kandavu.
Teuthis hexagonata, Blkr., Kandavu.
Gobius phalæna, C. V., Ovalau.

Euctenogobius ophthalmonema, Blkr., Kandavu.

Gobius ophthalmonema, Bleek, Nat. Tyds. Ned. Ind., 1856, vol. xii. p. 208.
Euctenogobius ophthalmonema, Gthr., Fisch. Südsee, p. 180, taf. cxi., fig. B.

Eleotris macrolepidota, Bl., Ovalau.
Eleotris fusca, Bl. Schn., Levuka.
Eleotris longipinnis, Benn., Ovalau.
Periophthalmus kölreuteri, Pall., Kandavu.

Petroscirtes oualanensis, n. sp.

D. $\frac{12}{18}$, A. 20. The length of the head is a little more than the depth of the body and one-fifth of the total. Snout with the upper profile obliquely descending forwards. The canine teeth of the lower jaw are very large, those of the upper small. Orbital tentacle none. Diameter of the eye equals the width of the interorbital space. The dorsal fin is not elevated, commences on a line with the posterior margin of the præoperculum, and terminates at a short distance from the root of the caudal. The upper and lower caudal rays prolonged into filaments. Uniform light olive coloured in spirits. Ovalau. Length of specimens, $2\frac{1}{2}$ and 3 inches.

Petroscirtes, sp. (not in g. st.), Ovalau.
Atherina lacunosa, Forst. (Forst. Descr. An., p. 298; Gthr., Fisch. d. Südsee, p. 213, taf. cxviii., fig. E), Levuka.
Pomacentrus scolopsis, Q. and G., Levuka.
Glyphidodon xanthozona, Blkr., Levuka.
Glyphidodon assimilis, Gthr., Ovalau.
Platyglossus trimaculatus, Q. and G., Levuka.
Julis dorsalis, Q. and G., Ovalau.
Chilinus trilobatus, Lac., Levuka.
Chilinus chlorurus, Bl., Levuka.
Pseudoscarus nuchipunctatus, C. V., Kandavu.
Pseudoscarus microrhinus, Blkr., Kandavu.
Rhomboidichthys, sp. (?) Levuka.
Solea heterorhina, Blkr., Ovalau.
Saurus varius, Lac., Ovalau.
Belone annulata, C. V., Levuka; Ovalau; Kandavu.
Hemirhamphus commersoni, Kandavu.
Clupea tembang, Blkr., Levuka; Kandavu.
Megalops cyprinoides, Brouss., Ovalau.
Anguilla mauritiana, Benn., fresh-water of Levuka; Ovalau.
Muræna polyuranodon, Blkr., Ovalau.
Doryichthys brachyurus, Blkr., Ovalau.
Balistes stellatus, Lac., Kandavu.
Balistes fuscus, Bl. Schn., Kandavu.
Balistes aculeatus, L., Kandavu.
Tetrodon immaculatus, Bl., Ovalau.
Ostracion cornutus, L., Ovalau.
Ostracion cubicus, L., Ovalau.

C. THE SEA BETWEEN AUSTRALIA AND NEW GUINEA.

The Challenger proceeded from the Fiji Islands to Api, one of the New Hebrides (August 18, 1874), to Raine Island (August 31), and to Cape York, where the Expedition stayed from September 2 to September 8. Much attention to collecting specimens was paid on the passage to the Arafura Sea, the trawl being used every day in this comparatively shallow basin; finally the Aru and Ki Islands were visited (September 9 to September 27).

The fishes collected in this part of the Voyage may be conveniently enumerated separately, as comparatively little had been done previously in the exploration of this fauna;

at least much less than in the Fiji group towards the east, and the East Indian Archipelago towards the west. It bears thoroughly the character of the Indo-Pacific Ocean, and probably none of the characteristic forms will be found to be absent. There is but a slight admixture of specifically Australian forms, like *Cnidoglanis.* The great proportion of new forms is due to the circumstance that a very interesting collection was made at Station 192 in the Ki Islands, at a depth of 129 fathoms : which depth appears to be sufficient to ensure the discovery of distinct species. Several of the fishes obtained there are so markedly distinguished as deep-sea forms as to necessitate their removal to that series.

Trygon pastinaca, L., Arafura Sea.

Urolophus kaianus, n. sp.

No dorsal fin. Disk much broader than long ; the anterior margins meeting at a very obtuse angle. Snout not projecting. Tail a little shorter than the disk. Disk entirely smooth. Uniform brownish. Distance of the extremity of the snout from the vent, $4\frac{3}{4}$ inches. Distance of the extremity of the tail from the vent, $4\frac{1}{2}$ inches. Greatest width of the disk, $5\frac{10}{12}$ inches. Ki Islands. Length of specimens, $8\frac{3}{4}$ and $9\frac{1}{4}$ inches. Station 192 ; 129 fathoms.

Anthias megalepis, n. sp. (Pl. XVI. fig. E).

D. $\frac{10}{16}$, A. $\frac{3}{7}$, L. lat 30, L. transv. $2\frac{1}{2}/12$. The height of the body is rather more than one-third of the total length (without caudal), the length of the head two-fifths. The diameter of the eye equals the length of the snout, and is one-fourth of that of the head. Interorbital space flat, scaly, very narrow. The maxillary extends to, or nearly to, the posterior margin of the eye. A pair of canines in the upper jaw, and a pair in the middle of the side of the lower are well developed. Præorbital very narrow, narrower than the maxillary. Præoperculum strongly serrated. Six series of scales on the cheek. Dorsal spines of moderate strength and length, not so strong as the second of the anal fin. Pectoral extending to the first soft anal ray. Rose coloured; uniform, or with irregular blackish patches on the back. Ki Islands. Length of specimens, 3 to 4 inches. Station 192 ; 129 fathoms.

Centropristis pleurospilus, n. sp. (Pl. XVI. fig. D).

D. $\frac{10}{10}$, A. $\frac{3}{7}$, L. lat. 44, L. transv. $\frac{3}{11}$. The height of the body is two-ninths of the total length (without caudal), the length of the head two-fifths. The diameter of the eye is longer than the snout, and more than one-fourth of the length of the head. Interorbital space one-third of the diameter of the eye. The maxillary reaches beyond the vertical from the centre of the orbit. Præoperculum rounded throughout, serrated. Operculum with two spines. Six series of scales on the cheek; a series of four or five oblong black spots along the side of the body. Ki Islands. Length of specimens, $5\frac{1}{4}$ inches. Station 192; 129 fathoms.

Myriodon waigiensis, Q. and G. Station 186 (trawl).
Serranus diacanthus, C. V. Arafura Sea. Station 189.
Mesoprion annularis, C. V. Arafura Sea, Station 189.
Mesoprion chrysotænia, Blkr. Somerset, Cape York.

Apogon monogramma, n. sp. (Pl. XVI. fig. B).

D. $7/\frac{1}{9}$, A. $\frac{2}{8}$, L. lat. 26. The height of the body is one-third of the total length (without caudal), the length of the head two-fifths. Inner edge of the præoperculum not serrated. Dorsal spines of moderate strength, the fourth a little longer than the third. White (in spirits), with a well-defined narrow blackish band from the snout through the eye, to and along the central rays of the caudal fin. No black round spot at the base of the caudal. A narrow blackish line along the base of the soft dorsal and anal. Length of specimens, 2 to 3 inches. Arafura Sea.

Apogon septemstriatus, n. sp. (Pl. XVI. fig. A).

D. $7/\frac{1}{8}$, A. $\frac{2}{8}$, L. lat. 28. The height of the body is two-fifths of the total length (without caudal), and equal to the length of the head. Inner edge of the præoperculum not serrated. Dorsal spines rather strong, the third and fourth equal in length. White (in spirits), with three well-defined narrow black streaks on each side; the first from the snout, through the eye, along the middle of the tail and caudal fin; the second from the snout along the superciliary margin to the back of the tail; the third from the occiput along the base of the dorsal fins; a seventh stripe runs along the median line of the head and nape. No black round spot at the base of the caudal. A narrow blackish line along the base of the soft dorsal and anal fins. Length of specimens, 3 inches. Arafura Sea.

Apogon arafuræ, n. sp. (Pl. XVI. fig. C).

D. $7/\frac{1}{9}$, A. $\frac{2}{8}$, L. lat. 26. Form of the body as in *Apogon tæniopterus*, but with the snout shorter, and the caudal fin rounded. Both limbs of the præoperculum are serrated; snout as long as the eye; interorbital space convex, as wide as the eye. Light coloured, with some indistinct darker transverse spots on the back; upper half of the first dorsal black; second dorsal and anal with a black band along the middle; upper margin of the second dorsal and posterior margin of the caudal black; pectoral, ventral, and hyoid region powdered with black. Length of specimen, $4\frac{1}{2}$ inches. Arafura Sea.

(?) *Acropoma japonicum*, Gthr., Arafura Sea (not in good state).

Therapon servus, L., Somerset.[1]
Therapon caudovittatus, Rich., Somerset, Cape York.
Priacanthus benmebari, Schles., Arafura Sea.
Pentapus vitta, Q. and G. Station 188 (South of New Guinea).

Propoma, n. gen. (Pristipomatidæ).

This genus is closely allied to *Heterognathodon*, but differs from it in having nine dorsal spines only, in lacking the canine teeth in the upper jaw, and in having considerably smaller scales on the back.

Propoma roseum, n. sp. (Pl. XX. fig. B).

D. $\frac{9}{10}$, A. $\frac{3}{7}$, L. lat. 60, L. transv. $\frac{5}{15}$. The height of the body is contained thrice and a half or thrice and three-fourths in the total length (without caudal), the length of the head thrice and one-fourth or thrice and a half. Eye large, one-third of the length of the head, much longer than the snout, or than the width of the interorbital space. Snout rather convex and obtuse, with the jaws sub-equal in front; teeth very small, maxillary covered with scales, extending to, or nearly to, the centre of the eye. Præoperculum with a flat projecting spine at the angle, and with a very fine serrature along its lower limb; operculum with an acute small spine. Infraorbital extremely narrow, the end of the maxillary nearly touching the eye. Dorsal spines feeble, sub-equal in height; the third anal spine is the longest. Caudal fin deeply forked, with the lobes produced into filaments. Pectoral extending to the vent. Scales very finely ciliated. Apparently rose coloured during life; caudal fin yellowish. Lower parts silvery. Off Ki Islands. Length of specimen, $5\frac{1}{2}$ inches. Station 192; 129 fathoms.

Gerres abbreviatus, Blkr., Somerset.
Lethrinus nebulosus, Forsk., Somerset.

Myripristis kaianus, n. sp.

D. $11/\frac{1}{13}$, A. $\frac{4}{11}$, L. lat. 29, L. transv. $2\frac{1}{2}/7$. The height of the body is rather more than the length of the head, and one-half of the total (without caudal). The diameter of the eye is two-sevenths of the length of the head, and twice the width of the interorbital space which is convex. The maxillary reaches to below the hind margin of the eye, and is not denticulated. Scales deeply serrated, those above the lateral line with acute long spines. Opercles covered with series of spines; opercular spine strong, of

[1] [The fishes in this list marked "Somerset, Cape York," were mostly taken with the seine at Albany Island.—C. Wy. T.]

moderate length. The third dorsal spine is the longest, nearly half as long as the head; the third anal spine much stronger and also longer than the fourth, and much longer than the opercular spine. Reddish-pink, with a silvery line along each series of scales. Ki Islands. (*a*) Length of specimen, $7\frac{1}{2}$ inches. Station 192; 129 fathoms.

Sebastes hexanema, n. sp. (Pl. XVII. fig. B).

D. $11/\frac{1}{9}$, A. $\frac{3}{5}$, L. lat. ca. 53. The height of the body is contained thrice or thrice and one-third in the total length (without caudal), the length of the head nearly twice. The snout is considerably produced, the diameter of the eye being two-ninths of the length of the head, and two-thirds of that of the snout. The interorbital space is very narrow, concave, two-fifths of the length of the eye. Vertex with the spines rather prominent, and covered with very small scales. A simple tentacle above the anterior angle of the orbit, a second longer one above the middle of the eye, and a third, which is again shorter, between the nuchal spines. Other small tentacles along the lateral line. The maxillary extends nearly to below the middle of the eye. The band of vomerine teeth is V-shaped, that on the palatine bones very narrow. Tongue free and pointed. The third and fourth dorsal spines are the longest, rather less than one-third of the length of the head, and shorter than the second of the anal. Pectoral fin not quite reaching the anal. Rose coloured, with more or less indistinct blackish patches on the back, one extending over the dorsal fin, and occupying the space between the seventh and ninth spines. Ki Islands. Length of specimens, 2 to $5\frac{1}{2}$ inches. Station 192; 129 fathoms.

Lioscorpius, n. gen. (Scorpænidæ).

Head and body compressed, the former with muciferous cavities above, but with scarcely any ridges or spines. Occiput without groove, naked. Opercles armed as in *Sebastes*. Body covered with very small scales, and with a wide lateral line. Vertical fins not elongate. Dorsal fins entirely separate, the first with eight or nine spines. Pectoral fin long, without separate appendages. Bands of villiform teeth in the jaws, on the vomer and palatine bones. Seven branchiostegals.

Lioscorpius longiceps, n. sp. (Pl. XVII. fig. C).

D. 8 or 9/11, A. $\frac{2 \text{ or } 3}{6}$, P. 23, V. $\frac{1}{5}$. The height of the body is one-fourth of the total length (without caudal), and the length of the head is contained in it twice, or, one-fourth. Snout rather produced, the diameter of the eye being one-half of the length of the snout, and two-elevenths of that of the head. The interorbital space flat, its width being nearly equal to the diameter of the eye; the maxillary does not quite extend to the hind margin of the orbit. Armature of the head weak, and limited to a pair of minute spines on the occiput, to another above the præoperculum, to two small ones on the præorbital, four on the margin of the præoperculum, and two on the operculum. The bands of teeth are very narrow, those on the vomer and palatine bones almost linear. Dorsal spines rather slender, the third and fourth are the longest, one-third of the length of the head. Anal spines feeble. Pectoral fin extending to the middle of the anal. Ventral fin thoracic, terminating at some distance from the vent.

Coloration, uniform reddish, with some obscure spots on the base of the second dorsal and caudal. Ki Islands. Length of specimen, 4½ inches. Station 192; 129 fathoms.

Pterois lunulata, Schleg., Arafura Sea.

Minous pictus, n. sp. (Pl. XVIII. fig. D).

D. $\frac{11}{10\text{-}11}$, A. 12. The length of the head is two-fifths of the total length, without caudal, and equal to the length of the pectoral fin. Præorbital, with a rather strong spine, obliquely directed downwards and backwards, and with another small one in front. Interorbital space concave, equal in width to the vertical diameter of the eye. Dorsal spines slender; the three anterior a little remote from the remainder of the fin. Back and dorsal fin largely marbled with blackish-brown and white; lower parts and caudal whitish. Pectoral ventral and anal black; the posterior surface of the pectoral whitish, with a black stripe along each ray. Length of specimens, 2 to 2½ inches. Arafura Sea. Station 188. (South of New Guinea.)

Platycephalus insidiator, Forsk., Somerset.
Platycephalus malabaricus, C. V., Arafura Sea. Station 188; 28 fathoms.
Platycephalus isacanthus, C. V., South of New Guinea. Station 187.

Platycephalus sculptus, n. sp. (Pl. XVII. fig. A).

D. 9/11, A. 12, L. lat. 70 Length of the head is one-third of the total (without caudal), and its width between the præopercular spines is contained once and one-third in its length. Interorbital space very narrow and concave, its width being one-half of the vertical diameter of the eye, or one-fourth of the length of the snout. Snout rather obtuse. Bones of the head deeply sculptured with radiating striæ. A series of spines along the superciliary margin, along the ridges of the crown of the head, along the opercular ridge, and along the infraorbital ring. Angle of the præoperculum armed with two spines, of which the upper is much longer than the lower, though not quite so long as the eye, and armed at the upper part of its base with a small accessory spine. Anterior half of the lateral line spiny. The third and fourth dorsal spines are the longest, one-half of the length of the head. A tongue-shaped membranaceous flap below the præopercular spines. The bands of vomerine and palatine teeth are very narrow, almost linear. Coloration nearly uniform; a few indistinct cross bands; spinous dorsal with a black margin. Length of specimens, 2 and 8½ inches. Arafura Sea.

Platycephalus spinosus, Schleg., South of New Guinea. Station 187; 6 fathoms.
Platycephalus pristiger, C. V., South of New Guinea. Station 187.

Trigla leptacanthus, n. sp. (Pl. XVIII. fig. B).

D. 8/11, A. 12. Scales exceedingly small. The præorbital and suprascapular spines are slender and very long, as long or longer than the eye. Præopercular, opercular, and humeral spines short. Interorbital space concave, equal in width to the diameter of the eye. Dorsal spines of moderate length and strength. The pectoral reaches to the sixth or seventh anal ray. Lateral lines not spiny. Light reddish; back and base of the second dorsal with scattered irregular blue ocelli. A bluish streak below the canthus rostralis. Posterior surface of the pectoral fin blue, with a white margin all round, and a large black spot at the base. Ki Islands. Length of specimens, 4 to 4½ inches. Station 192; 129 fathoms.

Lepidotrigla spiloptera, n. sp. (Pl. XVIII. fig. C).

D. 9/15, A. 15, L. lat. ca. 65. Scales very indistinctly serrated. Lateral line without spines. Anterior profile of the snout concave. Præorbital projecting in the form of a short triangular lamina. Interorbital space very concave, in width nearly equal to the vertical diameter of the eye. A deep transverse groove separates the interorbital space from the crown of the head. The spines of the dorsal fin are of moderate strength, those running along the base of the dorsal fins are well developed, lanceolate. Pectoral fin extending to the fourth anal ray. Coloration uniform reddish. Pectoral dark blue on its inner surface, with numerous white ocelli, and a white margin. In very young specimens the groove behind the eyes is but slightly indicated; the white ocelli on the pectoral fin are absent, and a blackish blotch occupies the membrane between the fourth and sixth dorsal spines. Ki Island. Length of specimens, 3½ to 5¼ inches. Station 192; 129 fathoms. Arafura Sea.

Dactylopterus orientalis, C. V., Arafura Sea. Station 188.
Peristethus moluccense, Blkr. Station 192, Ki Islands; 129 fathoms.
Pegasus natans, L., Somerset, Cape York.
Sillago ciliata, C. V., Somerset, Cape York.

Acanthaphritis, n. gen. (Trachinidæ).

Head depressed, tail compressed. Cleft of the mouth sub-horizontal, with the upper jaw longest. Eye rather large, obliquely directed upwards. Scales large, ciliated. Two separate dorsal fins, the first with five or six spines. Ventrals jugular, with one spine and five soft rays. The lower pectoral rays branched. Bands of villiform teeth in the jaws, without canines; vomerine teeth in two small widely separate patches. Opercles unarmed; each præorbital with a horizontal spine pointing forward. Six branchiostegals. Gill-membranes entirely separate from each other, and from the isthmus.

Acanthaphritis grandisquamis, n. sp. (Pl. XVIII. fig. A).

D. 5–6/20, A. 24, L. lat. 33, L. transv. 8. Head depressed, its length being rather more than two-sevenths of the total length (without caudal); the eyes are large, occupying the second fourth of the length of the head, and standing very close together; mouth wide, the maxillary extending to below the middle of the eye. Occiput, cheeks, and opercles scaly. The first dorsal composed of feeble and short spines; the second high, the posterior rays being the longest, and extending in old specimens to the middle of the caudal fin. The anal commences immediately behind the first dorsal; caudal subtruncated; pectoral broad, reaching to below the commencement of the second dorsal; ventrals reaching to the vent. The scales are very coarsely ciliated. Light olive coloured, with an indistinct series of silvery spots along the upper side of the body; the first dorsal black. Ki Islands. Length of specimens, $2\frac{1}{4}$ to $5\frac{1}{2}$ inches. Ki Islands, Station 192; 129 fathoms.

Champsodon vorax, Gthr., Arafura Sea, Ki Islands. Station 192; 129 fathoms.

Uranoscopus fuscomaculatus, Steindachner (Wien, S. B. 1868, vol. lviii. p. 319). Previously known from Kandavu. Arafura Sea.

Uranoscopus kaianus, n. sp. (Pl. XIX. fig. A).

D. 4/13, A. 13. No barbel below the chin. The length of the head is contained thrice and two-thirds, or thrice and three-fourths in the total without caudal. Suboperculum with one, præoperculum with four, five, or six spines pointing downwards. Humeral spine more or less directed upwards. Upper parts brown, with numerous round whitish spots. Lower parts whitish. First dorsal black. Ki Islands. Arafura Sea. Length of specimens, 7 to 10 inches. Station 192; 129 fathoms. Station 188; 28 fathoms.

Caranx speciosus, Forsk., Somerset.

Caranx armatus, Forsk., Somerset.

Chorinemus toloo, C. V., Somerset.
Trachynotus ovatus, L., Somerset.

Hypsinotus rubescens, Gthr.

D. $\frac{7-8}{27-35}$, A. $\frac{3}{26-33}$. Young specimens have the body comparatively less high than old ones; in the latter the depth exceeds much the length (fins excluded), in the former the length may even exceed the depth. Japan, Celebes. Ki Island. Length of specimens, $1\frac{1}{2}$ to $2\frac{1}{2}$ inches. Station 192 ; 129 fathoms.

Upeneoides, sp. (?), Arafura Sea.
Gobius genivittatus, C. V., fresh-water at Api, New Hebrides.
Gobius albopunctatus, C. V., Somerset.
Gobius bynoensis, Rich., Somerset.
Gobius ornatus, Rüpp., Somerset.
Callionymus longicaudatus, Schleg., South of New Guinea. Station 188.

Callionymus kaianus, n. sp. (Pl. XIX. fig. B).

D. 4/9, A. 9, C. 10. Præopercular spine shorter than the eye, terminating in three hooks, of which the hindermost points backwards and the middle upwards, both being barbed; the third is very small. Anterior dorsal spine prolonged, second dorsal high, caudal long. The ventral extends somewhat beyond the origin of the anal. The occipital region granulated on each side. Gill-opening reduced to a small foramen on the upper side of the neck. Lateral line single. The length of the head is contained thrice and one-fourth in the total length, without caudal. Eye as long as the snout, and one-fourth the length of the head. Reddish-white, with irregular, rounded violet spots along the middle of the side of the body. A lunate black spot between the third and fourth dorsal spines. Second dorsal ornamented with large subocellated and inframarginal bands. Ki Islands. Length of specimen, 7 inches. Station 192; 129 fathoms.

Batrachus diemensis, Les. Station 186 (trawl).
Antennarius marmoratus, Gthr., Ki Doulan, Little Ki Island.

Tetrabrachium, n. gen. (Pedicalidæ).

Head large, compressed; cleft of the mouth vertical, narrow. Teeth very small. Eye small, projecting on the upper surface of the head. Skin naked. The spinous dorsal is reduced to three isolated spines, with the same arrangement and functions as in

Antennarius; the soft dorsal and anal rather long; pectoral with the upper portion detached. The gill-opening is reduced to a small foramen at the lowermost part of the root of the pectoral fin.

Tetrabrachium ocellatum, n. sp. (Pl. XIX. fig. C).

D. 1/1/1/18, A. 12, P. 4/5, V. 5. The head and body are strongly compressed, the trunk being very short; the neck is raised into a convex hump, the mouth looking upwards, transverse, without being cleft down the sides of the snout. The first and second dorsal spines are close together, situated above the upper lip, the first being very short and slender, the second as long as the mouth is wide and fringed. The third is again very small and delicate, and occupies the middle of the nape. Dorsal and anal rays short, enveloped in a tight membrane. Caudal rounded. The upper four pectoral rays form a separate portion; the lower part of the fin being horizontally spread out, and with the inner ray attached to the body in its whole length; also the ventral fins are attached to the side of the body by a loose membrane by which a kind of recess is formed. Eyes very small, prominent, covered by the general integument. The upper half of the fish is brownish, with numerous white ocelli greatly varying in size; they extend on the dorsal fin, but all the other fins are white, without any spots. South of New Guinea. Length of specimen, $2\frac{3}{4}$ inches. Station 188; 28 fathoms.

Sicydium, sp., Fry., freshwater at Api, New Hebrides.
Congrogadus subducens, Rich. Station 186 (trawl).
Mugil waigiensis, Q. and G., Somerset.
Glyphidodon septemfasciatus, C. V., Raine Island.
Glyphidodon sordidus, Forsk., Raine Island.

Heliastes roseus, n. sp. (Pl. XX. fig. D).

D. $\frac{11}{8}$, A. $\frac{2}{8}$, L. lat. 26, L. transv. $\frac{1}{10}$. The height of the body is contained twice and two-thirds in the total length (without caudal), the length of the head three times. Eye very large, scarcely two-fifths of the length of the head. Snout extremely short, with the cleft of the mouth very oblique; maxillary narrow, not extending to below the middle of the eye. The lateral line pierces two or three scales behind the head, is then interrupted, and proceeds close to the base of the dorsal fin, at the end of which it stops. Caudal fin subtruncated. Pectoral with a broad base extending to the origin of the anal fin. Scales very finely ciliated. Uniform rose coloured. Off Ki Islands. Length of specimen, $2\frac{1}{2}$ to $3\frac{1}{2}$ inches. Station 192; 129 fathoms.

Xiphochilus quadrimaculatus, n. sp. (Pl. XX. fig. C).

D. $\frac{12}{8}$, A. $\frac{3}{10}$, L. lat. 30, L. transv. $2\frac{1}{2}/10$. The height of the body is rather less than the length of the head, and contained thrice and three-sevenths in the total length (without caudal); snout rather short, as long as the eye, the diameter of which is two-sevenths of the length of the head. The maxillary reaches the front margin of the eye; both jaws with four canine teeth in front, the upper with a posterior one; operculum dilated into a large flap; three series of scales on the cheek; sub- and inter-operculum scaly; præorbital as high as the orbit. Dorsal spines rather slender. Rose coloured; a blackish spot below the sixth and seventh dorsal spines on the lateral line; another above the end of the lateral line above the caudal fin. Length of specimen, 4 inches. Arafura Sea.

Chœrops cyanodon, Rich., Somerset.
Chœrops ommopterus, Rich. Station 186 (trawl).

Ophidium murænolepis, n. sp. (Pl. XX. fig. A).
The length of the head equals its distance from the vent, which is somewhat nearer to the end of the snout than to that of the tail. (In *Ophidium broussoneti* the distance of the vent from the end of the tail is nearly twice that from the end of the snout.) The scales are extremely small, not imbricate, elongate, and obliquely arranged as in an eel. The outer pair of barbels is considerably longer than the inner, and much shorter than the head. The lower branch of the outer branchial arch with four gill-rakers, which are very short, scarcely one-third of the diameter of the eye. No hook-like prominence at the ethmoid. Head entirely naked. Dorsal fin with a blackish edge. Ki Islands. Length of specimen, 7 inches. Station 192; 129 fathoms.

Pseudorhombus russelli, Gray, Arafura Sea; 35 to 49 fathoms.

Rhomboidichthys angustifrons, n. sp. (Pl. XXI. fig. B).
D. 83, A. 62, L. lat. 80. The height of the body is a little more than one-half of the total length with the caudal; the length of the head one-fourth; head about as high as long; anterior profile of the head parabolic, with a small notch in front of the inter-orbital space. Cleft of the mouth narrow, with the lower jaw prominent, and with the maxillary extending to below the front margin of the orbit; snout a little shorter than the eye, the diameter of which is two-sevenths of the length of the head. An inconspicuous knob superiorly on the maxillary, and on the front margin of the lower orbit. Length of the maxillary a little less than one-third of that of the head. Interorbital space very narrow, deeply concave, smooth. Vent on the left side. Scales of the coloured side ethmoid, of the blind side smooth. No spines along the base of the dorsal and anal fins. In the single specimen observed, the anterior dorsal rays are nearly detached and produced. Light brownish with indistinct darker spots, of which a series

runs along the base of the dorsal and anal; also the caudal is ornamented by a pair of similar spots, one being close to the upper and lower margin. Three large black ocelli, edged with white, and with a black outer ring, are placed in the middle of the body in the form of a triangle. Length of specimens, $5\frac{1}{2}$ inches. Arafura Sea; 30 fathoms.

Rhomboidichthys spilurus, n. sp. (Pl. XXI. fig. A).

D. 90, A. 66, L. lat. 47. The height of the body is contained once and three-fourths in the total length (without caudal). Scales deciduous. Interorbital space scaly, concave; its width being equal to the diameter of the orbit, which is one-fourth of the length of the head; mouth narrow, the length of the maxillary being equal to the diameter of the eye. The dorsal fin terminates immediately before the root of the caudal, the left pectoral longer and more developed than the right. Greyish, finely marbled with brown; caudal with a pair of black spots on the middle of its length, each spot being close to the upper and lower margins.

This species is closely allied to *Rhomboidichthys grandisquama*, but distinguished by the much narrower interorbital space and smaller scales. South of New Guinea, Zebu. Length of specimen, 4 inches. Station 188; 28 fathoms.

Samaris maculatus, n. sp. (Pl. XXI. fig. A).

D. 73, A. 57. Scales very small. The height of the body is contained thrice and one-fourth in the total length without caudal, the length of the head thrice and three-fourths. None of the dorsal rays are prolonged, but the anterior are much more distant from each other than the succeeding. Right pectoral with narrow base, five-rayed, elongate, but shorter than the head. No pectoral fin on the blind side. Eyes very close together, the lower somewhat in advance of the upper. Light coloured, with a series of five distant black spots along the dorsal profile; a similar series along the anal profile, and a third composed of three spots along the lateral line. Vertical fins, with irregular blackish dots and blackish margins. Pectoral variegated with black. Ki Islands. Length of specimen, 4 inches. Station 192; 129 fathoms.

Arnoglossus aspilus, Blkr., Arafura Sea; 30 fathoms.

Anticitharus, n. gen.

Mouth wide, or rather wide; the length of the maxillary being more than one-third of that of the head. Teeth conical, of unequal size, in a single series in both jaws; vomerine and palatine teeth none. The dorsal fin commences on the snout. Scales of moderate size, smooth, deciduous. Lateral line, with a strong curve above the pectoral. Eyes on the left side. Gill-membranes broadly united below the throat. Gill-rakers short and lanceolate. Ki Islands.

Anticitharus polyspilus, n. sp. (Pl. XXII. fig. A).

D. 106, A. 82, L. lat. 75. Height of the body is contained twice and two-thirds in the total length (without caudal). The length of the head thrice and three-fourths. The curve of the lateral line is rather open, its span being equal to the length of the head without snout. Snout about as long as the eye, which is one-fourth of the length of the head. The eyes are separated from each other by a narrow scaleless ridge, the lower being considerably in advance of the upper. Mouth obliquely ascending upwards, but with the lower jaw scarcely projecting beyond the upper. The maxillary extends to behind the front margin of the eye. Anterior teeth stronger and longer than the lateral. The dorsal fin commences anteriorly on the snout, and is continued to the root of the caudal. Its anterior rays are somewhat longer than the succeeding, but not longer than those behind the middle of the length of the fin. Pectoral of the coloured side somewhat longer than that of the blind, and rather more than half as long as the head. Ventrals separate, opposite to each other, the anterior being rather in advance of the posterior. Coloration transparent, with some small black spots regularly disposed, but not constantly present. They form a series of three or four near the dorsal and ventral outlines ; another along the lateral line ; a pair of spots occupying the basal portion of the caudal. Similar but larger spots along the dorsal and anal fins. Ki Islands. Length of specimens, 7 and 8½ inches. Station 192 ; 129 fathoms.

Pœcilopsetta, n. gen. (Pleuronectidæ).

Mouth rather narrow, the length of the maxillary being one-third of that of the head. Each jaw with a narrow band of villiform teeth. Vomerine and palatine teeth none. The dorsal fin commences above the middle of the eye. Scales very small. Gill-membranes united below the throat.

Pœcilopsetta colorata, n. sp. (Pl. XXII. fig. B).

D. 61, A. 50. The height of the body is contained twice and one-fourth in the total length (without caudal), the length of the head thrice and three-fourths. Lateral line with a semi-circular curve above the pectoral fin, the diameter of which is equal to three-fourths of the length of the head. Snout very short, with the jaws equal in front. Cleft of the mouth obliquely ascending upwards, the maxillary reaching beyond the anterior margin of the eye. Eyes large, one-third of the length of the head, opposite to each other, separated by a narrow, flat, scaly space ; the upper encroaches upon the upper profile of the head. Only the rays of the caudal fin are scaly. The dorsal fin commences above the middle of the eye, and is continued to within a short distance of the caudal. None of its rays are elongate. Pectoral equally developed on both sides, more than half as long as the head. Ventrals separate, opposite to each other. Light brownish ; head and body with numerous black dots ; dorsal and anal blackish ; caudal with a large black spot near its upper and lower margins ; pectoral with a large black spot occupying nearly the whole fin. Ki Islands. Length of specimens, 6 inches. Station 192 ; 129 fathoms.

Læops parviceps, Gthr. Station 190. Arafura Sea ; 35 to 49 fathoms.

Brachypleura novæ-zealandiæ, Gthr., Arafura Sea ; 35 to 49 fathoms. Coast of New Guinea ; 30 fathoms.

Solea kaiana, n. sp. (Pl. XXI. fig. C).

D. 70, A. 50, L. lat. ca. 70. The height of the body is two-fifths of the total length (without caudal), the length of the head rather more than one-fourth ; the width of the interorbital space equal to the diameter of the eye. No pectoral whatever. Light brownish : head, body, and fins reticulated with brown, the network being more distinct towards the margins of the fish. Ki Islands. Length of specimen, $4\frac{1}{4}$ inches. Station 192 ; 129 fathoms.

Synaptura zebra, Bl., Arafura Sea ; 35 to 49 fathoms.

Synaptura arafurensis, n. sp.

D. 65, A. 52, P. 6, L. lat. 100. The height of the body is two-fifths of the total length, with the caudal; the length of the head one-fifth. Scales ciliated on both sides of the body, those of the neck not larger. There are several patches of black filaments on different parts of the body ; the largest is in the middle of the length of the lateral line, two or three smaller ones along the base of the dorsal, and of the anal, and one on the base of the caudal. Upper jaw slightly overlapping the lower. The eyes are very small ; they occupy jointly a single protuberance, which can partially be received in a hollow. Pectorals rudimentary, about one-sixth of the length of the head ; the right is black between the rays, and its axil is black also. The last dorsal and anal ray extends beyond the middle of the length of the caudal. Nasal tubes short. Uniform brownish-grey. Arafura Sea. Length of specimen, $4\frac{1}{4}$ inches. Station 190; 35 fathoms.

Cynoglossus kopsi, Blkr., Arafura Sea. Station 190.

Cnidoglanis nudiceps, n. sp.

Closely allied to *Cnidoglanis lepturus* and *Cnidoglanis microcephalus*, but with the occipital region osseous, and not covered with loose skin. Head depressed, small, its length being equal to its distance from the vent; the nasal and maxillary barbels do not extend to the end of the head; lower lip not pendent or fringed; isthmus between the branchial membranes comparatively broad, as broad as the interorbital space. Intermaxillary teeth conical, in two subtriangular patches; vomerine teeth more obtuse, in two series which form a subcrescentric band; mandibulary teeth in a band. Eye of moderate size. The first dorsal is lower than the body, and placed at a very short distance from the occiput; spine serrated in front and behind, as long and strong as that of the pectoral fin. Light brownish, fins with a black margin. Length of specimen, 8½ to 9 inches. Arafura Sea.

Saurus intermedius, Agass.
Hitherto known from the Atlantic only. Arafura Sea.

Saurus kaianus, n. sp. (Pl. XXIII. fig. C).
D. 11, A. 10, V. 8, L. lat. 63, L. transv. 3½/8. Body subcylindrical. Length of the head contained thrice and two-thirds in the total (without caudal). Snout depressed, pointed, nearly as broad as long, with the upper jaw projecting beyond the lower. Interorbital space slightly concave, narrower than the eye, the diameter of which is two-ninths of the length of the head. Frontal bones without sculpture. There are seventeen scales between the occiput and the dorsal fin. Dorsal fin as high as long. The pectoral fin extends to the twelfth scale of the lateral line. The series of scales on the tail without keel. Upper parts greenish, lower silvery. A series of blackish spots alternately larger and smaller along the middle of the body. Ki Islands. Length of specimen, 5½ inches. Station 192; 129 fathoms.

Saurida grandisquamis, Gthr., Arafura Sea.
Belone strongylurus, Blkr., Somerset.
Belone annulata, C. V., Somerset.
Hemirhamphus quoyi, C. V., Somerset.
Hemirhamphus commersoni, Cuv., Somerset.
Chirocentrus dorab, Forsk., Somerset.
Phyllopteryx tæniophorus, Gray, male with full pouch. Cape York. Station 186; 8 fathoms.
Triacanthodes anomalus, Schleg., Ki Island. Station 192; 129 fathoms.
Monacanthus penicilligerus, Cuv. Station 188; 28 fathoms.
Monacanthus longirostris, Cuv., New Caledonia.

Monacanthus filicauda, n. sp. (Pl. XXIII. fig. D).
D. 35, A. 37. Scales minute, the entire surface of the fish being uniformly covered with asperities longitudinally arranged. Dorsal spine rather slender, longer than the

snout, granular in front, and armed with a double series of barbs behind; it is placed above the hind margin of the orbit. Body elevated, its depth being contained once and three-fifths in the total length (without caudal). The origin of the dorsal fin is the highest point in the dorsal profile. Snout moderately produced, with the upper profile very slightly concave. Caudal fin obliquely truncated with the upper ray prolonged into a filament. Ventral spine movable, small. Light brownish, with more or less conspicuous darker spots; a round black spot immediately below the anterior third of the dorsal fin is constant. South of New Guinea. Length of specimen, $3\frac{1}{2}$ to 5 inches. Station 188; 28 fathoms.

Tetrodon nigropunctatus, Bl., Arafura Sea; 35 to 49 fathoms.

D. THE EAST INDIAN ARCHIPELAGO.

A few species only were collected by the Expedition at Banda (September 30, 1874) and Amboyna (October 4). Better opportunities offered themselves during the prolonged stay of the Challenger at the Philippine Islands: Manilla was visited twice, from November 4 to 11, and from January 11, 1875, to January 14; Zebu was reached on the 18th, and its celebrated sponge-grounds were thoroughly examined; but the majority of fishes were obtained at Samboangan, where the Expedition landed several times. Some of the species collected there prove to be new, two being fluviatile.

Chiloscyllium indicum, Gm., Manilla.
Serranus diacanthus, C. V., Philippines. Station 203.

Acropoma philippinense, n. sp.

D. $9/\frac{1}{8}$, A. $\frac{2}{7}$, L. lat. 31, L. transv. $\frac{2}{9}$. The height of the body is contained thrice and a half in the total length (without caudal), the length of the head twice and three-fifths. Eye one-third of the length of the head, and longer than the snout and the interorbital space. The two canine teeth of the upper jaw are strong, much longer than in *Acropoma japonicum;* lower jaw with a pair of small canine teeth in front, and with three strong ones on each side. Vomerine and palatine teeth small, in very narrow bands. Lower jaw not much projecting beyond the upper; maxillary without scales, not extending to the centre of the eye. Præoperculum with the angle slightly produced and serrated; operculum without prolongation. Dorsal spines rather feeble, the third being the longest, and half as long as the head. Caudal fin forked. Pectoral reaching to the vent. Uniform silvery, with the back greenish. Philippine Islands. Length of specimens, 2 to $3\frac{1}{2}$ inches. Station 201; 82 to 102 fathoms.

Therapon theraps, C. V., Philippines. Station 203.
Priacanthus, sp. (?). Station 194, off Banda, in tow-net.
Scolopsis monogramma, C. V., Philippines. Station 203.
Sebastes nematophthalmus, Gthr. Hitherto known from the West Indies and Mauritius. Philippines. Station 201 ; 82 fathoms.
Tetraroge longispinis, C. V., Philippines. Station 203.
Lioscorpius longiceps, n. sp. (see p. 40). Station 204. Philippines.
Equula fasciata, Lac., Philippines. Station 203.
Equula dussumieri, C. V., Philippines. Station 203.
Acanthurus hepatus, L., Samboangan.

Champsodon vorax (Pl. XXIII. fig. A), (Gthr., Proc. Zool. Soc., 1867, p. 102).

D. 5/17–20, A. 17–19. A series of numerous and apparently full-grown examples enables me to correct an error in the original generic diagnosis, in which the bones of the head are described as unarmed. The angle of the præoperculum is armed with a long lanceolate spine obliquely directed upwards, and there are several denticulations on the hind margin of the same bone. Also the præorbital has some obtuse spines. Eye with one or two minute filaments at its supero-posterior angle. Two lateral lines become very distinct as soon as the fish is dry, and both are provided with lateral vertical branches. Length of specimens, 3 to 4 inches. Station 204 ; 115 fathoms. Philippines.

Opisthognathus macrolepis, Peters (Berl. Monatsber., 1866, p. 520).

B. 6, D. $\frac{11}{11}$, A. 13, L. lat. 56. The maxillary is not so much elongate as in the other species ; it reaches beyond the eye, but not to the angle of the præoperculum. The height of the body is one-fifth of the total length (without caudal), the length of the head a little less than one-third. Eyes very close together. The last spine of the dorsal fin considerably shorter than the first ray. Dorsal fin with a large black spot between the second and fourth spines. Length of specimen, 4 inches. Philippines. Station 201 ; 82 fathoms.

Platycephalus, sp., young, Philippines. Station 203. Straits near Zebu ; 18 fathoms.

Peristethus murrayi, n. sp. (Pl. XXXII. fig. A).

D. 7/21, A. 20, L. lat. 30. Præorbital processes narrow, narrower in their basal half than towards their extremity ; their length is one-third of the distance between their extremity and the front margin of the orbit. Snout and forehead without any spines ; a small spine above the posterior margin of the orbit, and one on each side of the occiput. Præopercular ridge prominent, trenchant, terminating in a slender spine nearly as long as the eye. Interorbital space concave, its width being equal to the diameter of the eye. Anterior abdominal scutes not much longer than broad, and nearly equal in size to the posterior, which are as broad as long. Red, dorsal fins with a blackish margin. Sea of Banda. Length of specimen, 8 inches; 200 fathoms,

It seems that the sojourn at a moderate depth (200 fathoms) has not sufficed to effect a visible modification of the different organs of the fishes of this genus. However, it seems to me that also the other species of the genus, and especially the Mediterranean form, of the habits of which more is known than of any other, descend to greater depths than is generally supposed.

Gobius echinocephalus, Rüpp., Zebu.

Callionymus curvicornis, C. V., Philippines. Station 201; 82 fathoms.

Callionymus calauropomus, Rich. Station 204. Philippines; 115 fathoms. (This specimen, which is a male, has the first dorsal spine prolonged into a filament, and a black ocellus between the third and fourth spines.)

Lophius naresi, n. sp. (see p. 60, and Pl. XXV.) Station 204; 115 fathoms.

Trypauchen vagina, Bl., Amboyna; 15 fathoms.

Amphisile scutata, L., Philippines. Station 203; 10 to 20 fathoms.

Ophiocephalus vagus, Ptrs. (scarcely distinct from *Ophiocephalus striatus*, Bl.), Manilla.

Duymæria flagellifera, C. V. (=*Daymæria filamentosa*, Ptrs.), Samboangan.

Bregmaceros macclellandi, Thomps., Amboyna; 15 fathoms.

Pseudorhombus russelli, Gray. Station 203. Philippines.

Rhomboidichthys pavo, Blkr., Island of Malanipa, near Samboangan.

Rhomboidichthys spilurus, n. sp. (see p. 47, and Pl. XXI. fig. A.), Straits of Zebu; fathoms, 18.

Solea ovata, Rich. Station 203. Philippines.

Cynoglossus puncticeps, Rich. Station 203. Philippines.

Barbus maculatus, C. V., var.

D. 11, A. 8, L. lat. 26, L. transv. $4\frac{1}{2}/4\frac{1}{2}$. The osseous dorsal ray is rather feeble, its stiff portion being about as long as the head without snout; its serrature is fine and rather inconspicuous. There are two and a half longitudinal series of scales between the lateral line and the root of the ventral fin. The depth of the body is one-third of the total length (without caudal). The length of the head one-fourth. Snout of moderate length, a little longer than the diameter of the eye, which is one-fourth, or a little less than one-fourth of the length of the head. Barbels well developed, longer than the eye. The origin of the dorsal fin is slightly in advance of the vertical from that of the ventrals, and scarcely nearer to the end of the snout than to the root of the caudal. A series of four round black spots along the middle of the side of the body, a fifth similar spot below the origin of the dorsal fin. Samboangan, Philippines. Length of specimens, 2½ to 5 inches. Pasananca, near Samboangan.

Rasbora philippina, n. sp.

L. lat. 28–29. The origin of the dorsal fin is much nearer to the base of the ventrals than to the anal, and opposite to the ninth and tenth scales of the lateral line. The length of the head is contained four and one-third times in the total (without caudal). Barbel none; maxillary extending to below the front margin of the eye. Pectoral as long as the head. A silvery band along the side of the tail. River at Pasananca, near Samboangan (Philippine Islands). Length of specimens, 2½ to 3½ inches.

Muræna richardsoni, Blkr., Reefs near Zebu, Samboangan.
Muræna nebulosa, Ahl., Reefs of Zebu.
Muræna, sp., young, Reefs near Zebu.
Balistes verrucosus, Bl., Schn., Reefs of Zebu.
Monacanthus pardalis, Rüpp., Reefs of Zebu.

Monacanthus tessellatus, n. sp. (Pl. XXIII. fig. B).

D. 36, A. 32. Skin velvety, without distinct scales. The depth of the body is one-half of the total length (without caudal). Snout long, the distance of the eye from its extremity being two-sevenths of the total length (without caudal). Upper profile very slightly concave. Gill-opening below the middle of the eye; root of the pectoral below its posterior half. Dorsal spine rather long, nearly half as high as the body above the posterior half of the eye, armed with four rows of barbs, of which the anterior are close together. Caudal with the margin rounded. Dorsal and anal fins but little higher anteriorly than posteriorly. Ventral spine small, fixed. Colour light brownish. Head and body ornamented with squarish dark brown spots, regularly arranged in transverse and longitudinal series; caudal blackish. Philippine Islands. Length of specimen, 5 inches. Station 204; 115 fathoms.

Tetrodon immaculatus, Bl., Schn., Philippines. Station 203.
Tetrodon patoca, H. B., Philippines. Station 203.
Chilomycterus orbicularis, Bl., Straits near Zebu; 18 fathoms.

E. HONG KONG.

The Expedition remained at this locality from November 16, 1874, to January 6, 1875. Its fish-fauna being well known, but few species were collected, one of which appears to be undescribed.

Serranus diacanthus, C. V.
Mesoprion vitta, Q. and G.
Chilodactylus zonatus, C. V.
Sebastes marmoratus, C. V.
Scorpæna cirrhosa, Thunb.
Drepane punctata, L.
Platycephalus insidiator, Forsk.
Platycephalus japonicus, Tiles.
Stromateus argenteus, Bl.
Gobius knutteli, Blkr.
Eleotris sinensis, Lac.
Apocryptes polyophthalmus, Gthr.
Callionymus curvicornis, C. V.
Trypauchen vagina, Bl., Schn.

Trypauchen chinensis, Steind., off Hong Kong, in 10 fathoms.

Ctenotrypauchen chinensis, Steindachner, Wien. S. B., 1867, vol. lv. p. 530, taf. vi. fig. 3.
Trypauchen chinensis, Steindachner, *ibid.*, p. 708.

Ophiocephalus maculatus, Lac.
Pseudoscarus nuchipunctatus, C. V.
Pseudorhombus cinnamomeus, Schleg., off Hong Kong, in 7 fathoms.

Arnoglossus tenuis, n. sp.

D. 93, A. 70, L. lat. 48. Scales very thin and deciduous. The height of the body is two-fifths of the total length (without caudal), the length of the head two-ninths. The greatest depth between the anal fin, and the straight portion of the lateral line is less than the length of the head. Snout with the lower jaw somewhat projecting, as long as the diameter of the eye, which is nearly one-fourth of the length of the head. The length of the maxillary is one-third of the length of the head, that of the mandible rather less than one-half. Eyes separated by a very narrow ridge, the lower being considerably in advance of the upper. Lateral line with a semicircular curve above the pectoral. The dorsal and anal are continued on to the root of the caudal, and the rays of moderate length. The rays of the left ventral occupy the whole length between throat and vent. Humeral arch without projecting spines. Coloration uniform. Length of specimens, $2\frac{1}{2}$ and $4\frac{1}{2}$ inches.

Solea ovata, Rich., off Hong Kong; 7 fathoms.
Cynoglossus melampetalus, Rich., off Hong Kong; 7 fathoms.
Saurida argyrophanes, Rich.
Cyprinus auratus, L.

F. THE ADMIRALTY ISLANDS.

The visit of the Challenger to the Admiralty Islands extended from March 4 to March 10, 1875. The fishes collected are, as might have been expected, identical with those of the Indo-Pacific Ocean. Three have proved to be undescribed, viz., a *Lophius,* which also occurs in the Philippines, and two *Pleuronectidæ;* they are inhabitants of the moderate depth of 150 fathoms.

Mesoprion monostigma, C. V., Nares Harbour.
Sphærodon grandoculis, Forsk., Nares Harbour.
Gerres macracanthus, Blkr., Nares Harbour.
Pimelepterus waigiensis, Q. and G., Nares Harbour.
Upeneus barberinus, C. V., Nares Harbour.
Peristethus liorhynchus, Gthr., outside Nares Harbour ; 152 fathoms.
Sillago sihama, Forsk., Nares Harbour.
Champsodon vorax, Gthr., outside Nares Harbour ; 152 fathoms.
Caranx crumenophthalmus, Bl., Nares Harbour.
Platax orbicularis, Forsk., (=*vespertilio,* Bl.), Nares Harbour.
Acanthurus blochi, C. V., Nares Harbour.
Teuthis concatenata, C. V., Nares Harbour.
Teuthis vermiculata, C. V., Nares Harbour.
Teuthis margaritifera, C. V., Nares Harbour.

Lophius naresi, n. sp. (Pl. XXV.).

D. 3/3/8, A. 6. Head and body covered with long fringes. Interorbital space deeply concave, with sharp raised denticulated superciliary edges. Humeral spine simple, acute. Mouth behind the hyoid greyish. Length of specimens, 3 and 8 inches. Nares Harbour, Admiralty Island. Station 219. North of New Guinea. 152 fathoms.

Pseudorhombus ocellatus, n. sp. (Pl. XXIV. figs. A and B).

D. 88, A. 75–76. Scales minute, but distinctly imbricated, not ciliated; lateral line anteriorly with a strong curve, the diameter of which equals the length of the pectoral fin. The height of the body is one-half of the total length (without caudal), the length of the head one-fourth. Eyes separated merely by a ridge, large, one-third of the length of the head, the lower considerably in advance of the upper. One (male) specimen with a small spine in front of each eye, another above the mouth, and a fourth at the mandibulary symphysis. Snout very short, with the narrow mouth obliquely directed upwards, the maxillary terminating immediately behind the front margin of the orbit. The dorsal fin commences above the nostrils, is not scaly, and terminates close to the caudal, its anterior rays being shorter than the middle ones. In the male the thirteenth to nineteenth rays of the dorsal, and the seven anterior of the anal, are prolonged into long filaments. Pectoral as long as the postorbital portion of the head. Ventrals distinct, opposite to each other. Brown, with scattered, more or less irregular whitish ocelli, margined with black. Fin-rays with black dots, and some entirely black for some portion of their length. On the blind side the anterior half of the body is whitish, the posterior blackish. Admiralty Islands. Length of specimens, $5\frac{1}{2}$ inches. Outside Nares Harbour; 152 fathoms.

Nematops, n. gen. (Pleuronectidæ).

Cleft of the mouth narrow. Teeth minute; scarcely any teeth on the coloured side. Vomerine teeth none. The dorsal fin commences above the eye. Scales rather small, ciliated. Lateral line with a strong curve anteriorly. Eyes on the right side, large, each provided with a tentacle, the upper encroaching upon the upper profile.

Nematops microstoma, n. sp. (Pl. XXIV. fig. C).

D. 64, A. 54, L. lat. 65. The height of the body is contained twice and a half in the total length (without caudal), the length of the head four times and a third. Snout extremely short, with narrow mouth obliquely ascending upwards. Eyes very large, two-fifths of the length of the head, very close together, the upper encroaching upon the upper profile. Tentacle nearly as long as the eye, attached to its posterior half. The eyes are inserted on the same level. The dorsal fin commences above the middle of the eye, and terminates at a very short distance from the caudal; its rays are of moderate length. Pectorals of both sides nearly equally developed, half as long as the head. Ventrals separate, opposite to each other. The scales of the coloured side are indistinctly ciliated, those of the blind smooth. The curve of the lateral line is semicircular, with a diameter shorter than the head. Dorsal and anal rays dotted with black, and a larger black spot on the posterior dorsal and anal rays. Caudal black, with a broad whitish posterior margin. Length of specimen, $3\frac{3}{4}$ inches. Outside Nares Harbour, in 152 fathoms.

Belone liuroides, Blkr., Nares Harbour.
Clupea moluccensis, Blkr., Nares Harbour.
Balistes maculatus, Gm., North of Admiralty Islands.

G. THE FRIENDLY AND SOCIETY ISLANDS.

But few species were collected during the Challenger's stay at Tongatabu (July 20, 1874), to which were added a small number from Tahiti (September 1875). None of them are of special interest.

Zygæna malleus, Risso, (stuffed), Tongatabu.
Trygon kuhli, M. and H., Tongatabu.
Serranus dispar, Playf., Tongatabu.
Mesoprion fulviflamma, Forsk., Tongatabu.
Dules marginatus, C. V., Papeuriri, Otaheiti.
Cæsio tile, C. V., Tongatabu.
Gerres oyena, Forsk., Tongatabu.
Holocentrum spiniferum, Forsk., Tongatabu.

Caranx hippos, L., brackish water near Papiete, Tahiti.

Caranx hippos, L. : Gthr., Fish., vol. ii. p. 449, and Fisch. d. Südsee, p. 131, taf. lxxxiv.

Acanthurus (?), sp., young (*Acronurus*), brackish water near Papiete, Tahiti.
Eleotris fusca, Bl., Schn., streams and brackish water near Papiete, Tahiti.
Mugil kelaarti, Gthr., Tongatabu.

Mugil tongæ, n. sp.

D. $4/\frac{1}{8}$, A. $\frac{3}{8}$, L. lat. 45, L. transv. 16. The height of the body is one-fourth of the total length (without caudal), the length of the head two-sevenths; the snout is very broad, the width of the interorbital space being a little more than two-fifths of the length of the head. Eye with a broad adipose membrane. Lips thin; the maxillary is nearly entirely covered by the præorbital, only a narrow strip of its extremity being visible; cleft of the mouth nearly twice as broad as deep; the angle made by the anterior margins of the mandibles slightly exceeding a right one. Anterior dorsal spines half as long as the head, occupying the middle of the distance between the snout and the root of the caudal. There are about twenty-six scales between the snout and the spinous dorsal fin; the eleventh, thirteenth, and twenty-seventh scales of the lateral line correspond to the extremity of the pectoral fin, and to the origins of the two dorsals. Coloration uniform. Length of specimen, $6\frac{1}{2}$ inches. Tongatabu.

Gomphosus tricolor, Q. and G., Harbour of Tahiti.
Anguilla aneitensis, Gthr., Lake Waihirra, Tahiti. A malformed specimen from River near Lake Waihirra.
Anguilla mauritiana, Benn., Lake Waihirra, Tahiti.
Ophichthys maculosus, Cuv., Tongatabu.
Muræna nebulosa, Ahl., Tahiti.
Muræna richardsoni, Blkr., Tahiti.
Diodon hystrix, L., Tahiti.

H. THE SANDWICH ISLANDS.

The Challenger stayed a fortnight at Honolulu, and five days at Hilo, Hawaii. The fauna is almost purely Polynesian, although we may remember that several species from the West Coast of America have strayed as far eastwards as to reach this group. Most of the fresh-water species, on the other hand, are peculiar to this isolated group; and the Expedition obtained two Blennioids which hitherto had escaped observation.

Zygæna malleus, Risso, Reefs at Honolulu.
Dules marginatus, C. V., Hilo, Hawaii (seine). Reefs at Honolulu.

Scorpæna nuchalis, Gthr. (Fisch. d. Südsee, p. 76).

If the two following specimens really belong to this species, it is subject to variation of colour, the Sandwich Islands specimens showing no white dots on any part of their body; both, however, have a broad light band across the nape and side of the head. One of the specimens has a large black spot between the four last dorsal spines, which is absent in the other specimen. The typical specimen came from Rarotonga. Length of specimens, 2½ to 3 inches. Reefs at Honolulu.

Cirrhites arcatus, C. V., Reefs at Honolulu.
Cirrhitichthys maculatus, Lac., Reefs at Honolulu.
Caranx crumenophthalmus, Bl., Reefs at Honolulu.
Caranx hippos, L., Hilo, Hawaii (seine).
Acanthurus blochi, C. V., Reefs at Honolulu.
Upeneus trifasciatus, Lac., Reefs at Honolulu.
Polynemus sexfilis, C. V., Hilo, Hawaii (seine).

Gobius stamineus, Valenc. (Voy. Bonite Poiss., p. 179, pl. v. fig. 5).

This is the first time that this species has been rediscovered since it was described and figured by Valenciennes. Although the figure given in the French Voyage is recognisable as far as the form is concerned, the coloration seems to be imaginary, and is certainly very different from that of the specimens before me. This species is closely allied to *Gobius ocellaris* and *crassilabris;* from the former it differs in having smaller scales on the neck, and in lacking a black dorsal spot; from the latter in having the eye placed farther back.

D. 6/11, A. 11, L. lat. 60. Fifteen longitudinal series of scales between the origin of the second dorsal and anal; scales on the neck much smaller than those on the tail; cheeks and opercles naked. The height of the body is four and one-half times, the length of the head thrice or thrice and one-fourth the total length (without caudal).

Head low, flattened above, with the snout much produced, the small eye being nearer to the gill opening than to the end of the snout. Mouth horizontal, scarcely extending to the eye, with projecting upper jaw and very thick lips. Teeth in villiform bands, without canines. Interorbital space wider than the eye in old specimens, and of about the same width in younger ones. Dorsal fins lower than the body, caudal rounded; ventral terminating a long way from the vent, with broad basal membrane. Yellowish or brownish, with irregular darker spots, some in the middle of the body being arranged more or less distinctly in a longitudinal series; the rays of the dorsal fins and of the caudal with small black spots; a round spot at the root of the caudal, and an oblong one on the upper part of the root of the pectoral are rather constant. Length of specimen, 2 to 8 inches. Fresh-waters of Honolulu. Streams of Hawaii.

Gobius sandvicensis, n. sp.

D. $6/\frac{1}{9}$, A. 9, L. lat. 35. Twelve longitudinal series of scales between the second dorsal and the anal. Only a few very small scales before the dorsal, the nape and the whole head being naked. The height of the body is contained five and a half times in the total length (without caudal), the length of the head four times. The head is rather broader than high, with the cheeks swollen. Interorbital space very narrow. Eye as long as the snout, which is convex. Cleft of the mouth scarcely oblique. Jaws equal in front; a curved canine tooth on each side of the jaw. Upper pectoral rays silk-like. Dorsal and anal fins of moderate height. Caudal fin obtusely rounded, not quite so long as the head. The ventral fin does not quite reach to the vent, and has the basal membrane well developed. Reddish-olive with lighter dots, and with a series of larger brown spots along the lower half of the side of the body. Vertical fins dotted with brown. Length of specimen, $1\frac{1}{2}$ inches. Honolulu, fresh-water.

Eleotris fusca, Bl., Schn., Honolulu, fresh-water.

Sicydium nigrescens, n. sp. (Pl. XXVI. fig. C).

D. 6/11, A. 11. The scales on the nape, on the anterior half of the trunk, and on the abdomen, are very small; sixteen longitudinal series may be counted between the origin of the first dorsal and anal. Head small, two-ninths of the total length (without caudal), broad, with small eye, the diameter of which is scarcely one-half of the width of the interorbital space. In the adult the third dorsal spine is prolonged into a filament, and the posterior rays of the second fin are much prolonged, so as to extend sometimes beyond the root of the caudal. Old specimens are nearly uniform black. Younger ones are sometimes of a lighter colour, with irregular and indistinct dark transverse spots and bands. Caudal without spots or bands. Length of specimen, 2 to 5 inches. Honolulu, fresh-water. Streams in the Island of Hawaii.

Lentipes concolor, Gill., Streams of Hawaii.

Sicyogaster concolor, Gill., Proc. Ac. N. Sc. Philad., 1860, p. 102.
Lentipes concolor, Gthr., Fish., vol. iii. p. 96.

Lentipes seminudus, n. sp.

D. 6/11, A. 10. A small fish, two inches long, and in an indifferent state of preservation, seems to be a second species of this genus, having the same singular dentition as *Lentipes concolor*, but the tail is covered with small scales, the head and trunk only being naked. It is an adult specimen, the ovaries being fully developed. The eyes are small, situated in the anterior half of the length of the head. The length of the head is one-fourth of the total, the caudal not included. The vent is somewhat nearer to the root of the caudal than to the head. Length of specimen, 2 inches. Honolulu, fresh-water.

Mugil dobula, Gthr., Hilo, Hawaii (shore).
Dascyllus albisella, Gill., Honolulu Reefs.

Julis obscura, n. sp. (Pl. XXVI. figs. A and B).

D. $\frac{8}{13}$, A. $\frac{2}{11}$, L. lat. 29, L. transv. $3\frac{1}{2}/10$. The determination of this species is rather doubtful, as it seems subject to great variation of colour, without being distinguished by some striking and constant peculiarity. There are four specimens in the collection, three of which are young, and the fourth apparently adult. The dorsal spines are remarkably short, and the upper and lower caudal lobes produced into short filaments. In the young the body is of a brownish-violet colour, which extends sometimes over the whole caudal fin, sometimes stopping short at the base of that fin, leaving it white. Scales with or without an indistinct vertical purplish line. Head apparently without markings. Dorsal and anal fins uniform blackish, or if of a lighter colour, with a black spot between the three anterior spines. Pectoral fin with a black spot superiorly at the base, and with a broad black longitudinal band, which sometimes becomes indistinct.

The adult has the ground colour light reddish, only the end of the tail, and the upper and lower margins of the caudal being black. Each scale with a vertical purple streak. Dorsal and anal fins greyish, without black spot in front. Pectoral light yellow, without black band, and without axillary spot. Length of specimen, 4 to 7 inches. Honolulu.

Rhomboidichthys pantherinus, Rüpp., Honolulu Reefs.
Chanos salmoneus, Forst., Reefs at Honolulu.
Albula conorhynchus, Bl., Schn., Hilo, Hawaii (seine); Hilo, Hawaii (seine).
Conger marginatus, Val., Reefs at Honolulu.
Muræna flavo-marginata, Rüpp., Reefs at Honolulu.
Muræna (?), sp., Reefs at Honolulu.

Doryichthys pleurotænia, n. sp. (Pl. XXVI. fig. D).

D. 25, Osseous rings 18 + 14. The edges of each ring terminate in a slightly prominent spine. Lateral line continuous, passing into the lower caudal edge. Snout with denticulated ridges; operculum with a slightly oblique raised line, below which there are several other radiating keels; snout shorter than the remaining portion of the head; interorbital space concave, the supraorbital ridge being raised, but scarcely serrated. Vent behind the middle of the dorsal fin, equidistant from the root of the pectoral, and from the end of the caudal. Pectoral shorter than the operculum; caudal longer than the snout. Light greyish, with a brownish-black band from the snout along the middle of the body and caudal fin.

Distance of the snout from the vent, 14 lines. Distance of the vent from the end of the caudal, 9 lines.

The figure is twice the natural size. Length of specimen, 23 lines. Off Honolulu; 18 fathoms.

Balistes buniva, Lac., Reefs at Honolulu.

I. JAPAN.

A considerable collection was brought together during the prolonged stay of the Expedition in Japan (April 11 to June 16, 1875). All the specimens were obtained on the southern and south-eastern shores of Nipon, viz., at Yokohama (where, besides marine fishes, several fresh-water species were purchased in the market), and from fishing-boats off Inosima. These boats were fishing with long lines in 400 fathoms. They had small hooks attached all along the lines, and on these they brought up, along with a number of deep-sea fishes, specimens of *Hyalonema*, and many Pennatulids and other Alcyonarians. The ship dredged in 345 fathoms. The remainder of the collection came from the sheltered straits which separates Nipon from the Southern Islands, called the "Inland Sea," and particularly from Kobé.

A fact to which I have repeatedly drawn attention, and again quite recently in Ann. Mag. Nat Hist., 1878, vol. i. p. 385, viz., that there exists the greatest similarity between the marine fauna of Japan and that of the Mediterranean, the adjacent parts of the Atlantic, and the West Indies, is fully borne out by the Challenger collections. It is proved not only by a number of species absolutely identical in the seas named, but also by a large proportion of representative species. The similarity becomes still more obvious when we take into consideration species which live at a moderate depth of from 200 to 400 fathoms; and although I have included the descriptions of those fishes in the deep-sea series, it will be useful to enumerate them here with an indication of their geographical range. Of the nineteen species obtained at a depth of 345 fathoms, four are identical with Mediterranean species, five are representatives of Mediterranean species, eight belong to genera with a wide range at great depths, and two only must be regarded as peculiar Japanese forms.

1. *Centrophorus squamulosus*, .	Eight species of *Centrophorus* from the Coast of Portugal, Madeira, and Mediterranean.
2. *Centrophorus foliaceus*, .	
3. *Beryx decadactylus*, . .	Madeira and Coast of Portugal.
4. *Polymixia japonica*, . .	One species of this genus from Madeira and St Helena. One species from Cuba.
5. *Lepidopus tenuis*, . .	One species from the Mediterranean and the East Atlantic.
6. *Physiculus dalwigki*, . .	Madeira and St Helena.
7. *Haloporphyrus lepidion*, .	Mediterranean, Madeira, and Coast of Portugal.
8. *Macrurus japonicus*, . .	The species of *Macrurus* and *Coryphænoides* are generally distributed over the deep sea.
9. *Macrurus macrochir*, . .	
10. *Macrurus parallelus*, . .	
11. *Coryphænoides nasutus*, .	
12. *Coryphænoides villosus*, .	
13. *Bathythrissa dorsalis.*	Peculiar to the sea off Japan.
14. *Xenodermichthys nodulosus.*	Peculiar to the sea off Japan.
15. *Gonostoma gracile*, . .	One species from the Mediterranean and Madeira, the other from the deep sea, and generally distributed.
16. *Synaphobranchus pinnatus*,	Madeira, Brazil.
17. *Synaphobranchus affinis.*	Japan.
18. *Nettastoma parviceps*, .	One species from the Mediterranean.
19. *Myxine australis*, . .	Southern Coasts of South America.

Trygon pastinaca, L., Market of Yokohama.

Myliobatis aquila, L., Market of Yokohama.

Percalabrax japonicus, C. V., off Inosima, from Japanese fisher-boats; Inland Sea, from Japanese fisher-boats.

Niphon spinosus, C. V., Market of Yokohama.

Serranus octocinctus, Schleg. (= *Serranus mystacinus*, Poey.), Market at Yokohama.

Apogon lineatus, Schleg., Inland Sea of Japan, Yokohama Bay, 15 fathoms; Harbour of Kobé, 8 fathoms.

Scombrops chilodipteroides, Blkr., off Inosima, 345 fathoms.

Hapalogenys mucronatus, Eyd. and Soul., Harbour of Kobé, 8 fathoms.

Chætodon modestus, Schleg., Market of Yokohama.

Upeneoides bensasi, Schleg., Market at Yokohama, Kobé.

Pagrus major, Schleg., off Inosima, from Japanese fisher-boats, Harbour of Oosima.
Pagrus cardinalis, Lac., Market of Yokohama.
Chrysophrys swinhonis, Gthr., Inland Sea of Japan, Market of Yokohama.
Hoplegnathus fasciatus, Schleg., Inland Sea of Japan.
Sebastes ventricosus, Schleg., Market of Yokohama.

Sebastes oblongus, n. sp. (Pl. XVIII.).

Allied to *Sebastes inermis* and *pachycephalus.*

D. $12/\frac{1}{12}$, A. $\frac{3}{5}$, L. lat. ca. 65. The height of the body is contained thrice and one-half in the total length (without caudal); the length of the head twice and three-fifths. The scales are rather irregularly arranged, and much smaller above than below the lateral line. On the upper side of the head they advance to the nostrils, very minute ones covering even the præorbital. The snout is pointed and longer than the eye, the diameter of which is one-sixth of the length of the head, and equal to the width of the flat interorbital space. None of the spines on the upper side of the head project, and those of the præoperculum are obtuse; the teeth form broad villiform bands in the jaws as well as on the vomer and palatine bones; the maxillary reaches to the vertical from the hind margin of the eye. Dorsal spines strong; the fourth to the seventh are the longest, two-fifths of the length of the head. Anal spines stronger, but much shorter than the longest of the dorsal. Brownish, marbled with darker; lower parts and all the fins with brown spots; an oblique brown streak from the præorbital towards the angle of the præoperculum. Inland Sea, Japan. Market of Yokohama.

Sebastes joyneri, Gthr. (Ann. and Mag. Nat. Hist., 1878, vol. i. p. 485). (Pl. XXIX. fig. A.)

D. $\frac{13}{15}$, A. $\frac{3}{7}$, L. lat. ca. 60. The height of the body is equal to the length of the head, and one-third of the total length (without caudal); scales very thin, scarcely serrated, a little smaller above the lateral line than below it; on the upper side of the head they advance to the nostrils and cover the præorbital and maxillary. Snout short, three-fourths of the diameter of the eye, which is three-tenths of the length of the head, and exceeds by one-third the width of the interorbital space which is flat. Upper surface of head smooth, scarcely armed, the two occipital ridges very low and terminating in short spines; præorbital with two flat spines; præoperculum with five spines, the second from above being the longest, and one-third of the diameter of the eye; operculum with two spines, the upper of which is the longest. Teeth in narrow villiform bands, in the jaws, on the vomerine and palatine bones; the vomerine teeth form a triangular patch. The maxillary does not reach to the vertical from the middle of the eye. The fourth dorsal spine is the longest, contained twice and a quarter in the length of the head. Anal spines stronger than those of the dorsal, the second anal spine being shorter than the third dorsal. Probably red in life, with five brown cross bars on the back and the dorsal fin, the three anterior ones descending a little below the lateral line. Fins immaculate. Pharynx uncoloured.

Although no specimens of this species have been obtained by the Challenger Expedition, I enumerate it here along with the other Japanese species of this genus. The two specimens, which have been quite recently discovered, are 9 inches long, and from the south-east coast of Niphon.

Sebastes macrochir, n. sp. (Pl. XXVII).

D. $14/\frac{1}{6}$, A. $\frac{3}{5}$, P. 17/5, L. lat. ca. 45. The height of the body is contained thrice and one-fourth in the total length (without caudal), the length of the head two and a half times. Scales rather regularly arranged. Eye very large, one-third of the length of the head, much longer than the snout. Mouth wide, the maxillary extending to behind the middle of the eye. The bands of intermaxillary teeth are of moderate breadth, but those of the vomer, palatines, and mandible are very narrow. Interorbital space flattish, scaleless, narrow, its width being only two-fifths of the orbit. Occipital region flat, with some rudimentary scales. A series of spines runs along each side of the forehead and occiput; it consists of a spine in front of the orbit, three above it, and two on each side of the occiput. Infraorbital ridge with strong spines. Præoperculum with five pointed spines on the margin. Each ramus of the mandible with three large muciferous apertures. Dorsal spines rather feeble; the third to the sixth are the longest, two-fifths of the length of the head. Anal spines stronger, but shorter than the longest of the dorsal. Caudal truncated. The pectoral fin is extremely broad, the five or six lower rays being elongated beyond the extremity of those next above them; their extremities are somewhat thickened, and they, like the similar outer ventral rays, serve as an organ of locomotion. The pectoral rays extend to, the ventral rays beyond, the vent. The latter are as long as the head without snout.

Red, with a large black spot on the posterior half of the spinous dorsal, and with another between the anal spines. Length of specimens, 7 to 11 inches. Inland Sea of Japan. Off Inosima, 345 fathoms.

Scorpæna miostoma, n. sp.

Allied to *Scorpæna zanzibarensis* and *Scorpæna longicornis*, but with a considerably narrower mouth.

D. $11/\frac{1}{10}$, A. 3/5, L. lat. 45. Palatine teeth; the vomerine teeth form a simple open V-shaped band. The height of the body is less than the length of the head, which is contained twice and one-third in the total length (without caudal). Head nearly entirely scaleless. Upper jaw slightly overlapping the lower. Orbital tentacles broad, fringed, shorter than the eye which equals the length of the snout. Interorbital space deeply concave, with a pair of slight ridges within its concavity. Vertex with a quadrate depression, which is rather broader than long, and surrounded by spines. The maxillary does not extend backwards to below the middle of the eye. All the cutaneous appendages on the head, body, and fins are well developed. The fourth and fifth dorsal spines are the longest, two-fifths of the length of the head, and equal to the second of the anal fin, which, however, is stronger. Eight of the pectoral rays are branched. Body and fins marbled with the usual colours of this genus, but without any peculiar markings. The axil of the pectoral is scarcely spotted, and the lower part of the head is white. Japan. Length of specimen, 5⅓ inches. Market of Yokohama.

Pterois lunulata, Schleg. (probably = *Pterois volitans*, L.), Market of Yokohama.

Tetraroge longispinis, C. V., var. *nuda*.

In the typical form of this species the body is covered with minute but very conspicuous scales. In the following specimens the scales are so rudimentary, and in such small number, that the body appears to be almost naked. No other distinction can be made out between the scaly and naked specimens. Length of specimens, 1½ to 3¼ inches, Kobé, Japan.

Sciæna sina, C. V., Inland Sea, Japan.
Trichiurus lepturus, L. (= *Trichiurus savala*, Cuv. = *Trichiurus armatus*, Gray = *Trichiurus japonicus*, Blkr.), off Inosima, 345 fathoms.
Prionurus scalprum, Langsd., Market of Yokohama.
Trachurus trachurus, L., Market of Yokohama.
Caranx muroadsi, Schleg., Inland Sea, Japan.
Equula nuchalis, Schleg., Market of Yokohama.
Zeus japonicus, C. V., Market of Yokohama.
Cybium niphonium, C. V., Inland Sea, Japan.
Brama raii, Bl. (this also is a new addition to the Japanese fauna), off Inosima, purchased of fishing-boats.
Psenes anomalus, Schleg., Market of Yokohama.
Percis sexfasciata, Schleg., Market of Yokohama.
Uranoscopus asper, Schleg., Market of Yokohama.
Sillago japonica, Schleg., Inland Sea, Japan.
Latilus argentatus, C. V., Market of Yokohama.
Lophius setigerus, Wahl, Yokohama, Kobé.
Platycephalus insidiator, Forsk., Yokohama Bay, Inland Sea of Japan.
Platycephalus punctatus, C. V., Inland Sea, Japan.

Platycephalus rudis, n. sp. (Pl. XXIX. fig. B).

D. 1/8/11, A. 11, L. lat. ca. 70. The length of the head is one-third of the total (without caudal), and its width between the præopercular spines is more than one-half of its length. All the bones on the upper surface, and the scales covering its sides, are rough. The space between the eyes is concave, its width being one-half of the vertical diameter of the eye. Superciliary edge serrated; ridges with distant spines along the infraorbital and above the operculum, the central ridges of the crown of the head being rather obscure. Opercular ridge not serrated. Three spines at the angle of the præoperculum, the lower of which is the smallest, the upper the longest, but only half the length of the eye. Only the foremost part of the lateral line is spiny. Ventral fins reaching to the anal. Greyish, with black dots on the trunk and operculum. The spinous dorsal and ventral black, the second dorsal and pectoral, with blackish dots. Caudal irregularly marbled with blackish. Length of specimen, $7\frac{1}{4}$ inches. Market of Yokohama.

Lepidotrigla microptera, Gthr. (Ann. and Mag. Nat. Hist., 1873, vol. xii. p. 241), Inland Sea, Japan.

Gobius yokohamæ, n. sp.

D. 6/11, A. 11, L. lat. 26. The height of the body is contained four and a half times in the total length (without caudal), the length of the head thrice and three-fourths. Snout obtuse, as long as the eye, the diameter of which is more than one-fourth of the length of the head. Eyes very close together; mouth oblique, with the jaws subequal in front, reaching to below the front margin of the eye; a very small canine tooth on each side of the lower jaw; head and occiput naked, but nape covered with small scales. A wide porus in front and behind the interorbital space, and two others behind the eye; they are the openings of the muciferous channels. Seven longitudinal series of scales between the second dorsal and the anal. The ventral fin terminates at some distance from the vent, which is midway between the root of the caudal and the præoperculum. Dorsal fins rather lower than the body; caudal slightly pointed, as long as the head. Light brownish olive, with a series of five brown spots along the lower half of the body, the last being on the root of the caudal and the most distinct; a triangular black spot occupies the lower angle of the operculum; gill-membrane on the throat blackish.

Small as this species is, it is adult, a female having the ovaries fully developed. Length of specimen, $2\frac{1}{2}$ inches. Yokohama Bay; 15 fathoms. Inland Sea of Japan.

Gobius hexanema, Blkr., Yokohama Bay, 15 fathoms, Inland Sea, Japan, Kobé.
Gobius flavimanus, Schleg., Market of Yokohama.
Trypauchen vagina, Bl. Schn., Kobé, 8 fathoms.

Callionymus lunatus, Schleg. (Faun. Japon. Poiss., p. 155, pl. lxxviii. fig. 4).
D. 4/9, A. 9, C. 10. Præopercular spine rather shorter than the eye, terminating

in four small hooks, three of which are directed upwards, the fourth being on the outer side of the spine and pointing forward. The *females* have the first dorsal spine prolonged into a much shorter filament than the males, but all have the large black sublunate spot between the third and fourth dorsal spines. Caudal fin with rather distant small black drops arranged longitudinally; caudal fin but little longer than the head, obtusely rounded. In the *males* the dorsal spines and caudal rays are much prolonged, and the greater portion of the first dorsal fin is whitish, with large ovate black spots. Length of specimens, 2 to 6 inches. Inland Sea, Japan. Yokohama Bay; 15 fathoms. Kobé.

Chirus hexagrammus, Pall., Inland Sea, Japan, Market of Yokohama.
Agrammus schlegeli, Gthr., Market of Yokohama.
Centronotus nebulosus, Schleg., Inland Sea, Japan, Market of Yokohama.

Mugil joyneri, Gthr. (Ann. and Mag. Nat. Hist., 1878, vol. i. p. 486).

D. $4/\frac{1}{9}$, A. $\frac{3}{8}$, L. lat. 40, L. transv. 14. The height of the body is less than the length of the head, which is two-ninths of the total (without caudal). Eye small; its diameter is one-seventh, the width of the interorbital space more than one-third of the length of the head. Adipose eyelid none; præorbital emarginate and denticulated; snout longer than the orbit; extremity of the maxillary visible. There are eighteen scales between the snout and the origin of the spinous dorsal; no elongate scale in the axil. Dorsal fins equal in height; the spines are rather slender, the length of the first being rather more than three-fourths of the postorbital part of the head; it is much nearer to the end of the snout than to the base of the caudal fin. The first two rays of the soft dorsal are scaly, the rest of the fin being devoid of scales; anal scaly anteriorly, as high as the soft dorsal, and commencing in advance of that fin. Caudal notched, one-seventh of the total length. Pectoral two-thirds of the length of the head. Axil without spot.

This species was not contained in the Challenger collection, but may be enumerated here for completeness' sake. It was discovered by Mr H. B. Joyner at Tokei. The specimens are 12 inches long.

Fistularia serrata, Cuv. (Pl. XXXII. fig. C).

Fistularia serrata, Cuv., Gthr., Fish., vol. iii. p. 533.

Dr Steindachner has recently directed my attention to certain differences in the sculpture of the head which he observed in a small series of examples from Japan, and the constancy of which I have been able to confirm in the series in the British Museum. It appears that two species were confounded by previous authors, and none of the various names used by them were given with the intention of distinguishing those two species;

so that it is impossible to say to which of them the names *serrata, immaculata,* and *commersoni* apply. Dr Steindachner and myself have agreed to treat those names as synonyms, and to leave the term *serrata* to the deeply-sculptured form, of which a full description is given in the "Catalogue of Fishes." This species may be characterised thus :—

Interorbital space concave ; the two middle ridges on the upper surface of the snout, run close and parallel to each other along the anterior half of the length of the snout. Body moderately depressed with minute asperities, which render the skin rough to the touch.

The British Museum series includes specimens from Aden, Madras, Penang, Singapore, Bengal, China, Formosa, New South Wales, and from Bermuda (Mr J. Matthew Jones). It reaches a length of nearly 5 feet. Length of specimens, 20 and 23 inches. Yokohama.

Fistularia depressa, n. sp. (Pl. XXXII. fig. D).

Bones of the head less deeply sculptured than in *Fistularia serrata*, but with the upper lateral edges of the snout likewise serrated. Interorbital space nearly flat. The two middle ridges on the upper surface of the snout are not very close together, and diverge again on the anterior half of the length of the snout, converging finally on the foremost part. Body much depressed, nearly smooth, the asperities of the skin being scarcely perceptible.

The British Museum series contains specimens from Natal, Zanzibar, Amboyna, China, New Guinea, New South Wales, Fiji Islands, and California. This species attains to the same length as *Fistularia serrata.* Length of specimen, 24 inches. Sulu Archipelago. Station 200 ; 255 fathoms.

I am inclined to doubt the occurrence of this shore fish at so great a depth as 250 fathoms, and it does not seem to me to be improbable that this specimen got into the trawl when near to the surface of the water.

Platyglossus pœcilopterus, Schleg., Inland Sea of Japan, Market at Yokohama.

Platyglossus pyrrhogramma, Schleg., Market at Yokohama.

Pseudorhombus olivaceus, Schleg., Inland Sea, Japan.

Hippoglossus olivaceus, Schleg., Faun. Japon. Poiss., p. 184, tab. xciv.
Pseudorhombus olivaceus, Gthr., Fishes, vol. iv. p. 429.

Pseudorhombus pentophthalmus, Gthr., Inland Sea, Japan.

Pleuronectes variegatus, Schleg., Market of Yokohama.

Pleuronectes yokohamæ, n. sp.

D. 68–72. A. 52. The height of the body is contained twice and one-sixth in the total length (without caudal), the length of the head four times. Snout shorter than the eye, the diameter of which is one-fifth of the length of the head; lower jaw prominent; maxillary as long as the eye; the upper jaw with a series of fifteen truncated teeth on the blind side, none on the other; eyes separated by a very narrow space covered with rudimentary scales. Scales small, cycloid, imbricate, larger about the lateral line than elsewhere; the anterior curve of the lateral line is strong in the adult specimen, but much more open in the young one; its width equals the length of the pectoral; pectoral more than half as long as the head; ventrals entirely separate; fin-rays smooth; the dorsal commences immediately behind the front margin of the orbit. The free portion of the tail much higher than long. Gill-rakers very short; about ten on the first branchial arch. Blackish-brown, uniform, or indistinctly mottled with darker. In the young specimen the rays of the vertical fins are dotted with brown, five or six of them, of the dorsal as well as of the anal, having a broad black ring. In the adult example those fin rays are uniformly coloured, only traces of the dark rings being still visible. Length, 12 inches. Inland Sea, Japan. Yokohama Bay; 15 fathoms.

Parophrys cornuta, Schleg., Inland Sea, Japan, Kobé.

Platessa cornuta, Schleg., Faun. Japon. Poiss., p. 179, pl. xcii. fig. 1.
Parophrys cornuta, Gthr., Fish., vol. iv. p. 455.

Cynoglossus interruptus, n. sp. (Pl. XXX. fig. B).

D. 106, A. 77–85, L. lat. 78. Two lateral lines on the left side, the upper of which is discontinued at the end of the anterior third of the body. The lateral lines are separated at the point of their greatest distance by twelve longitudinal series of scales. No lateral line on the blind side. Two nostrils, one immediately in front of the eyes, the other above the middle of the upper lip. Eyes close together, the upper somewhat in advance of the lower. Lips not fringed. The angle of the mouth is below the middle of the eye, much nearer to the extremity of the snout than to the gill-opening. The rostral hook terminates below the symphysis of the mandibles. The height of the body is contained thrice and three-fourths in the total length, the length of the head five times and one-third. Brownish, irregularly speckled with brown. Fin-rays dotted with brown. Length of specimens, 6 inches. Market at Yokohama.

Cynoglossus joyneri, Gthr. (Pl. XXX., fig. A.), (Ann. and Mag. Nat. Hist., 1878, vol. i. p. 486).

D. 106–107, A. 79, L. lat. 85. Three lateral lines on the left side; on the level of the end of the abdominal cavity the upper and lower lines are separated from the middle by thirteen rows of scales; four series of scales between the dorsal fin and the upper lateral line, and four between the anal and lower lateral line. No lateral line on the right side. All the scales on the left side strongly ctenoid; those of the blind side are nearly smooth on the anterior half of the body, and more conspicuously serrate on the posterior. One nostril situated between the eyes, the other above the lip. Eyes very small, the upper slightly in advance of the lower; interorbital space equal to the width of the orbit. Snout contained twice and two-thirds in the length of the head. Angle of the mouth much nearer to the end of the snout than to the hind margin of the gill-cover behind the eye. Tail not much elongate. The height of the body is two-sevenths of the total length (without caudal), the length of the head two-elevenths. Brownish, mottled with darker.

This species has been recently discovered by Mr H. B. Joyner at Tokei, and is introduced here for comparison with the preceding species. The specimens collected are $9\frac{3}{4}$ inches long.

Silurus asotus, L., Lake Hakou.
Saurida tumbil, Bl., Inland Sea of Japan.

Harpodon microchir, Gthr. (Ann. and Mag. Nat. Hist., 1878, p. 487).

D. 14, A. 14, V. 9. This gigantic species of *Harpodon* differs from *Harpodon nehereus* in having a second distinct band of palatine teeth within the first one, and in having the pectoral fin very short. The tubes of the lateral line are narrow and elongate; the basal half of the adipose fin is covered with scales. The interior of the mouth and gill-cavity is black.

A single specimen, 27 inches long, was obtained by Mr H. B. Joyner at Tokei. To judge from the structure of its skeleton, and from its evident rarity, it seems to descend to a moderate depth.

Salmo macrostoma, n. sp. (Pl. XXXI. fig. A).

B. 12, D. 13, A. 14, L. lat. ca. 130. This fish is distinguished by its remarkably pointed snout, the upper jaw being rather the longer, and by its wide oblique mouth, the narrow and slightly-curved maxillary extending considerably behind the hind margin of the orbit. The head is small, only one-fourth of the total length (without caudal). Eye small, nearly one-seventh of the length of the head. Teeth rather small; one pair on the head of the vomer is followed by three or four other small teeth, arranged in a series. Præoperculum crescent-shaped, without lower limb. Body rather deep, its depth being equal to the length of the head. There are sixteen or seventeen scales in a series obliquely descending from behind the adipose fin to the lateral line. Dorsal fin but little higher than long. Caudal fin deeply emarginate, silvery, with nine parr marks along the lateral line, and with several round spots above and below them on the sides.

This fish is in many respects very similar to one figured by Brevoort in United States

"Narrative of an Expedition to China and Japan," vol. ii., Fish., p. 277, pl. x. fig. 1. Unfortunately our specimen is eviscerated, so that nothing can be said as regards its anatomy. Length of specimen, 11 inches. Yokohama Market.

Aulopus japonicus, n. sp.

D. 15, A. 9, L. lat. 43, L. transv. $4\frac{1}{2}/6$. The length of the head is contained thrice and one-fourth in the total (without caudal). The diameter of the eye equals the length of the snout, and is contained thrice and two-thirds in the length of the head. Interorbital space concave, one-half of the width of the eye. Maxillary extending to behind the middle of the eye. Body irregularly marbled with blackish. Length of specimen, $7\frac{1}{4}$ inches. Market of Yokohama.

Plecoglossus altivelis, Schleg., Tokaido.
Salanx microdon, Blkr., Market at Yokohama
Hemirhamphus sajori, Schleg., Market of Yokohama.
Cyprinus auratus, L., Yokohama, Japan.

Leuciscus hakuensis, n. sp. (Pl. XXXI. fig. B).

D. 10, A. 10, L. lat. 73, L. transv. 15/14. The height of the body is one-fourth of the total length (without caudal), the length of the head two-ninths. The diameter of the eye is one-fifth of the length of the head, and nearly two-thirds of the length of the snout or of the width of the interorbital space. The head is remarkably small, with narrow pointed snout, the cleft of the mouth being oblique and not reaching to the front margin of the eye. Upper jaw overlapping the lower. Origin of the dorsal fin above the root of the ventrals, midway between the snout and the root of the caudal fin; fins generally small and short, the pectoral being not much more than one-half of its distance from the ventral. Scales very indistinctly striated; there are eight longitudinal series between the lateral line and ventral fin. Pharyngeal teeth 5/2, pointed. Coloration uniform.

This species is infested by a large *Ligula*, like so many other Cyprinoids of the Old World. Length of specimens, $7\frac{1}{2}$ and $9\frac{1}{2}$ inches. Lake Hakou, Japan.

Achilognathus melanogaster, Blkr., Lake Bioa.
Misgurnus anguillicaudatus, Cant., Kiyoto. (The Japanese fed *Sieboldia* in captivity on this fish, and said it was its natural food.)

Engraulis japonica, Houtt.

(?) *Atherina japonica*, Houttuyn, Verh. Holl. Maatsch. Wet. Haarlem, vol. xx. p. 340, pt. 2, 1781.
Engraulis japonica, Schleg., Faun. Japon. Poiss., p. 239, pl. cviii. fig. 3.

When I described specimens from the Coast of China under the name of *Engraulis* *japonica,* I had overlooked that a fish of the same genus had been described under the same name in the "Fauna Japonica." These two fishes prove to be distinct, the Japanese species having D. 13-14 and A. 17, whilst the fin formula of the Chinese species is D. 17, A. 22. Houttuyn gives much too little descriptive detail to show what species he had before him; but as his specimens were also Japanese, his *Atherina japonica* is better referred to the species described by Schlegel; thus, the specimens described by me in Fish., vol. vii. p. 390, require a distinct name, *Engraulis chinensis.* Length of specimens, 3½ to 5 inches. Inland Sea, Japan. Kobé.

Conger marginatus, Val., Inland Sea of Japan. (Tail mutilated.)
Congromuræna anago, Schleg., Market of Yokohama.

Congromuræna megastoma, n. sp.

The length of the head is two-thirds of that of the trunk, the tail being longer than the body; upper jaw much projecting beyond the lower, rather pointed; mouth extending far behind the middle of the eye, which is large, two-ninths or one-fifth of the length of the head, and nearly two-thirds of that of the snout; posterior nostril a wide, round, open aperture; length of the pectoral fin one-third of that of the head; the dorsal commences above the root of the pectoral; vertical fins with a light margin; terminal portion of the tail black, extremity of the fin white.

	Spec. 15½ in.	Spec. 11 in.
Distance of the snout from the root of the pectoral, . .	2 in. 4 lines.	1 in. 10 lines.
Distance of the snout from the vent, ...	6 ,, 2 ,,	4 ,, 8 ,,
Length of tail, . . .	9 ,, 4 ,,	6 ,, 6 ,,

Length of specimens, 11 to 19 inches. Off Inosima, from Japanese fisher-boats.

Muræuesox cinereus, Forsk., Kobé.
Tetrodon oblongus, Bl., Inland Sea, Japan, Kobé.
Tetrodon pardalis, Schleg., Market of Yokohama.
Tetrodon rubripes, Schleg., Inland Sea of Japan, Market of Yokohama.
Monocanthus septentrionalis, Gthr. (Ann. and Mag. Nat. Hist., 1874, vol. xiii. p. 158), Inland Sea, Japan.

Monocanthus modestus, n. sp.

D. 36, A. 34. Skin velvety, without spines or bristles on the tail; the height of the body is contained thrice and three-fourths in the total length (without caudal); upper profile of the head convex; the gill-opening extends downwards to the level of the middle of the root of the pectoral. The dorsal spine is inserted above the posterior third of the eye, and scarcely half as long as the head, or as its distance from the second dorsal fin; it is armed with four series of very small barbs, the two front series being very close together. The anterior half of the dorsal and anal fins elevated somewhat higher than the dorsal spine; ventral spine fixed. Uniform brownish-grey; caudal blackish, with the interradial membrane whitish and without any cross bands. Length of specimen, 12 inches. Inland Sea, Japan.

Monacanthus setifer, Benn., Market at Yokohama.

SYSTEMATIC LIST.

PALÆICHTHYES.

PLAGIOSTOMATA.

DIPNOI.

TELEOSTEI.

ACANTHOPTERYGII VERI.

ACANTHOPTERYGII PHARYNGOGNATHI.

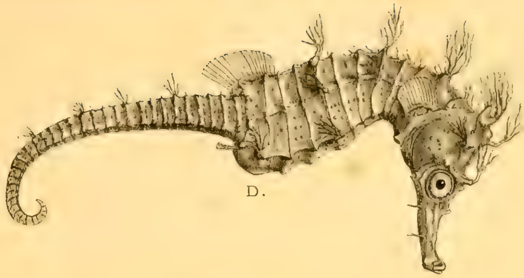
ANACANTHINI.

PHYSOSTOMI.

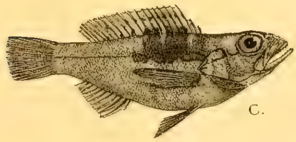
LOPHOBRANCHI.

PLECTOGNATHI.

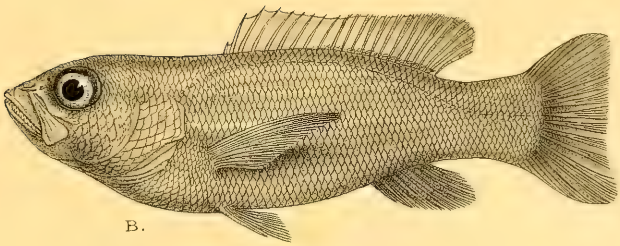
CYCLOSTOMATA.



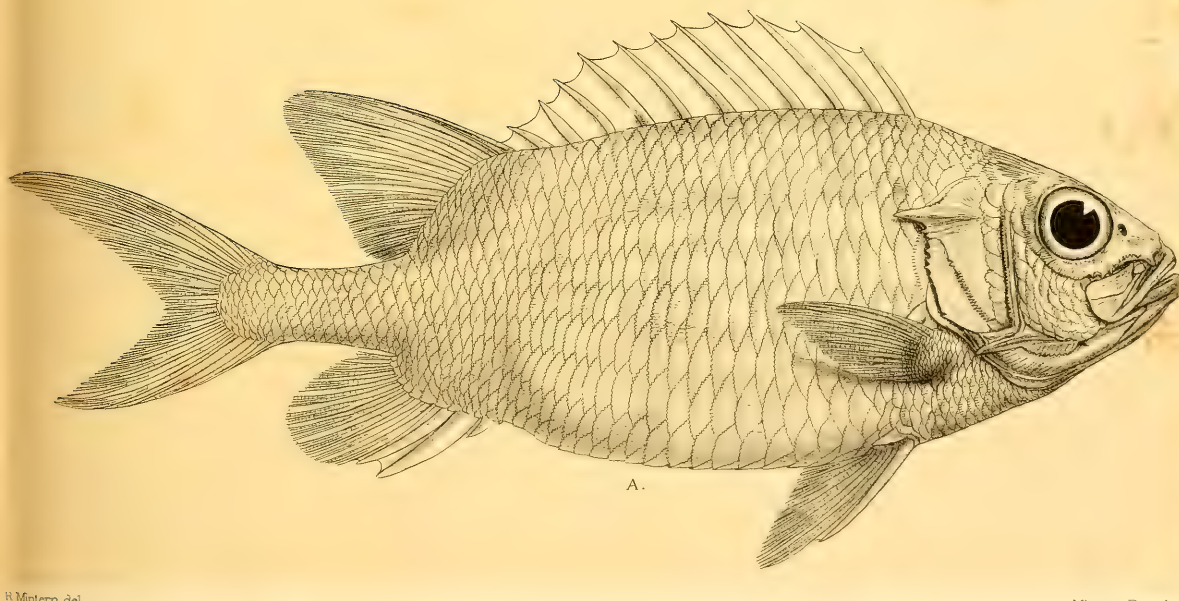
D.



C.



B.

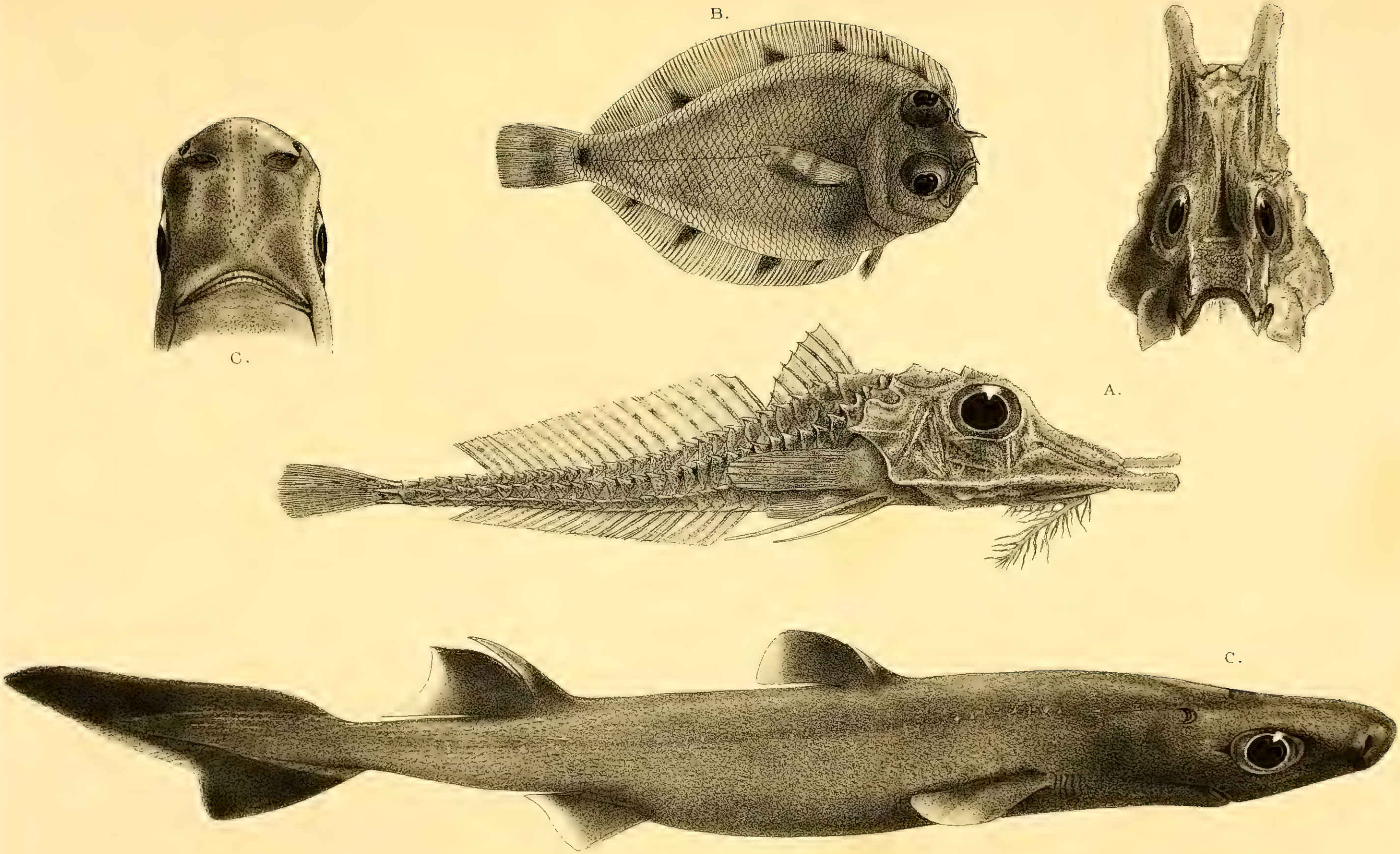


A.

R Mintern del.

Mintern Bros imp.

A. HOLOCENTRUM SANCTI PAULI.
(I.^d of S.^t Paul.)
B. BATHYANTHIAS ROSEUS. C. CENTROPRISTIS ANNULARIS. D. HIPPOCAMPUS VILLOSUS.
(Coast of Brazil.)



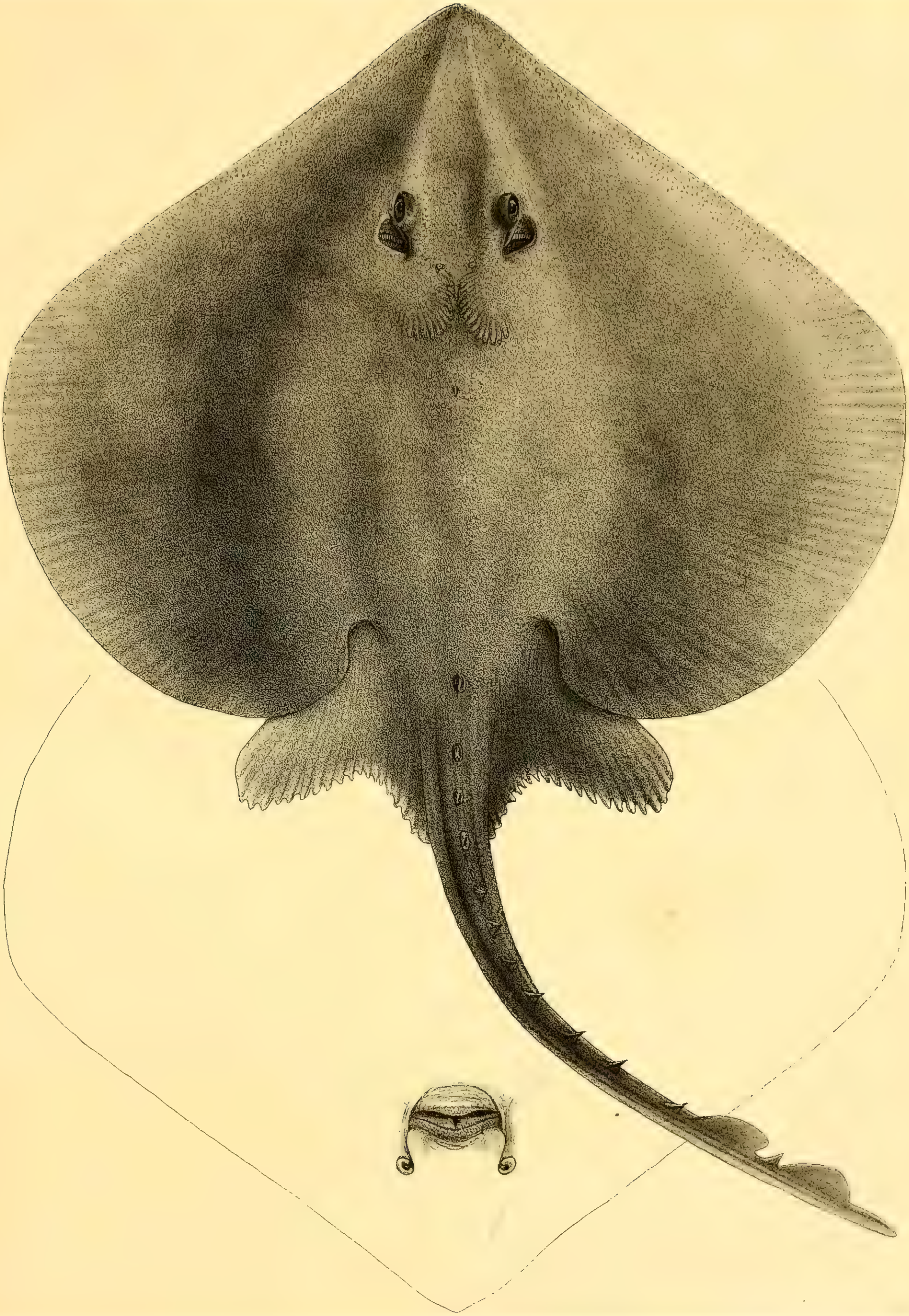
R. Mintern del.

A. PERISTETHUS TRUNCATUM. B. RHOMBOIDICHTHYS CORNUTUS.
(Pernambuco)
C. SPINAX GRANULOSUS.
(Chile)

R. Mintern del et lith.

Mintern Bros imp.

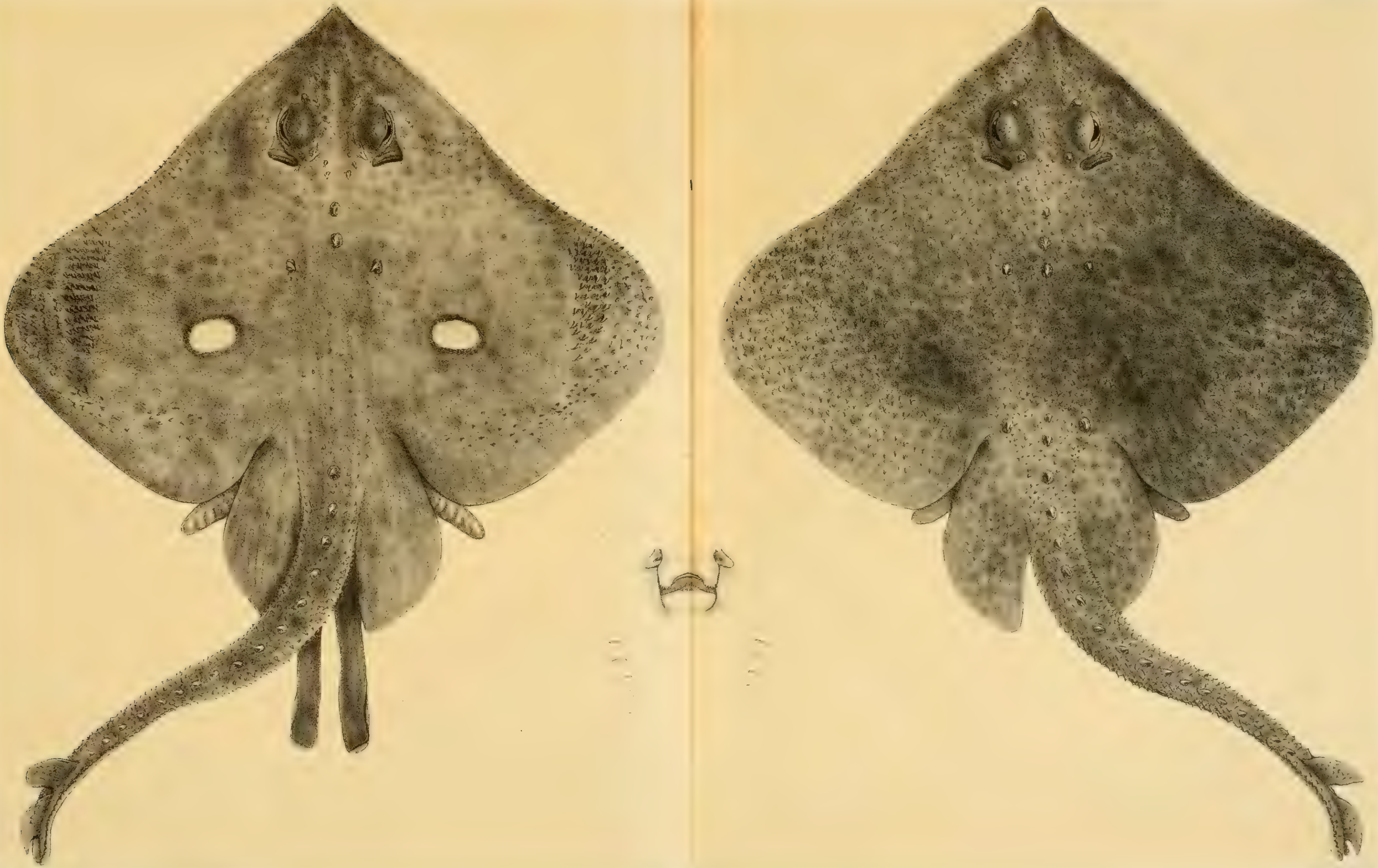
RAJA PLATANA.
(Mouth of the Rio de la Plata.)



R. Mintern del.

Mintern Bros imp.

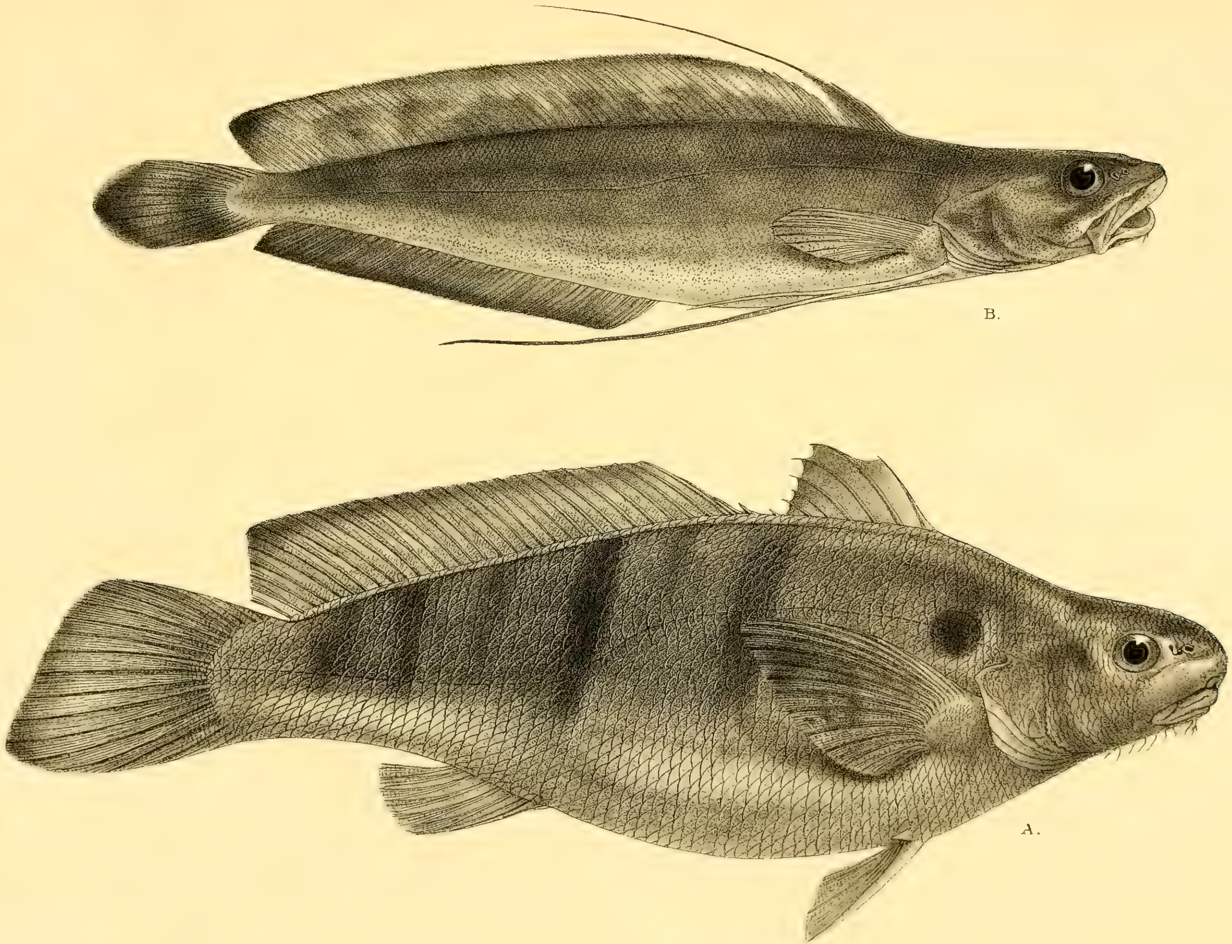
RAJA MICROPS.
(Mouth of the Rio de la Plata)



R. Mintern del.

R. Mintern del. et lith.
Mintern Bros imp.

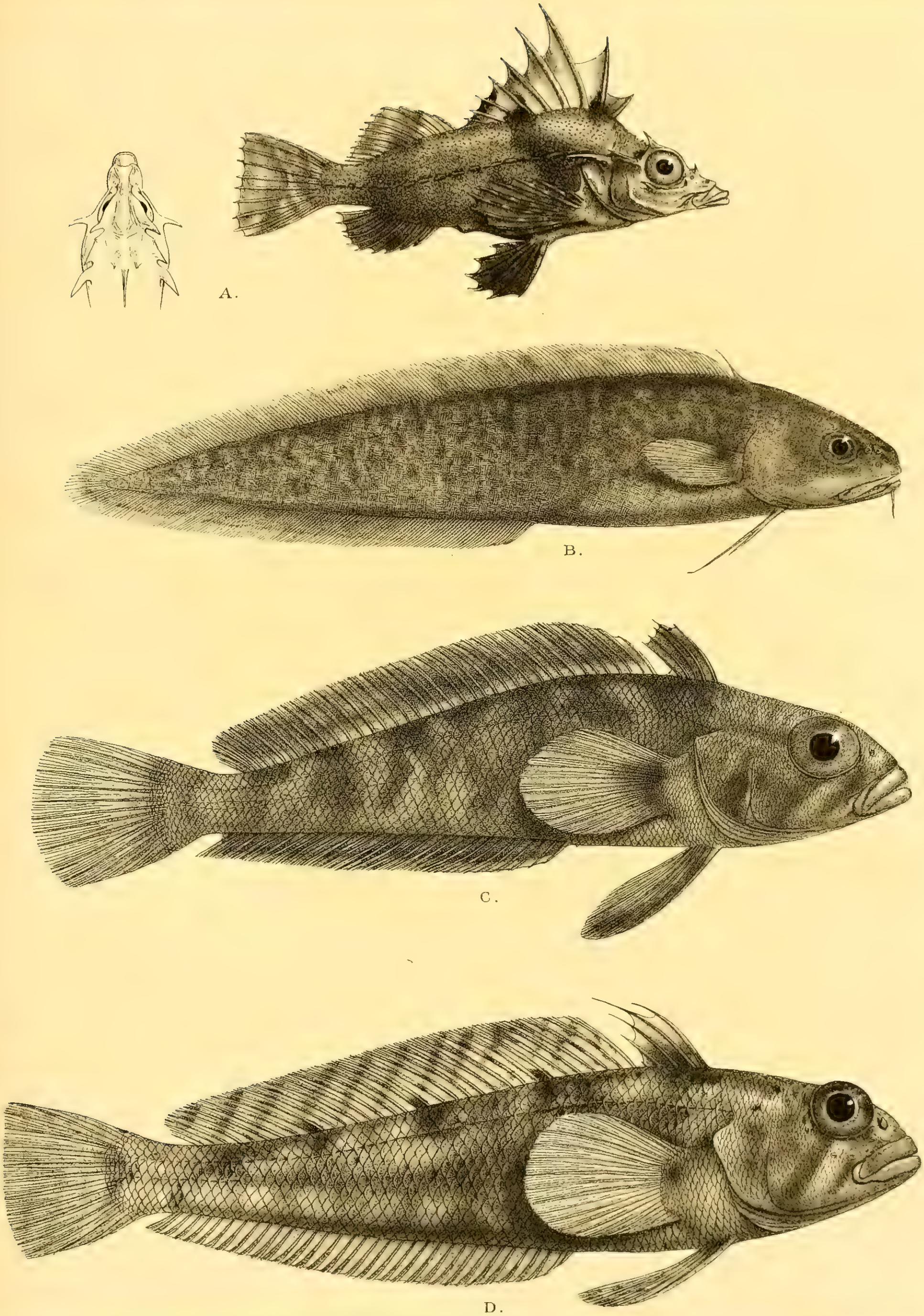
RAJA BRACHYURA.
(Magelhaen's Straits.)



R. Mintern, del.

Mintern Bros. imp.

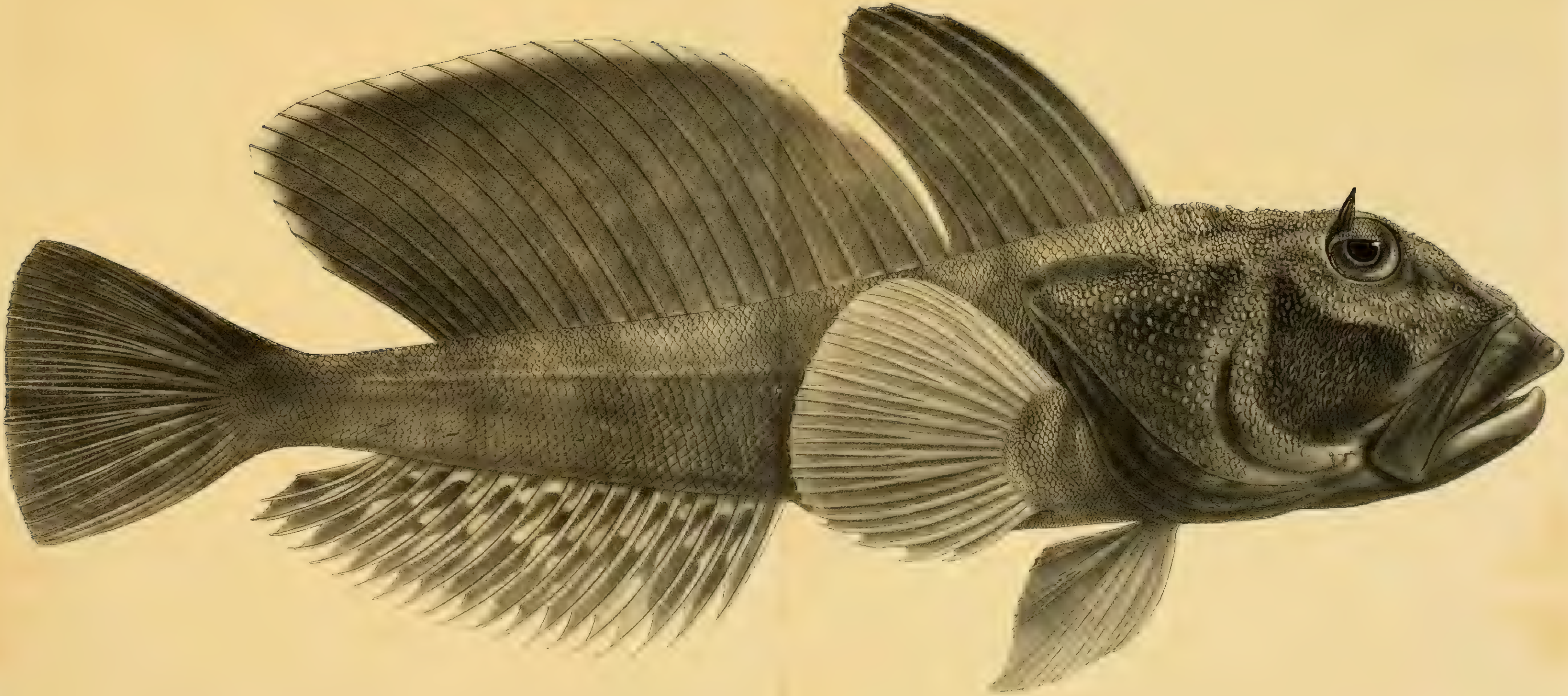
A. MICROPOGON ORNATUS B. LÆMONEMA LONGIFILIS.
(Mouth of the Rio de la Plata.)



R. Mintern del.

Mintern Bros imp.

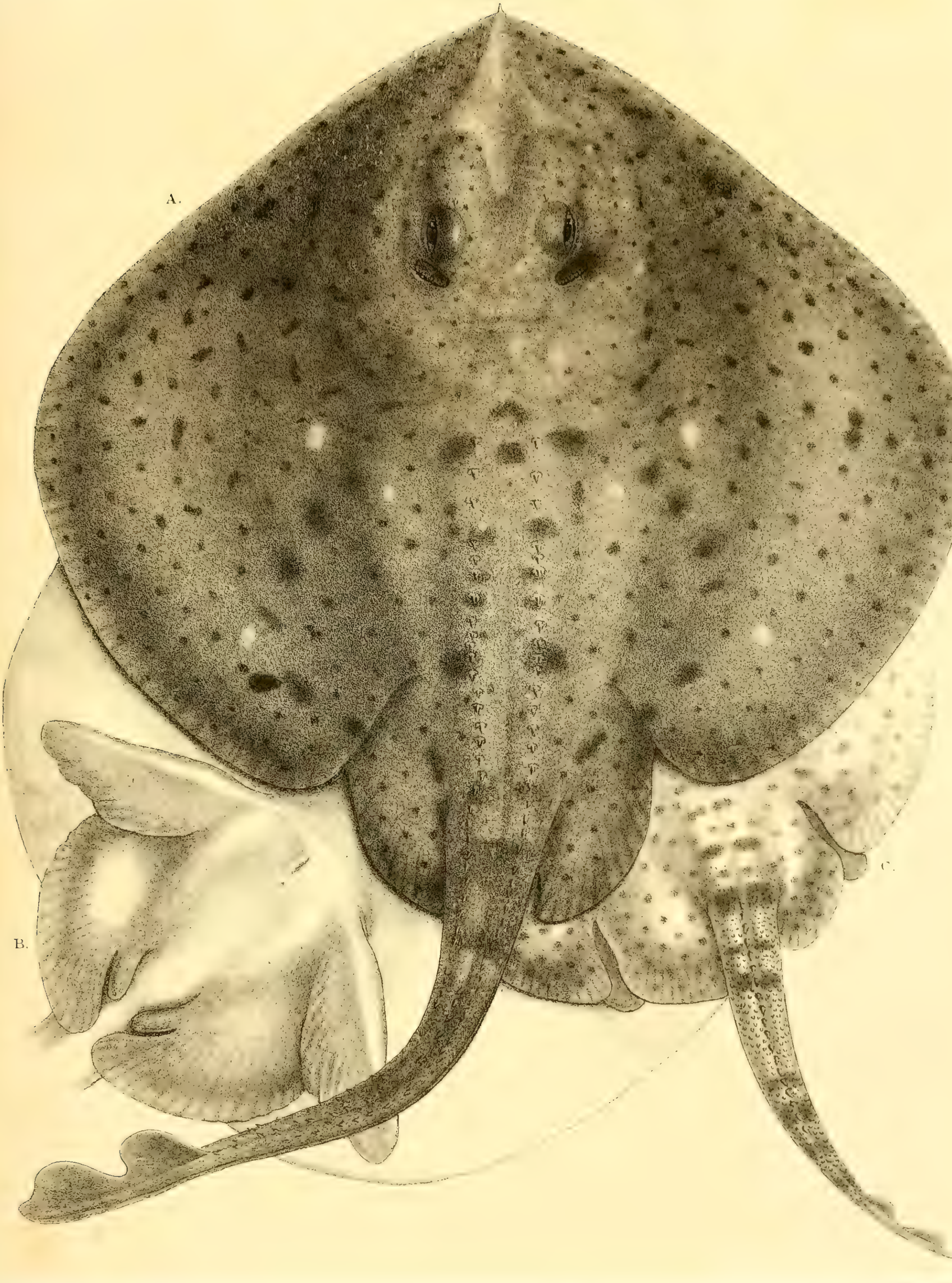
A. ZANCLORHYNCHUS SPINIFER. B. MURÆNOLEPIS MARMORATA.
C. NOTOTHENIA SQUAMIFRONS D. NOTOTHENIA MIZOPS.
(Kerguelen's Land.)



R. Mintern del.

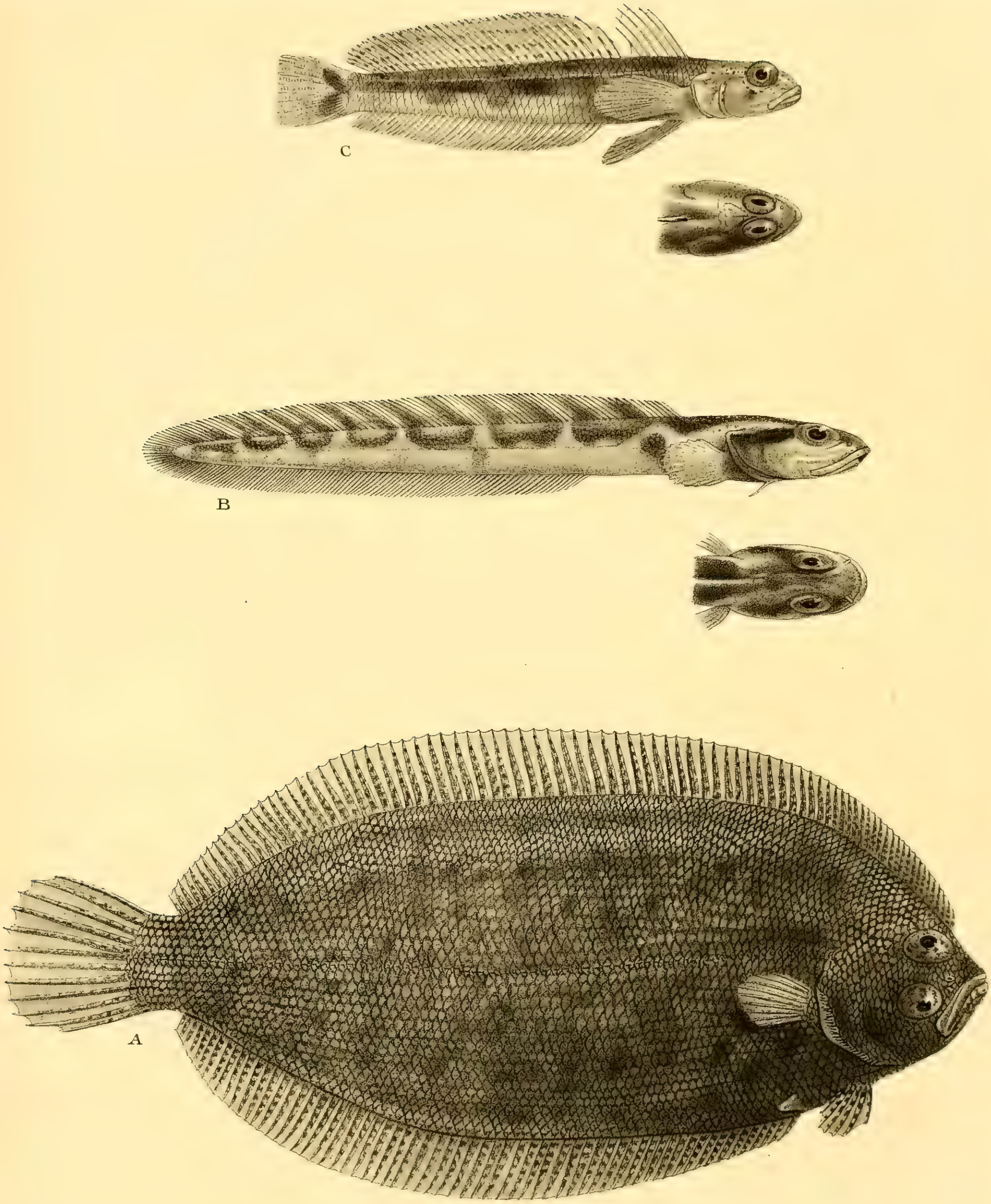
[illegible] IS [illegible]

Mintern Bros. [illegible]



R. Mintern del.

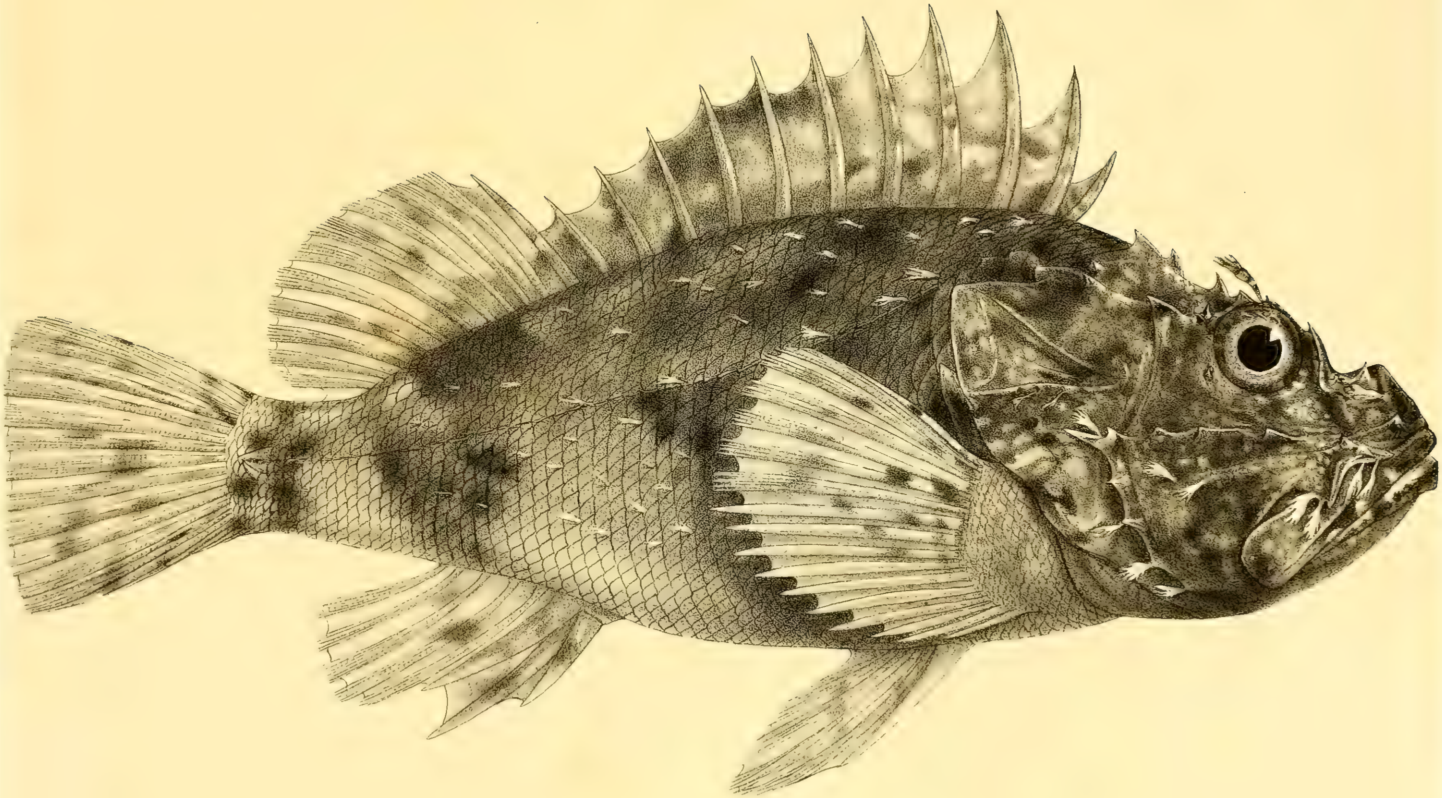
PSAMMOBATIS RU[illegible]S.
Magelhæns Straits



R. Mintern. del et lith.

Mintern Bros imp.

A. THYSANOPSETTA NARESII. B. LYCODES MACROPS. C. NOTOTHENIA ELEGANS.
Magelhaen's Straits.)

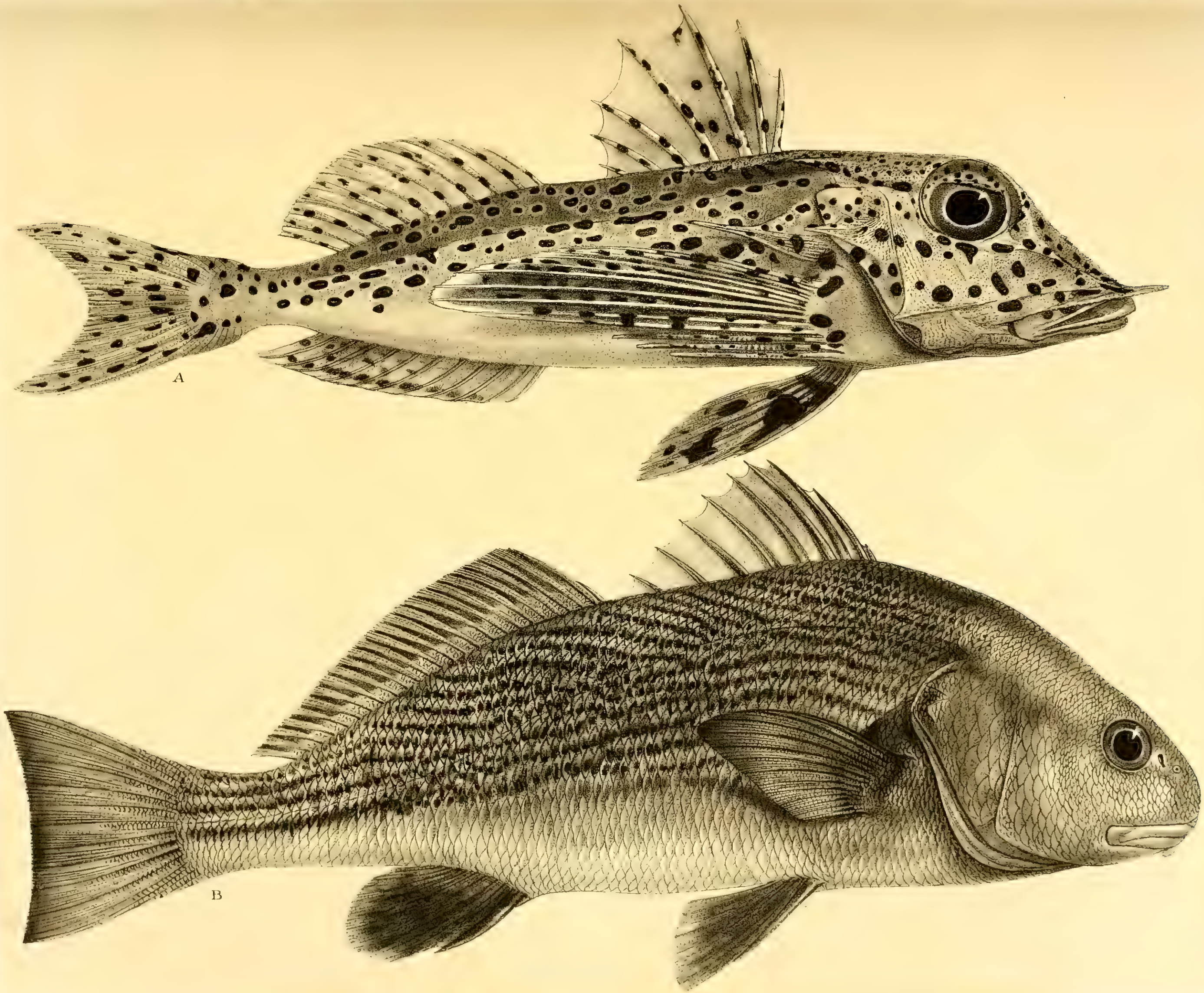


R. Mintern del.

Mintern Bros imp.

SCORPÆNA THOMSONII.

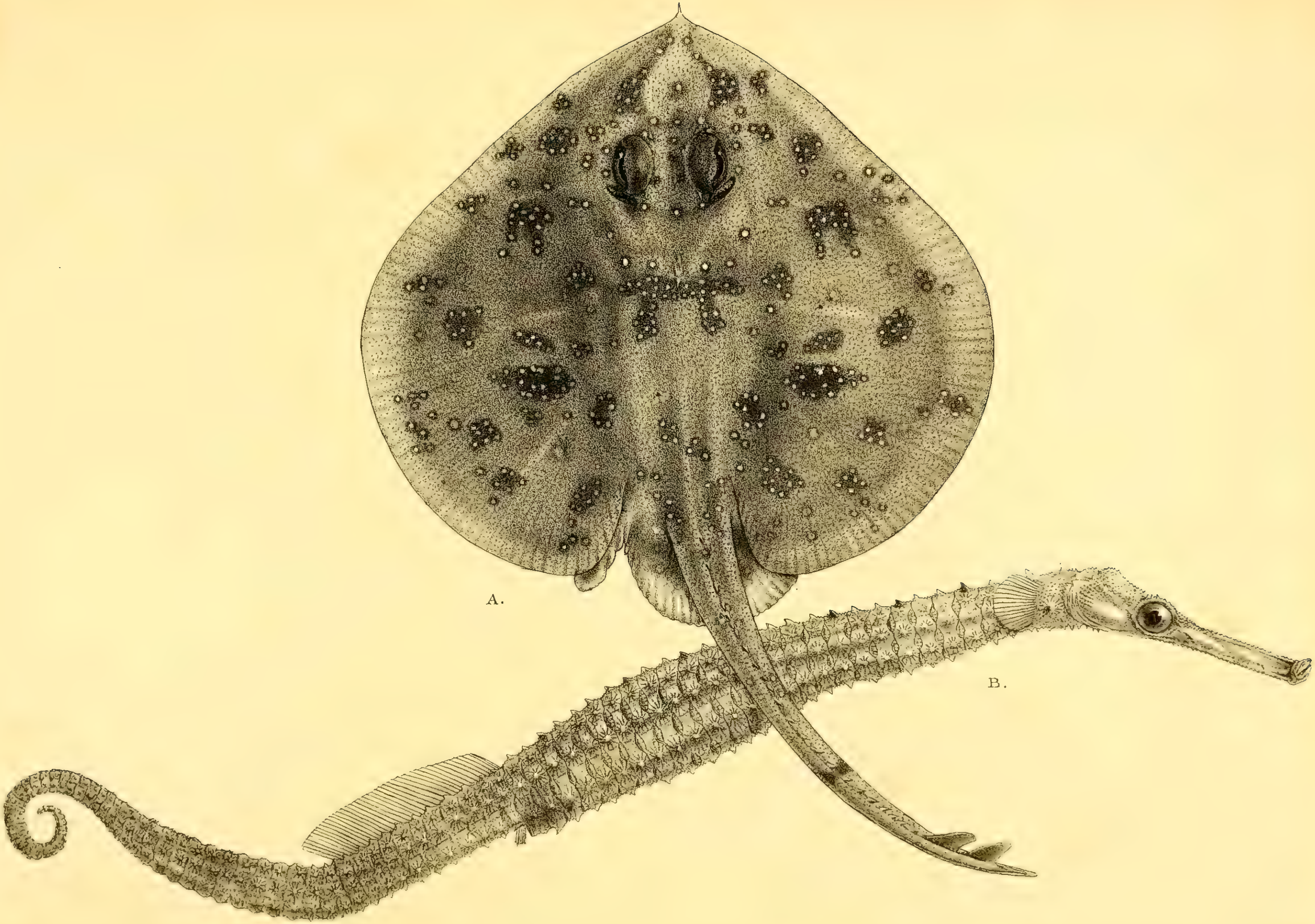
(Juan Fernandez.)



R. Mintern del et lith.

Mintern Bros imp.

A. TRIGLA PICTA, B. UMBRINA REEDII.
(Juan Fernandez.)

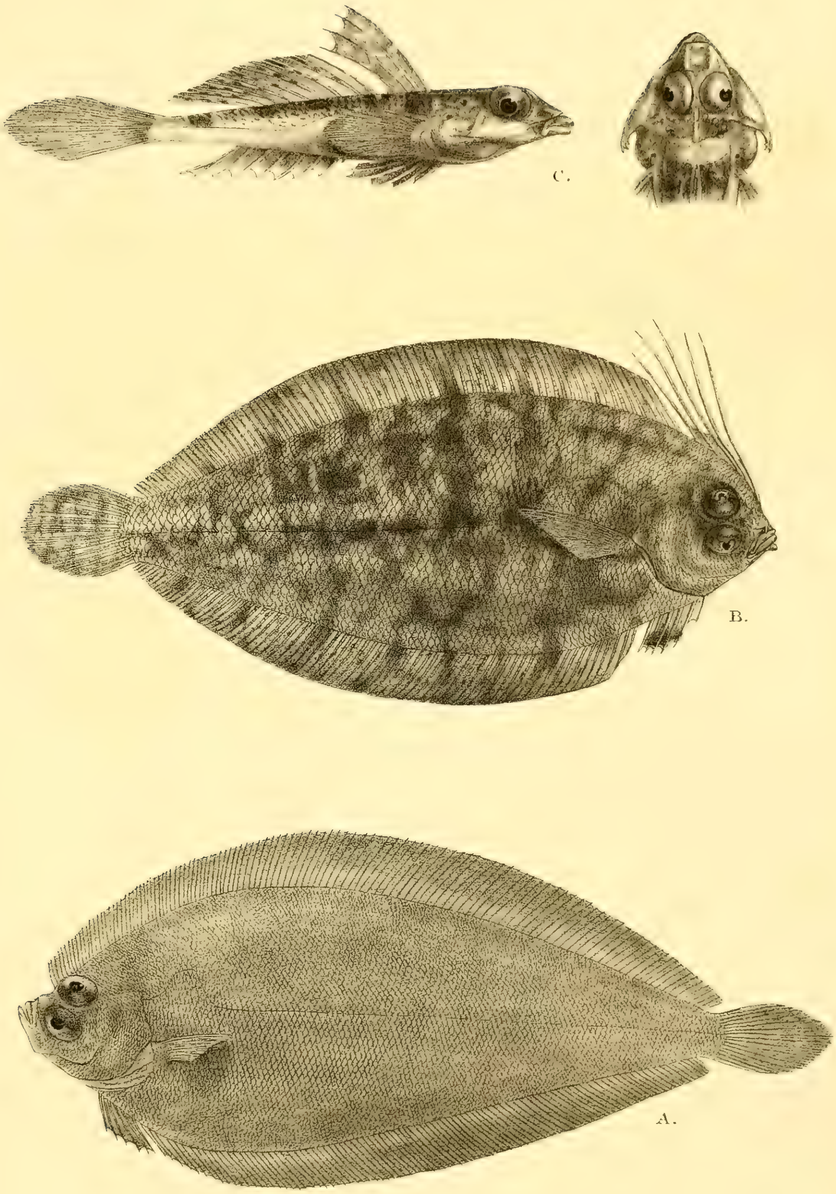


R. Mintern del.

Mintern Bros imp.

A. RAJA NITIDA. B. SOLENOGNATHUS FASCIATUS.

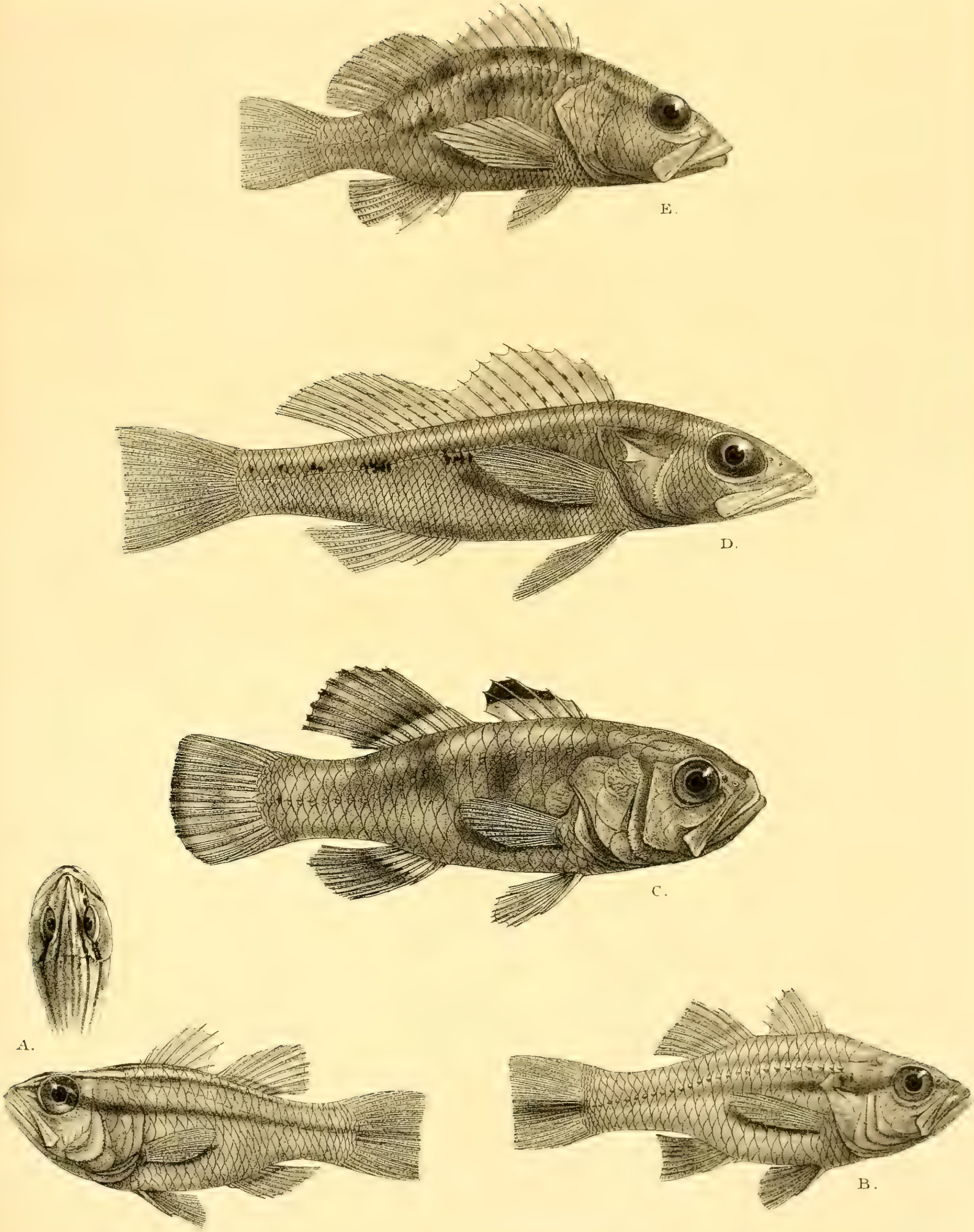
(Twofold Pay.)



R. Mintern del

A. LÆOPS PARVICEPS. B. LOPHONECTES GALLUS. C. CALLIONYMUS PHASIS.
(Twofold Bay.)

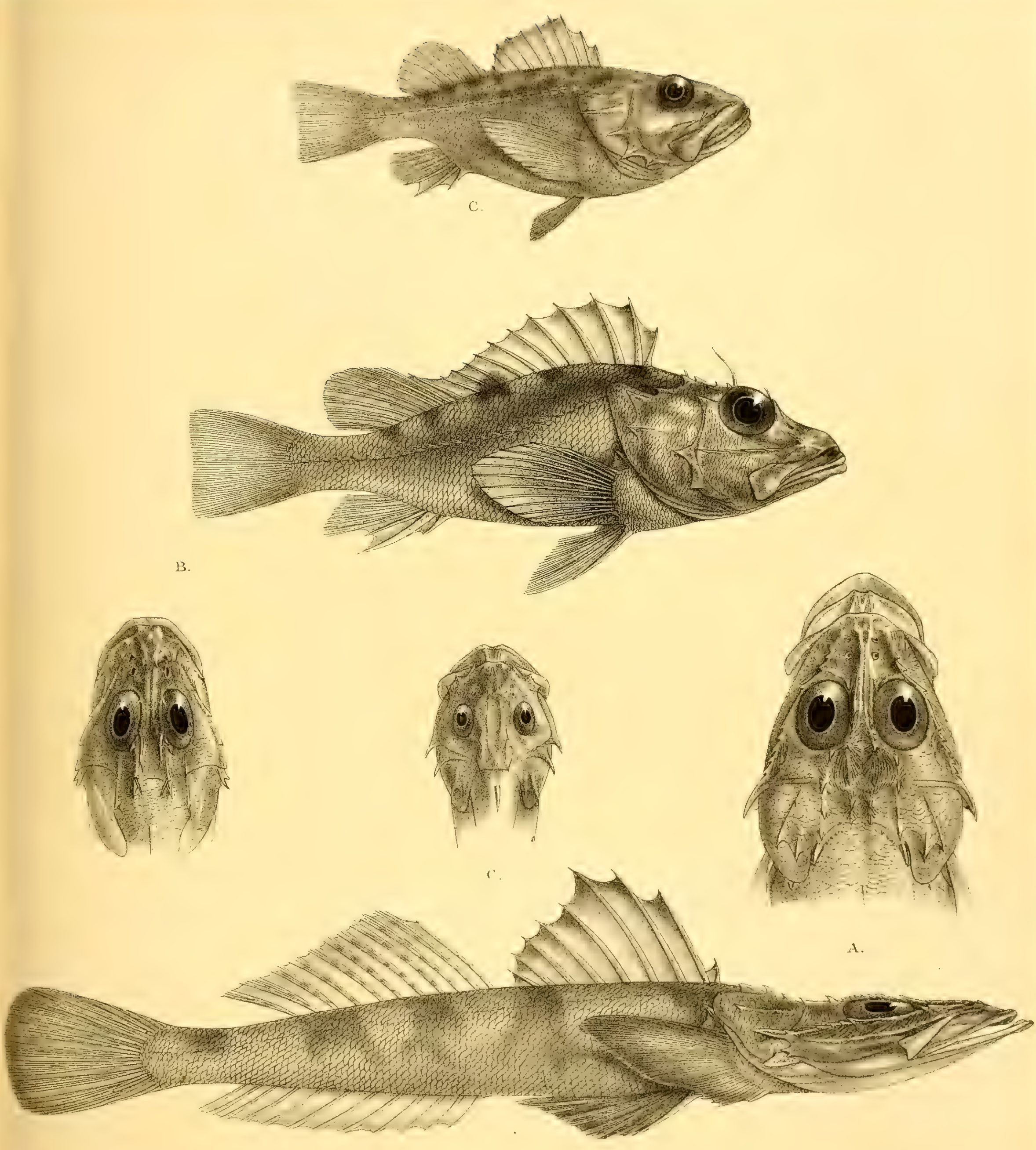
Mintern Bros imp.



R. Mintern del.

Mintern Bros imp.

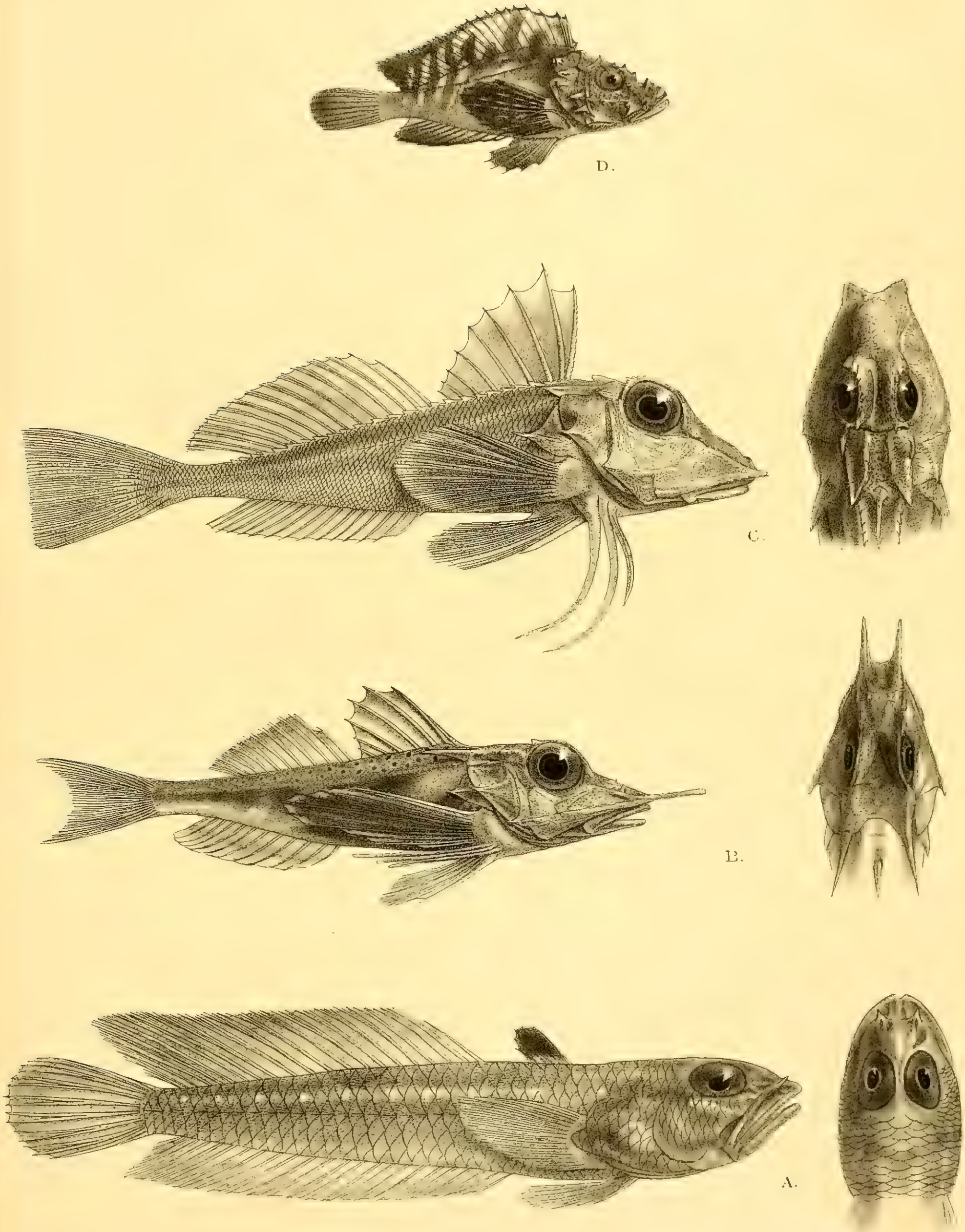
A. APOGON SEPTEMSTRIATUS. B. APOGON MONOGRAMMA. C. APOGON ARAFURÆ.
D. CENTROPRISTIS PLEUROSPILUS. E. ANTHIAS MEGALEPIS.
(Arafura Sea.)



R. Mintern del.

Mintern Bros imp.

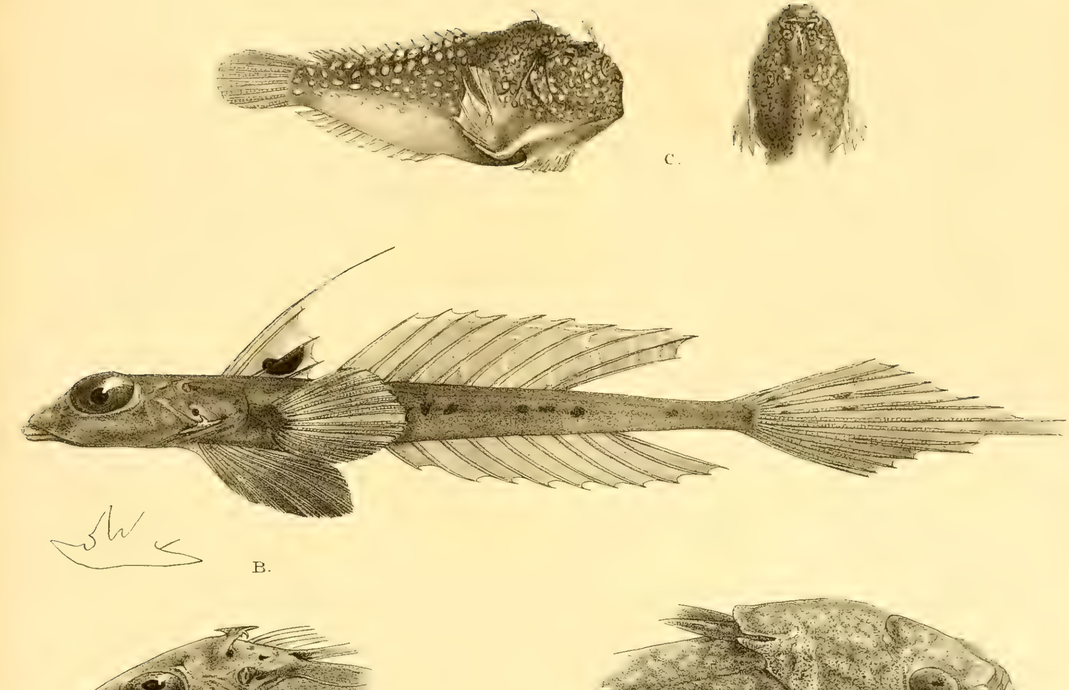
A. PLATYCEPHALUS SCULPTUS. B. SEBASTES HEXANEMA. C. LIOSCORPIUS LONGICEPS.
(Arafura Sea.)



R. Mintern del.

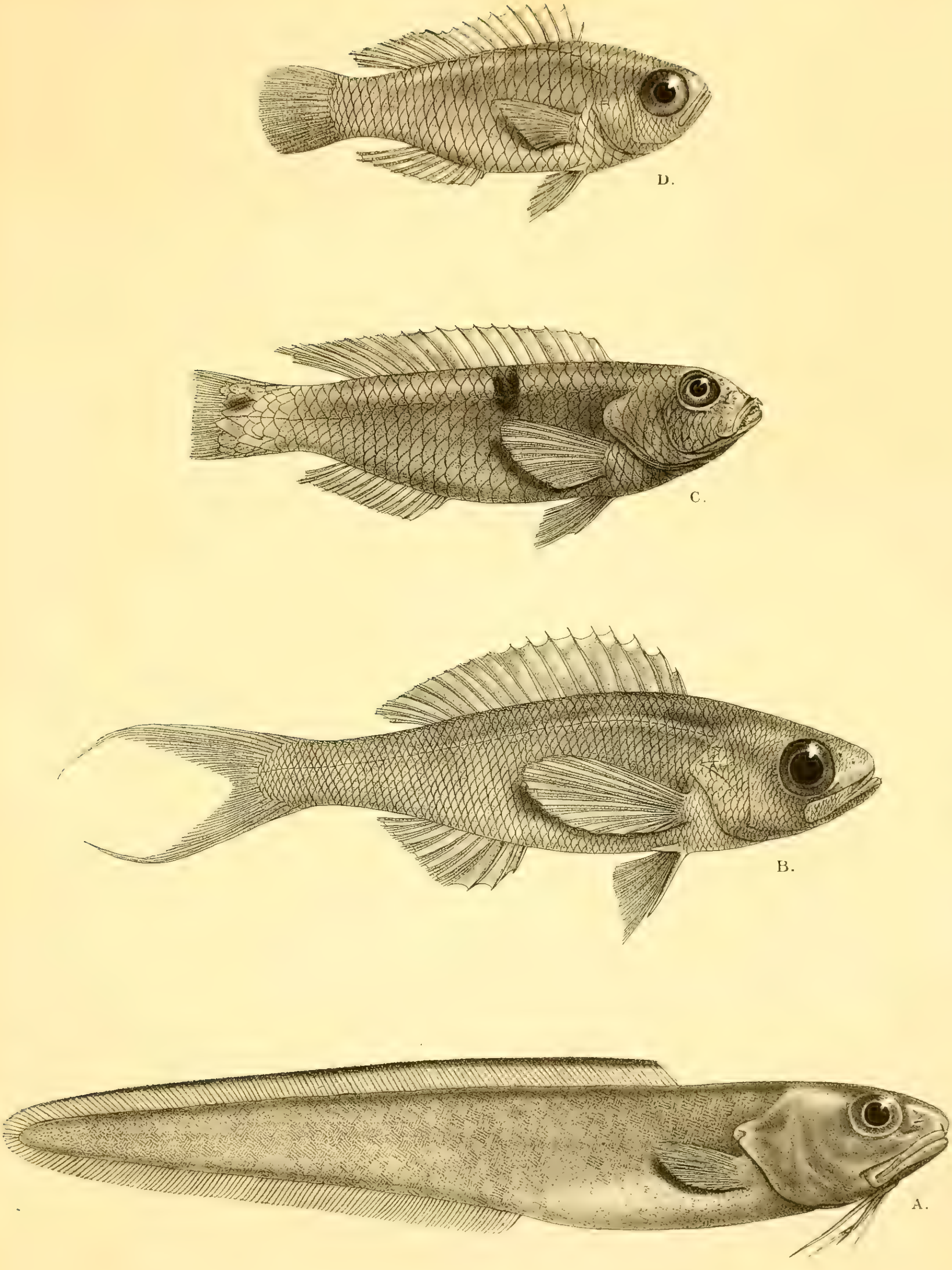
Mintern Bros. imp.

A. ACANTHAPHRITIS GRANDISQUAMIS. B. TRIGLA LEPTACANTHUS.
C. LEPIDOTRIGLA SPILOPTERA. D. MINOUS PICTUS.
(Arafura Sea.)



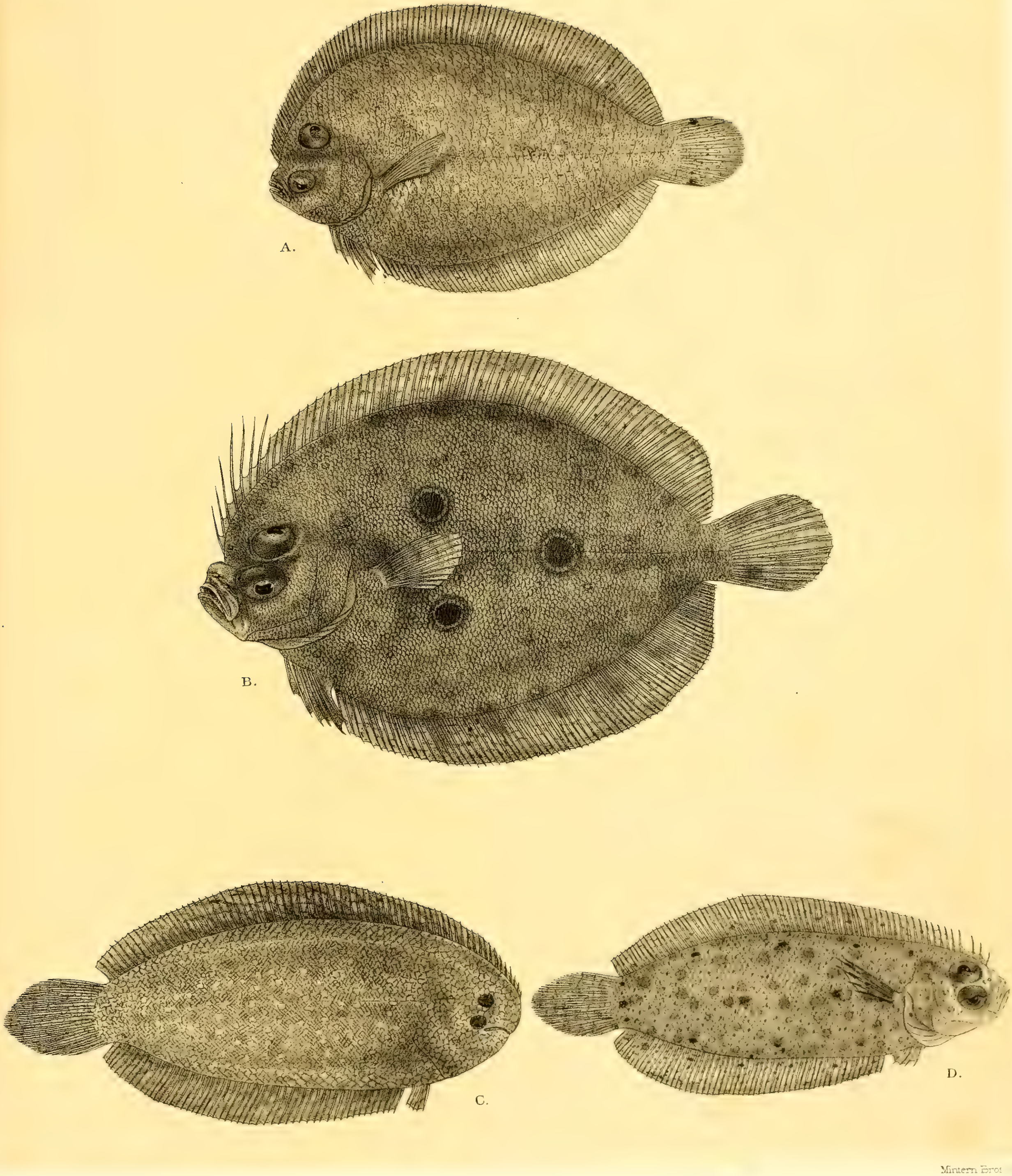
R. Mintern del. Mintern Bros imp.

A. URANOSCOPUS KAIANUS. B. CALLIONYMUS KAIANUS.
(Kay Islands.)
C. TETRABRACHIUM OCELLATUM.
(South Coast of New Guinea.)



R. Mintern del.
Mintern Bros imp.

A. OPHIDIUM MURÆNOLEPIS. B. PROPOMA ROSEUM. C. XIPHOCHILUS QUADRIMACULATUS.
D. HELIASTES ROSEUS.
(Kai Islands.)

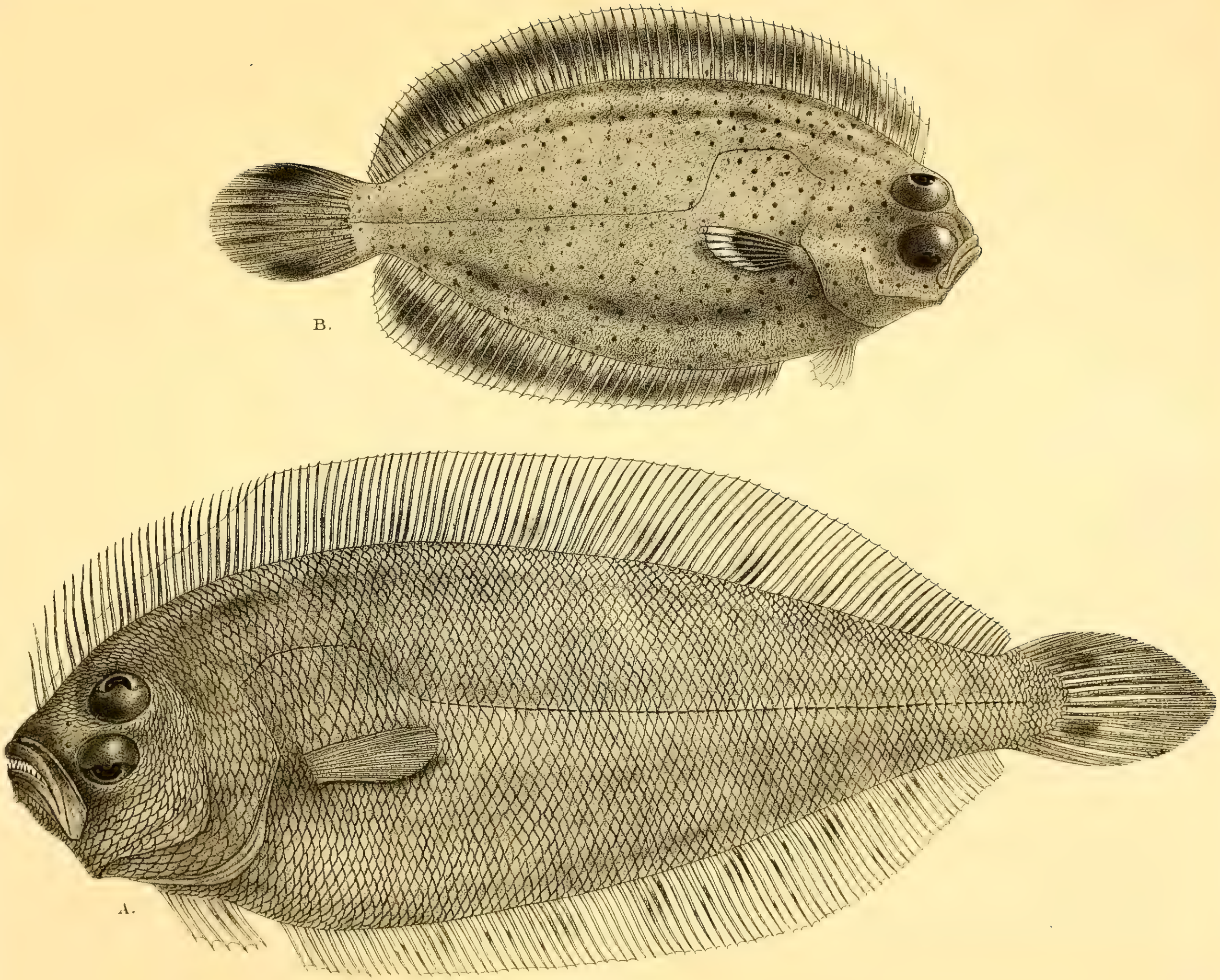


R. Mintern del

Mintern Bros. lith.

A. RHOMBOIDICHTHYS SPILURUS. B. RHOMBOIDICHTHYS ANGUSTIFRONS.
C. SOLEA KAIANA. D. SAMARIS MACULATUS.

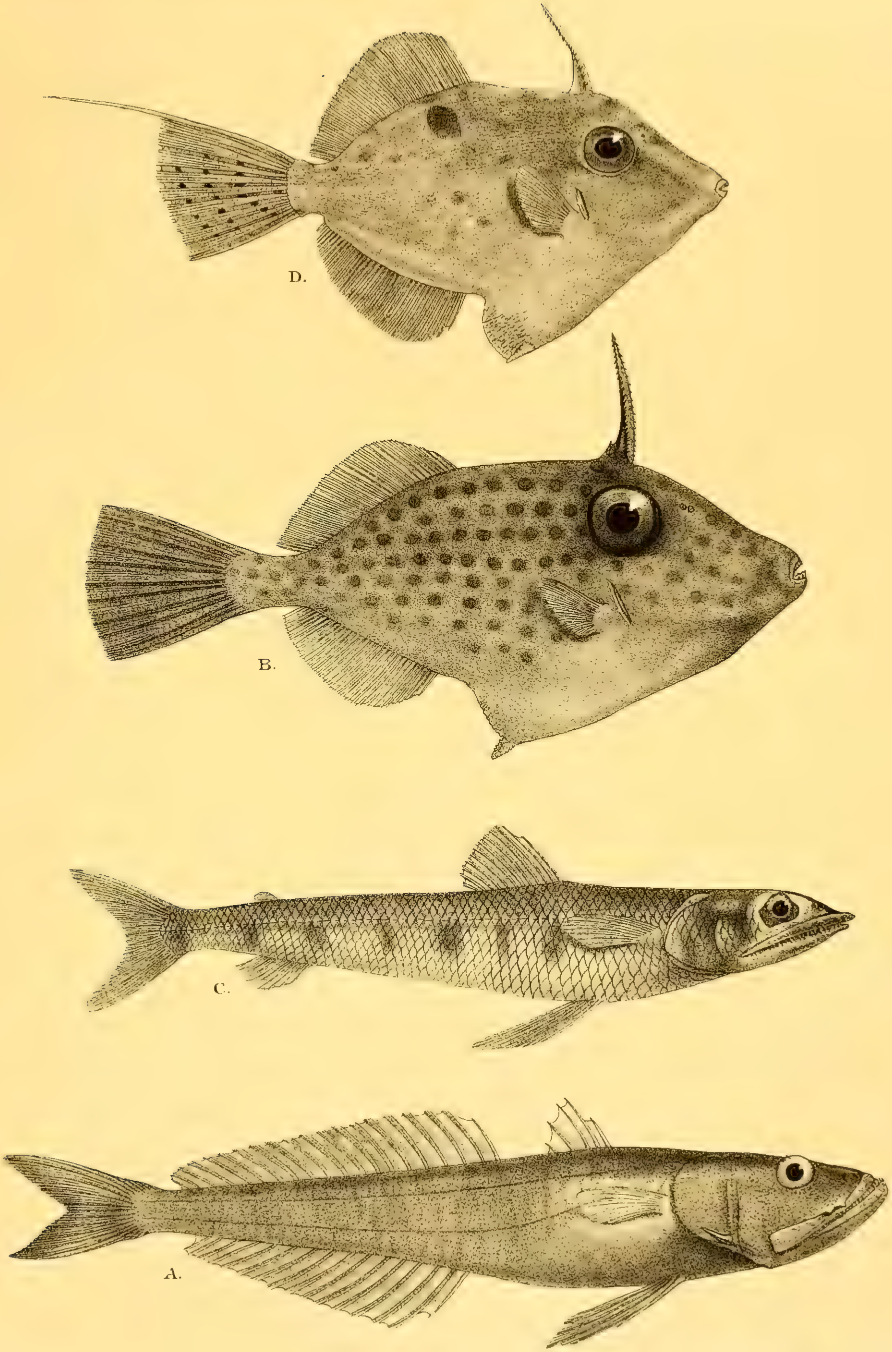
Arafura Sea.



R. Mintern del.

Mintern Bros. imp.

A. ANTICITHARUS POLYSPILUS. B. POECILOPSETTA COLORATA.
Kai Islands.



R. Mintern del.

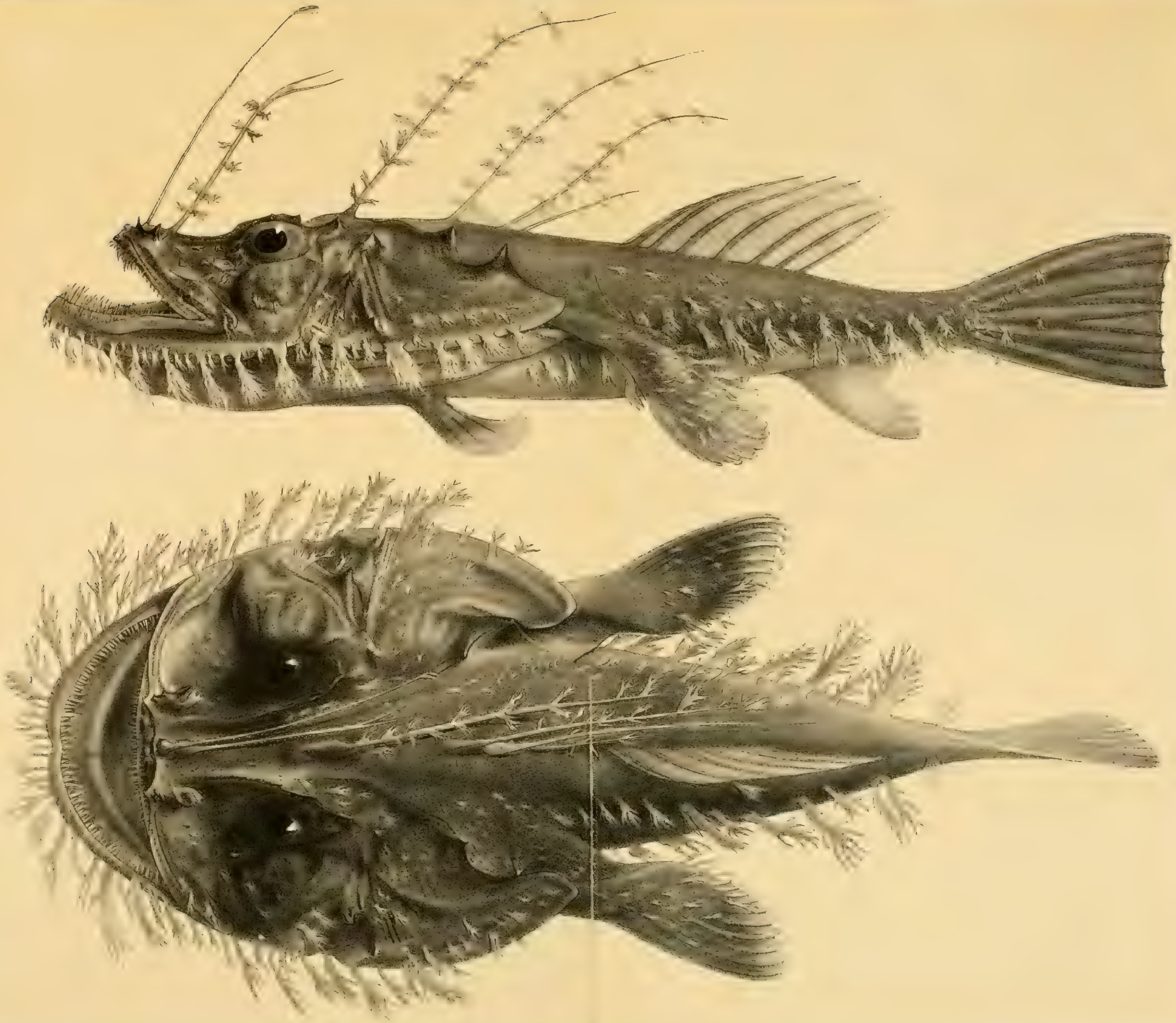
Mintern Bros imp.

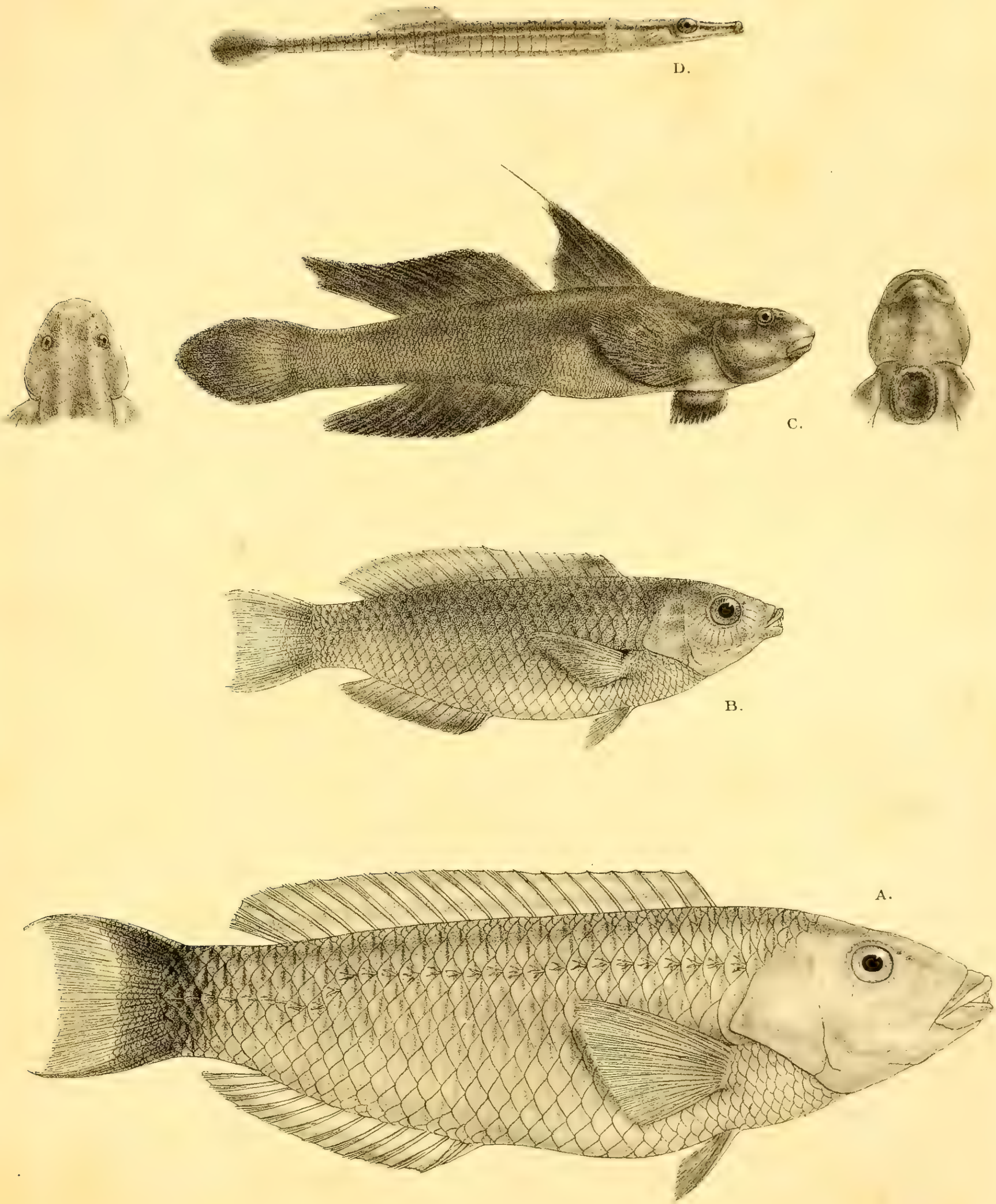
A. CHAMPSODON VORAX. B. MONACANTHUS TESSELLATUS.
(Philippine Islands.)
C. SAURUS KAIANUS. D. MONACANTHUS FILICAUDA.
Arafura Sea.

R. Mintern del.

Mintern Bros imp.

A. B. PSEUDORHOMBUS OCELLATUS ♂ et ♀. C. NEMATOPS MICROSTOMA.
(Admiralty Islands.)

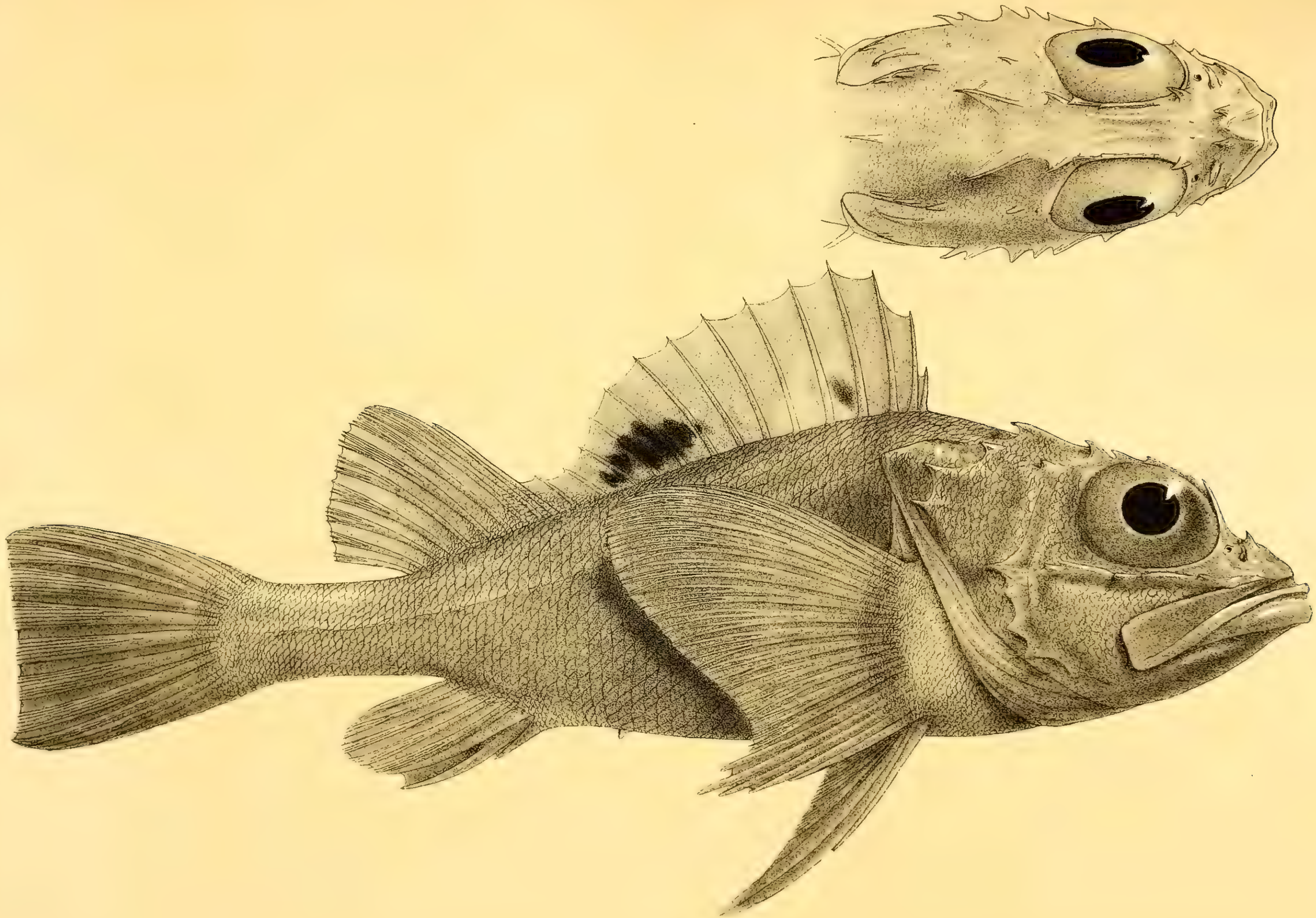




R. Mintern del.

Mintern Bros imp.

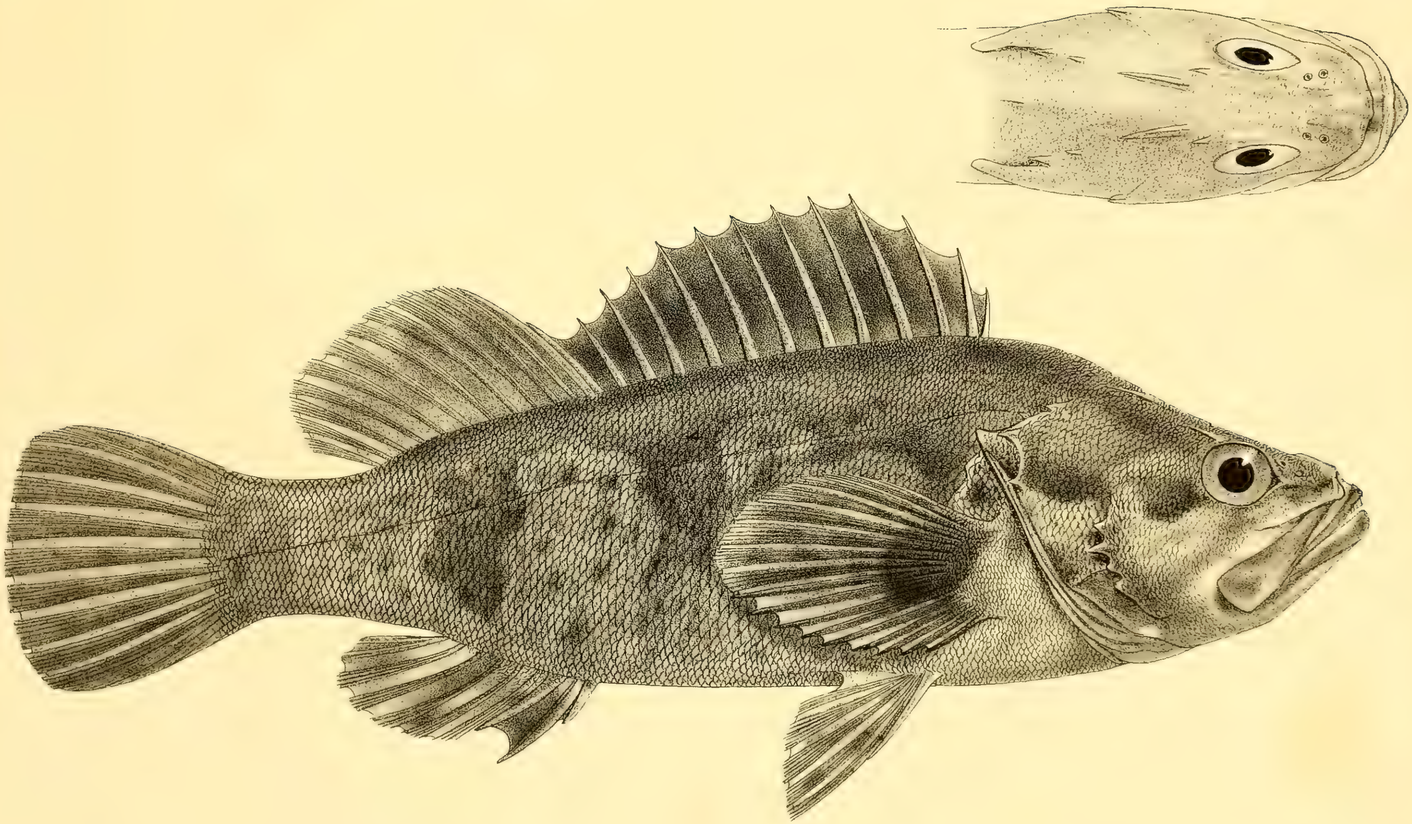
A.B. JULIS OBSCURA *ad. & juv.* C. SICYDIUM NIGRESCENS. D. DORYICHTHYS PLEUROTÆNIA.
(Sandwich Islands.)



R. Mintern del.

Mintern Bros imp.

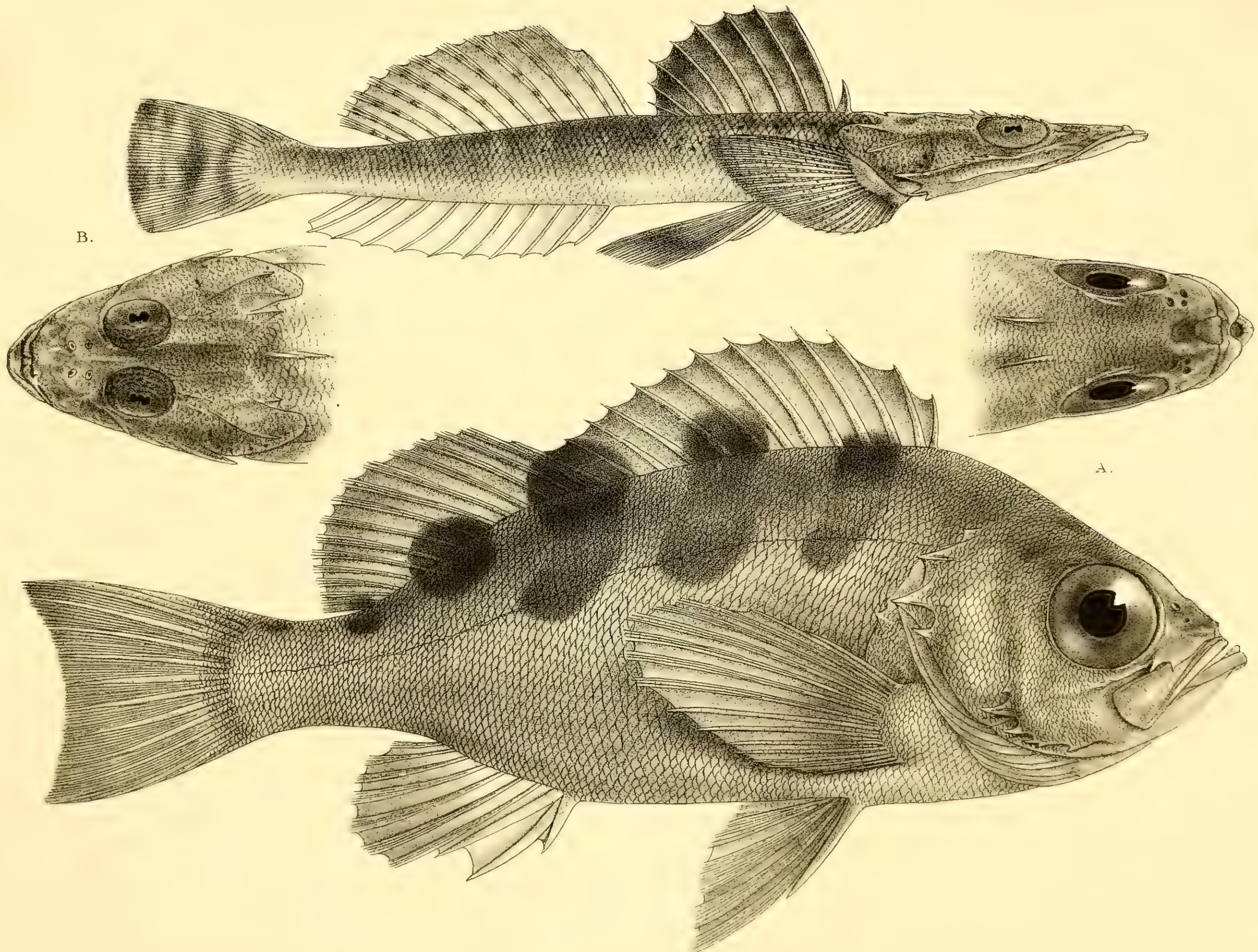
SEBASTES MACROCHIR.
(*Japan.*)



R. Mintern del.

Mintern Bros imp.

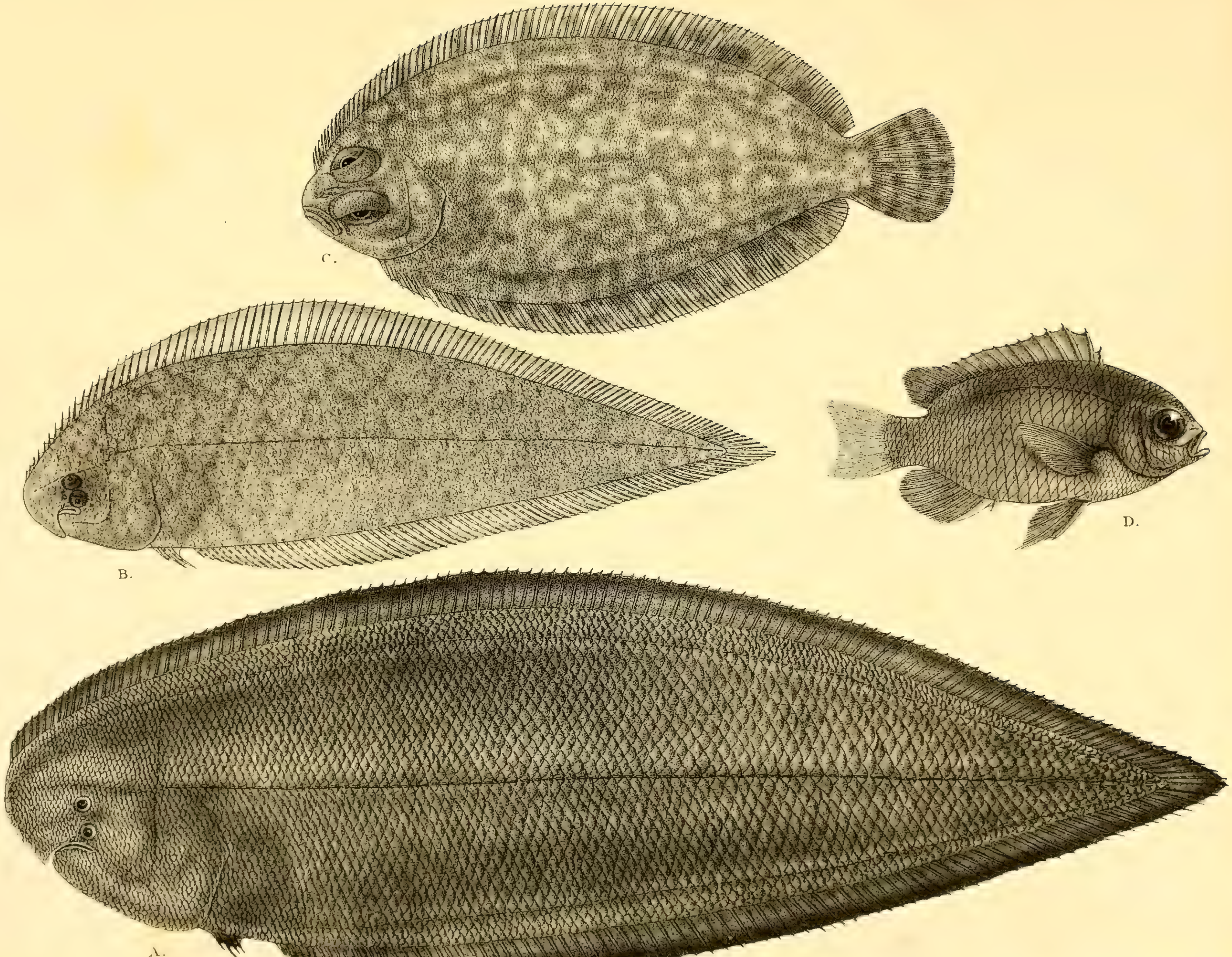
SEBASTES OBLONGUS.
(Japan.)



R. Mintern del.

Mintern Bros. imp.

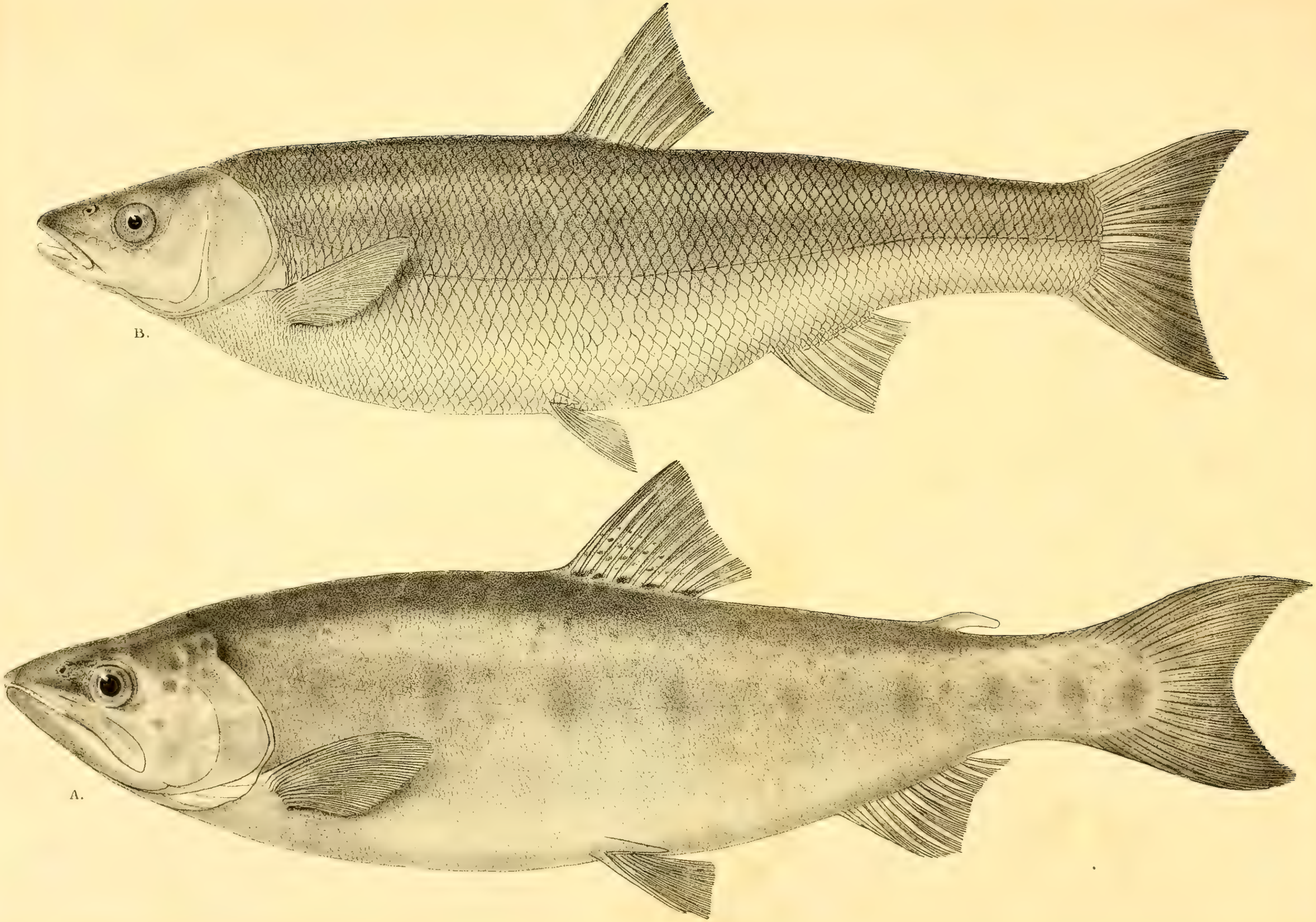
A. SEBASTES JOYNERI. B. PLATYCEPHALUS RUDIS.
(Japan.)



R. Mintern del.

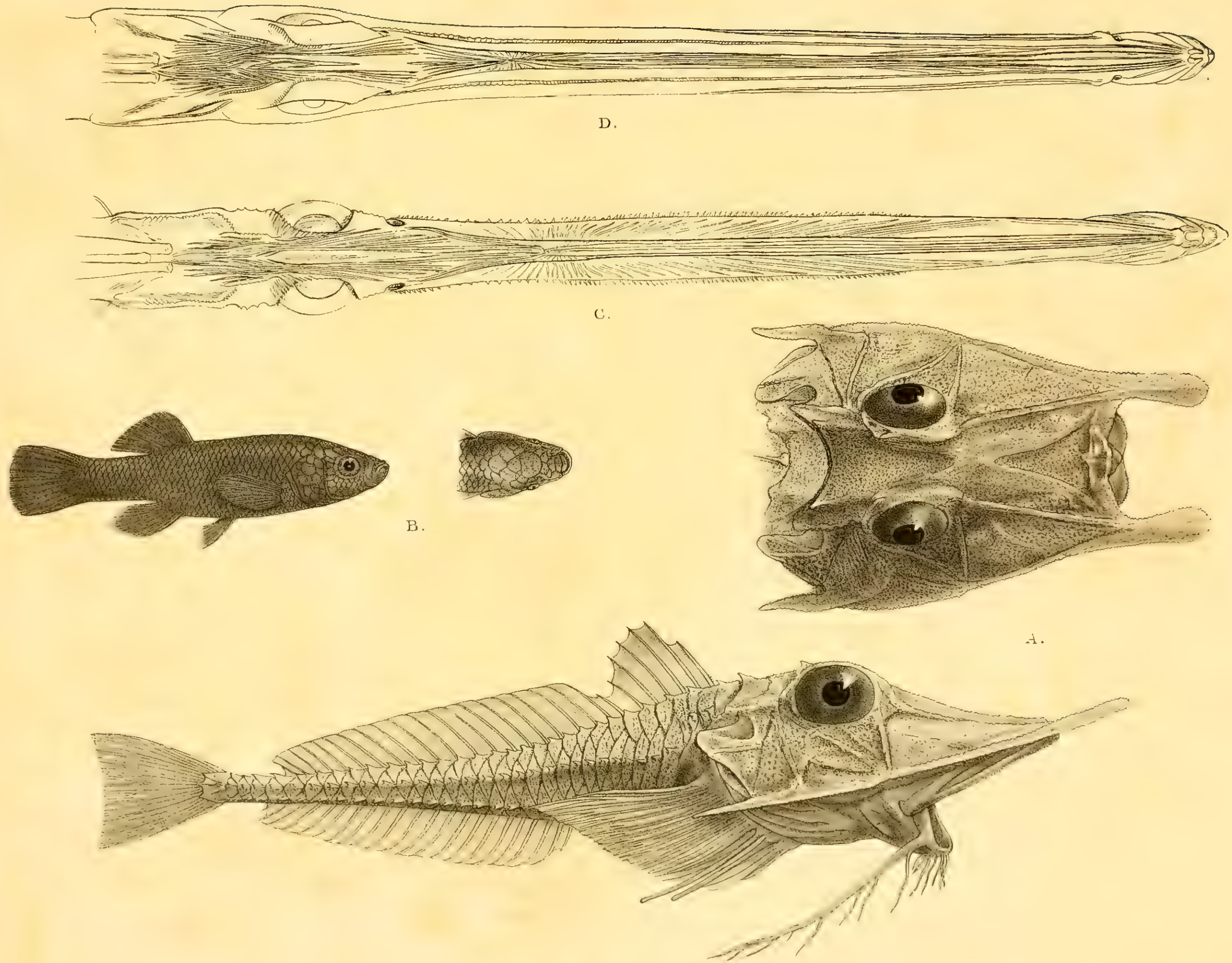
Mintern Bros imp.

A. CYNOGLOSSUS JOYNERI. B. CYNOGLOSSUS INTERRUPTUS.
(Japan.)
C. LEPIDOPSETTA MACULATA. D. HELIASTES FLAVICAUDA.
(Prince Edward Isl.) (Pernambuco.)



R. Mintern del.
Mintern Bros imp.

A. SALMO. MACROSTOMA. B. LEUCISCUS HAKUENSIS.
(Japan.)



R. Mintern del.
Mintern Bros imp.

A. PERISTETHUS MURRAYI. (Banda) B. FUNDULUS BERMUDÆ. (Bermudas)
C. FISTULARIA SERRATA. D. FISTULARIA DEPRESSA.