VI —*On the Geology of Southern Africa.*

By ANDREW GEDDES BAIN, Esq.

(*Communicated by the President.*)

[Read November 17th, 1852.]

PLATES XX.–XXVIII.

Introduction.

[Abridged.]

[BEFORE entering upon the special subject of his Memoir, Mr. Bain gives a sketch of the progress of his geological researches in South Africa, and refers to his former communication, laid before the Society in 1844*, descriptive of the Geology of the Eastern Provinces of the Cape Colony, which was accompanied by Professor Owen's description of the fossil remains of that peculiar reptile the DICYNODON.

Desirous of working out the history of this extraordinary creature and its habitat,—and further stimulated and encouraged by the grant of the Wollaston Donation Fund on the part of the Geological Society, and by a grant from the Royal Bounty Fund, through the hands of the late lamented Sir Robert Peel,—the author extended his researches, and sedulously applied himself to work out the geological phenomena of the Colonial territories through which he has now for some time been engaged in carrying out an extensive system of Military Roads.

As the basis for his operations, Mr. Bain has used the excellent Ordnance Map, compiled by Mr. Henry Hall of the Royal Engineer Department, and for a copy of which he was indebted to the kindness of the (late) Honourable Mr. Montagu, Secretary to Government, and of Charles Bell, Esq., Surveyor-General of Cape Colony.

Before explaining the details of the Geological Map now laid before the Society, Mr. Bain ventures to claim the indulgence of geologists for such imperfections as may be found to exist in the work he now submits to their consideration, and begs to remind the Society that, not only were the operations on which his observations are founded carried on, for the most part, in an uncivilized and dangerous

* Vide *supra*, p. 53 *et seq.*

region, but that the map, such as it is, is the result of the labours of a self-taught individual, thirty-six years of whose life have been spent in the arid wastes of Southern Africa, entirely cut off from participation in the advantages of a civilized country; and the results of his labours, consisting of a Geological Map of South Africa, with three general, and five local Sections, nineteen cases of fossil remains, transmitted in 1847, and four cases of fossils*, now sent, the author respectfully offers for the acceptance of the Geological Society of London. Another extensive collection, made on the Caledon and Orange Rivers, was unfortunately lost amidst the turmoils of the Kaffir war.

The author proceeds to describe the different Rock-formations of the Colony, as they present themselves along the lines of the several Sections (see Plate XXI.); reserving, however, the consideration of the extensive Reptiliferous deposits, presented in the southern portion of each section, until the other formations have been treated of. The general arrangement and relations of the formations here referred to are exhibited in the diagram at page 178.]

[The following list of authors comprises, first, several of the travellers who have more especially noticed the geological structure of the Cape and of other parts of South Africa; and, secondly, the geologists who have supplied more definite information on the rocks and fossils of that region:—

1801. J. Barrow. An Account of Travels into the Interior of Southern Africa, in the years 1797 and 1798. 4° London, 1801.

1810. In Wilson's 'History of Mountains' (4° London), vol. iii. pp. 727–748, will be found a full *résumé* of the geological facts noticed in Barrow's 'Travels in Southern Africa,' above alluded to, and other older works relating to Cape Town and its vicinity.

1812. H. Lichtenstein. Travels in Southern Africa in 1803 and 1806. (Translated by A. Plumptre.) 4° London, 1812.

1818. C. J. Latrobe. Journal of a Visit to South Africa in 1815 and 1816. 4° London, 1818.

1819. Clarke Abel. Narrative of a Journey in the Interior of China, and of a Voyage to and from that Country in the years 1816 and 1817 (p. 285, &c. Table Mountain, &c.). 4° London, 1819.

---

* Of the extensive suite of specimens here referred to, the fine collection of reptilian remains, with the rock-specimens and a series of the tertiary, secondary, and palæozoic fossils, have been transferred to the British Museum; and another series of the fossils has been placed in the Museum of Practical Geology. The description of the palæozoic and secondary fossils has been kindly undertaken by Mr. D. Sharpe and Mr. Salter, whose communications on the subject follow Mr. Bain's paper; and we may soon look for detailed accounts of some at least of the reptilian remains from the pen of Prof. Owen.—Ed.

1822. W. J. Burchell. Travels in the Interior of Southern Africa. 2 vols. 4° 1822–4.

1844. J. Backhouse. A Narrative of a Visit to the Mauritius and South Africa. 8° London and York, 1844.

1813. Professor Playfair. Account of the Structure of the Table Mountain and other parts of the Peninsula of the Cape; from observations made by Capt. Basil Hall. Trans. Roy. Soc. Edinburgh, vol. vii. p. 270.

1818. Capt. D. Carmichael. On the Geological Structure of part of the Cape of Good Hope. Trans. Geol. Soc. vol. v. p. 614.

1837. J. F. L. Hausmann. Beyträge zur Kunde der geognostischen Constitution von Süd Africa. Göttingische gelehrte Anzeigen, 1837, pp. 1449–1462.

1839. In the 'Silurian System,' p. 583, Sir Roderick Murchison alludes to several collections of fossils from South Africa.

1841. W. B. Clarke. On the Geological Phænomena in the Vicinity of Cape Town, South Africa. Proceed. Geol. Soc. vol. iii. p. 418. (Original drawings illustrative of lithological details of the structure of Table Mountain, and having reference to Mr. Clarke's paper, are in the Society's Portfolios.)

1844. C. Darwin. Volcanic Islands, &c. p. 148, &c. (Granite and Sandstone of the Cape.)

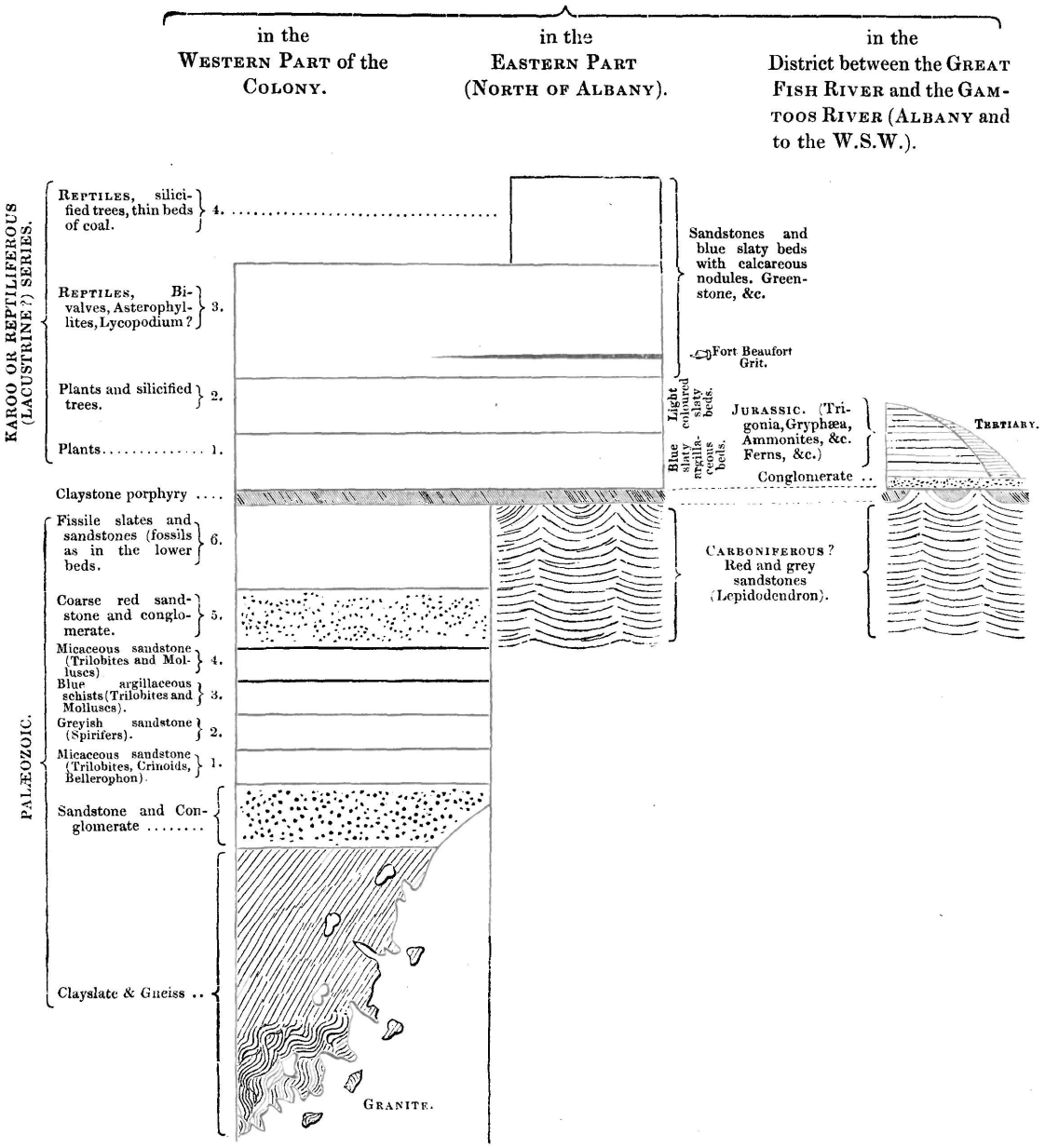
1845. A. G. Bain. On the Discovery of the Fossil Remains of Bidental and other Reptiles in South Africa. Trans. Geol. Soc. 2 ser. vol. vii. pp. 53–59.

1845. Prof. Owen. Report on the Reptilian Fossils of South Africa. Trans. Geol. Soc. 2 ser. vol. vii. pp. 59–84.

1850. Dr. Fr. Krauss. Ueber einige Petrefacten aus der untern Kreide des Kaplandes. Nova Acta C. L. C. Nat. Cur. vol. xxii. part 2. pp. 439–464 (plates); and Quart. Journ. Geol. Soc. vol. vii. part 2. Miscell. pp. 120–122.

1852. Dr. F. Sandberger. Ueber einige paläozoische Versteinerungen des Cap-landes. Leonhard and Bronn's N. Jahrb. für Min. &c. 1852, pp. 581–585; and Quart. Journ. Geol. Soc. vol. ix. part 2. Miscell. pp. 1–4.]

DIAGRAM OF THE STRATA



Section No. 1. (Plate XXI.)—*From the back of Table Mountain to the Middle Roggeveld.*

In this section *granite* is the fundamental rock, though the superincumbent gneiss and clayslate, as will afterwards be shown, are the oldest. It forms the basis of the celebrated Table Mountain and Lion's Head at Cape Town, and in those localities is, generally speaking, coarse-grained, and frequently porphyritic.

At the Paarl and in the neighbourhood of Bain's Kloof it often assumes a binary form, the mica being there wanting, and is everywhere traversed by veins of quartz and felspar; whereas at George, where this rock also appears, the mica seems to predominate and is in very large flakes. The granite is also found there in a porphyritic form.

At the foot of Table Mountain and at Bain's Kloof are extensive beds of a decomposed granite, sometimes attaining a thickness of from 50 to 60 feet; the angles of its component minerals are frequently rounded, and masses of sandstone from the mountains above are sometimes found imbedded in it; and, though it is so soft in some places as to be cut with a pickaxe or spade, yet distinct veins of quartz running through it can be traced in all directions: when it passes into the real granite, the line of junction can never be traced.

Granite, I am told, is also to be found in the neighbourhood of Port Natal; but I did not observe any when I was in that country. It is also said to appear in considerable masses at the Kamies Berg and the Bushman Karoo Flats; but I have not laid it down on the Map in those parts, as I do not know its extent.

I am not aware that any of the precious or other metals have ever been discovered in this rock in South Africa; but at the Lion's Head I found crystals of tourmaline and a small bed of kaolin.

In Europe, granite is generally found in the most elevated countries, as in the Alps, Pyrenees, &c.; but in South Africa, on the contrary, it invariably assumes a perfectly subordinate character, nowhere showing any elevated peaks, lofty *aiguilles*, or serrated ridges*. The Paarl Mountain and the Paardeberg are the most prominent of their class; but neither of them exceed the height of 1500 feet, and in the neighbourhood of the lofty sedimentary mountains appear but small hillocks in comparison. When I first saw the granitic formations in the district of George, I mistook them for tertiary rocks, from their soft rounded appearance, until a section in one of the rivers undeceived me. We next come to the

* Since writing the above, I hear from my talented friend T. Maclean, Esq., that Kamies Berg and Lely Fontein are exceptions to this rule.

Gneiss,

which never occurs but in contiguity with the granite; for it seems always to pass into clayslate when beyond the influence of the plutonic rock below. Section No. 4, Pl. XXI., shows the invasion of the latter on the ancient sedimentary deposits, where its veins are seen to penetrate the laminated rocks, whilst huge detached masses of granite are entangled in the gneiss, and fragments of gneiss remain isolated in the granite.

Gneiss occurs at Platte Klip at the foot of Table Mountain, Hottentots Holland, and near Little Brak River in the district of George. I consider it to be contemporaneous with the

Clayslate,

which is very extensively developed both in the southern and western parts of the colony, and is of great thickness. This formation contains rocks of various kinds, and presents a great diversity of aspects. At Cape Town extensive quarries are worked in it for building-purposes, and at Robben Island, in Table Bay, the rock is cut into square flags for pavements, grave-stones, &c., taking a smooth face and cutting very freely. It is there of a bluish-black colour, but is devoid of slaty cleavage, as are, I believe, all the other schists of the colony. In many parts it passes into mica-slate, as at Swartland, Tulbagh, Slaryhoek, Worcester, and many other parts. In some places it is completely decomposed into a soft clay, of various colours,—yellow, blue, pink, white, and brown, as at Bain's Kloof, where, in a tunnel which I perforated, through a thickness of 400 feet, I never required even the aid of a crowbar in the excavations (except through some massive quartz-veins), the whole being worked by the pickaxe and spade.

The clayslate, like the granite, never rises to any great height; but is generally found to constitute all the valleys of elevation in the western and southern parts of the colony, extending as far east as Gamtoos River.

The laminæ or strata, when visible, are always at high angles, frequently vertical and contorted, and often entirely overturned, having evidently suffered much from lateral compression. It is quite impossible to calculate the thickness of the clayslate. I have made many extensive excavations in these rocks, but never saw the least sign of a fossil in them. Hence I conclude that they are non-fossiliferous. Numerous quartz-veins traverse them in all directions. Their strike, like that of all the older rocks, is generally from S.E. and N.W. to E.S.E and N.N.W.; and, as far as my researches go, they are destitute both of metals and minerals.

Lying unconformably on the clayslate is a formation of great thickness and extent, which, from its geological position, though not at all from its physical attributes, I consider to be the equivalent of

*The Lower Silurian**

This is also widely developed; it consists of unfossiliferous sandstone and conglomerate, and forms the summits of Table Mountain and Lion's Head, as well as that of all the extensive and lofty ranges of the western and southern parts of the colony.

A very good description of it has been given, as far as it refers to the neighbourhood of Cape Town, in Clarke Abel's Travels, p. 295, to which I may with confidence refer. But I must at the same time observe that the imbedded pebbles very much decrease in numbers in an easterly direction, but increase as the range trends northerly; for at Pikeneers Kloof and Rinoster Hoek the whole mountain seems to be one mass of conglomerate, many of the imbedded stones being larger than a man's fist.

Those imbedded stones and pebbles being principally composed of clayslate and quartz, it becomes a matter of interesting speculation as to the district whence they were derived. No antecedent quartzose rock (excepting the quartz-veins in the clayslate) at present exists in South Africa; hence we must conclude that the parent of those numerous pebbles and conglomerates now lies buried in the depths of the Atlantic or Indian Oceans.

When this sandstone is seen to rest on the granite, as it does at Lion's Head (see Section 4) and at Du Zoits Kloof, it is evident that the granite had cooled down and was perfectly quiescent at the time of the deposition of the former; showing a very marked difference between the junction of the gneiss with the granite, and of the latter with the sandstone,—both of which are shown in this section.

The thickness of this formation it is difficult to ascertain; but, as far as I have been enabled to estimate it, it cannot be less than from 10,000 to 12,000 feet; so that, if Table Mountain was ever covered with a like thickness of deposit, which I have no doubt it was, and had retained it until the present day, then it would eclipse the Peak of Teneriffe, or even rival Mont Blanc in altitude.

To the advocates for the sudden upheaval of mountains, I think the removal of such a mass from the top of Table Mountain presents a considerable difficulty: but, compared to the immense denudation that has taken place in this formation on the Cape Flats alone, to say nothing of the extensive valleys of elevation leading from Tulbagh by Worcester, Swellendam, and George, and from Bain's Kloof to Picket Berg and Donkin's Bay, it is a mere nothing. A glance at Section

* The author's nomenclature is here retained: the probable geological age assigned by Mr. D. Sharpe and Mr. Salter to the fossiliferous rocks immediately overlying this sandstone will be seen in subsequent pages to be "Devonian."—Ed.

No. 1, from the top of Table Mountain to that of the high mountain at Michell's Pass, will give some faint idea of the magnitude of this denudation; for there cannot be the smallest doubt that those two mountains were at one time connected.

It appears to me that no agent with which we are acquainted could have effected this immense degradation and the complete removal of the fragments but the tides and marine currents, as the mountains slowly emerged from the bosom of the primeval ocean, and that too probably before the rocks had attained their present tenacity of consistence. Not a fragment of this sandstone is now to be found on the flats or plains at any distance from the mountains, except here and there small portions *in situ*, resting unconformably on the clayslate, just sufficient to attest that the whole had at one time been continuous.

This formation extends from Donkin's Bay, on the west coast, to Cape St. Francis, on the east, including all the high mountains of the Cape peninsula and Hottentots Holland; and, from the extensive excavations I have made in it, I think I can safely say that it contains no fossils. The only minerals I have discovered are iron-pyrites and some oxides of iron of no value.

Leaving the quartzose sandstone, I shall proceed briefly to describe the South African

*Upper Silurian Rocks**,

where the first signs of primeval life begin to appear. Many specimens of the fossils of this series have at various times found their way to Europe; but, as far as I am aware, no attempt has ever been made to show their position among the South African formations, which I shall now endeavour to do, however imperfectly.

This Upper Silurian formation can be well traced in the Warm and Cold Bokkevelden, where it rests conformably on the above-described sandstones, and where its lowest strata contrast wonderfully with the rough gritty sandstone beds on which they repose. They consist principally of soft micaceous deposits, of various colours, abounding in small Trilobites, Crinoids, and Brachiopods, the fossils being frequently enclosed in small rounded nodules. Higher up in the series, the rocks are composed of a greyish sandstone containing numerous casts of Spirifers, which, from a fancied resemblance to the Butterfly, the Boers call *Schoe-lappers*.

Next are found compact, blue, argillaceous schists, easily disintegrating when exposed to the sun, and abounding in Trilobites of a larger size, *Conularia*, Brachiopods, and other Mollusks. This subdivision is overlaid by a deposit resembling the lowest micaceous beds, but containing a much greater variety of Mollusks, as well as many specimens of the heads, bodies, and tails of a large

* See previous Note at p. 181.

species of *Homalonotus**. They are remarkable *Trilobites* with a hooked beak in front; hence I provisionally named them the "*hawksbill.*"

The next rock in superposition is a coarse red sandstone, of great thickness, containing numerous imbedded quartz-pebbles, much resembling the older sandstones of the Cape, and, like them, containing no fossils, as far as my researches go. It is this rock which forms the elevated ranges of the Cedar Berg, Swarteberg, and Cold Bokkeveld mountains, attaining in some parts an elevation of 6840 feet above the sea. Its contortions and flexures are such (see Section No. 5, Plate XXI.) as to bid defiance to any calculation of its thickness.

On the flanks of those mountains is an extensive deposit, principally of fissile slates and sandstones, geologically higher, though locally lower, extending far into the Karoo, and containing many fossils of a similar nature to those already described. These beds are the last and uppermost of the Upper Silurian series†, as developed in this country, and they disappear here under the zone of igneous rocks marked blue in the Map and Section, and which everywhere divides the palæozoic from the later and more northerly strata.

I have not yet discovered a vestige of limestone, marble, or corals in these deposits. The Crinoids seem to have been plentiful enough, but are never found in a perfect state. The finest I ever saw crumbled to pieces in my endeavours to extract it from the rock, so that I can show no better specimens than a few detached ossicles or joints.

The further description of this line of Section, with its extensive Reptiliferous strata, I shall leave (as stated at p. 176) until I have first described all the other formations.

Section No. 2. (Plate XXI.)—*From near Cape Recife to Lower Zeekoe River.*

The fundamental rock of all the country stretching from Gamtoos River to the Great Fish River, and bounded to the northward by the Bothus Hill and Zuurberg Ranges, appears to be that of our

Carboniferous Formation,

which lithologically differs but little from the quartzose sandstones of the Silurian (?) ranges of the western parts of the colony (except that the carboniferous rocks have no imbedded pebbles). This appearance led to a mistake on my part in the description given in my letter of April 1844 (see above, p. 54), where I classed them all as

* The *H. Herschelii*, of Murchison.

† It was to this fossiliferous palæozoic series, here termed "Upper Silurian," that Prof. E. Forbes alluded at the British Association Meeting in 1851 (Report of Sections, p. 58), when he called attention to the discovery of "Devonian" rocks in Fezzan by Dr. Overweg, and in the Cape Region, as above described.—Ed.

belonging to the carboniferous system, but which opinion subsequent researches have proved to be erroneous: otherwise I believe that description to be perfectly correct, and to which I would now refer. The quartzose sandstone, which is the general characteristic of this formation, passes into chloritic schist at De Stade's and Van Staaden's Rivers, where rich mines of galena and copper-ore have been lately successfully worked*.

No workable coal has yet been discovered in this formation; but I am told that numerous species of carboniferous plants† have lately been found near the Kowie River in the talcose schist.

The next rock in superposition is a *claystone porphyry*; but the description of this I shall defer for the present. Upon it rests a coarse

Conglomerate,

which has also been described in my former communication. It is here seen on the flank of the Zuurberg, and portions of it appear in Section No. 3, at Grobbelar's Kloof, near Graham's Town; also at Lange Kloof, and other parts of the district of George.

Reposing conformably on this conglomerate is an exceedingly interesting group of rocks, which I have ventured to call the

Lias (?),

from the prevalence of a characteristic liassic fossil, the *Gryphæa incurva*‡. This deposit does not seem to be anywhere extensively developed; but, as a glance at the map will show, occupies only small indentations of the coast about the estuaries of our largest rivers. I know that more of these deposits than I have laid down exist along the coast, especially in Kafirland; but, not being sufficiently acquainted with them, I have not given them a place in the map.

I shall not attempt to describe the various fossil treasures of this highly interesting formation; suffice it to say, that whole forests of calcified trees, of large size, are found in the neighbourhood of Sunday's and Bushman's Rivers, in a most perfect state of preservation, imbedded horizontally in the rock. Ferns, Zamias, and fragments of wood in a lignitic state, occur mixed up with fragments of gypsum and Reptilian bones, together with marine exuviæ—*Trigonia*, *Ammonites*,

* Copper-ores are also found in Namaqualand in chloritic rocks; but the mines cannot be worked to advantage, on account of the scarcity of water and fuel.

† A specimen of micaceous schistose rock with Lepidodendron-like impressions, from Kowie River, is in the Society's Museum.—Ed.

‡ This fossil, although very similar to the species above referred to, is an *Exogyra* (*E. imbricata*, Krauss). The formation in question, however, is probably referable to the lower jurassic or lias series on other fossil evidence: see Mr. D. Sharpe's paper in the sequel.—Ed.

and various other Mollusks, giving the formation, on the whole, perhaps more of an oolitic than a liassic character*.

Resting unconformably on the lias (?) and the older rocks along the coast, are several

Tertiary Formations,

principally of white calcareous rock, which I shall not attempt to describe, as I can neither correctly lay down their boundaries, nor has my experience among them qualified me to enter into particulars. They are probably of the Pliocene age, as they contain many specimens of Mollusks at present inhabiting the neighbouring seas. My collection contains a few specimens, principally from the eastern province, and one from Mossel Bay.

Having now briefly described the rock-formations in the more southerly portions of the Sections Nos. 1 and 2, I shall pass over that part of No. 3 (Plate XXI.) which contains what has been already described until we reach the

Claystone Porphyry,

a description of which I attempted in my paper before referred to (*supra*, p. 54), as far as I then knew it to extend, viz. from the mouth of the Gualana River in Kafirland to the Little Fish River in the Division of Somerset, a distance of eighty miles. I little dreamt then of its enormous extent, or to what important conclusions it would lead, for I have since traced it (with the exception of a small tract of country which I have had no opportunity of exploring, but through which I have no doubt it is continuous all the way, as above described) from the Gualana Mouth, behind the Zuurbergen and further along, and running nearly parallel to the Great Swartberg, Witteberg, and Cedarberg ranges, up to where my researches terminate, in a north-west direction as far as Hantam in the Clan William Division; a distance of nearly 600 miles. How much farther it may extend is a problem for future geologists to solve.

This enormous igneous mass, as will be seen by the map and sections, rests on the carboniferous rocks in the eastern province, and in the western parts on the flanks of our Upper Silurian (?) ranges, running, like the mountain chains, generally

* In 1851 Col. Portlock exhibited to the Meeting of the British Association at Ipswich a series of fossils collected by Mr. R. Rubidge at Sunday River; and observed that they comprised *Ammonites*, *Gryphæa*, *Pholadomya*, and *Trigonia*; together with plants of the genera *Zamia*, *Neuropteris*, *Pecopteris*, and *Sphenopteris*. "The shells were apparently of Jurassic age; the plants had been examined by Dr. Harvey, and the species of *Neuropteris*, *Pecopteris*, and *Sphenopteris* were regarded as chiefly resembling those of the coal of Australia; whilst the presence of the genus *Zamia* in abundance impresses an oolitic aspect on the flora." Report Brit. Assoc. 1851, Sect. p. 68. [From a late communication from Mr. Rubidge, it appears doubtful whether some of the *plants* here alluded to were not derived from the Karoo series on the eastern side of the Stormberg.]—Ed.

nearly parallel to the coast. There can be no doubt that its former horizontal extent was much greater than at present, for we find detached masses of it to the south of Governor's Kop and Zuurberg (see Sections No. 3 and 2), and in the Cold Bokkeveld (see Section No. 1), having, according to my idea, covered all those immense mountain-masses before the period of their upheaval. I have no doubt also that many detached portions will be found to the south of the Great Swartberg chain; but my acquaintance with that part of the country is too limited to enable me to point them out.

In what manner could this extensive mass of igneous matter have been poured out on the surface of the earth, whose northern limit perhaps extends thousands of miles in the interior, and whose eastern termination must for ever remain a mystery? In vain have I searched for dykes, as the channels of eruption, such as are so plainly visible in the other trap-rocks of the country. It is true, that at its junction with the carboniferous schists in Albany the strata are frequently vertical, and even overlie the porphyry, and are much altered by heat (see Catalogue of Rocks of Section No. 3, specimen No. 14, marked A in the section), giving the latter the appearance of being the upheaving rocks. At Ecca Valley, however (marked B in Section No. 3), at Pluto's Vale, and at Hantam, the opposite extreme, the reptiliferous beds rest conformably on the igneous rock, and no indications of heat are exhibited by those slates (as the specimens in the collection will show), the porphyry having evidently cooled before the deposition of the former; consequently this great zone of igneous rock cannot be an immense dyke, as might otherwise be supposed.

From the numerous imbedded pebbles of granite, sandstone, quartz, and clay-slate, apparently not altered by heat, one might be led to believe that the whole was an aqueous deposit; but after inspecting the magnificent amorphous masses of hundreds of feet in height, as seen at Pluto's Vale in Albany, Toverberg in the Western Karoo, and at Klip Rug in Hantam, with many other splendid sections, where not the smallest sign of stratification appears, that idea also falls to the ground.

In this dilemma, I trust, I may not be considered visionary if I attribute the whole to the production of an immense volcano, which we may suppose to have existed somewhere near the junction of the Vaal and Orange Rivers, or perhaps about the site of the present Compass Berg, whose peak rises to the height of 10,000 feet above the sea-level; and thence deluged with fiery billows the Silurian (?) plains, and spread ruin and desolation over the carboniferous forests for tens of thousands of square miles.

Besides the imbedded pebbles, &c., above mentioned, I found at one place, near Zout Kloof in the Karoo, a great number of rounded calcareous nodules imbedded in this rock, from 3 inches to a foot in diameter, some of them being perfectly

spherical, and resembling cannon-balls or bomb-shells; these balls I have never found in any other locality.

Having now described the claystone-porphyry along its whole line, I shall return to Section No. 1, where I have already entered on that part of the colony known as the Great Karoo Desert, which, from the Praam Berg, in Hantam, to the Sunday's River, in Graaff Reinet Division, scarcely contains the permanent residence of a dozen families. It may be considered altogether as a great hill-studded plain, bounded on the west by the Cedar Berg and Swart Rug, and on the south by the Witte Berg, Great Swarte Berg, and Blauw Berg, very prominent mountain-ranges. The elevated plateaux of Hantam, Roggeveld, Nieuwveld, and Snieuw Berg form its inland boundaries. In the summer, with the few exceptions above mentioned, it is quite uninhabited, being a perfectly arid desert; but the autumnal rains cause the vegetation to spring forth so rapidly, that in the course of a few days it is (as if by magic) suddenly converted into a perfect flower-garden, and yields abundant herbage for cattle and sheep, so that all the Boers from the surrounding highlands descend to the plains below during the winter months, living in tents, surrounded by their families, flocks, and herds in true patriarchal simplicity.

This immense desert, as well as the whole tract coloured by different shades of green in the Map (Plate XX.), would appear from geological evidence to have been once occupied by an enormous lake or sea. The fauna and flora of this perhaps isolated inland sea are now represented by the plant-remains buried in its finely laminated deposits, and by the singular family of Dicynodonts and other peculiar ancient reptiles, who here sported about in a world of their own.

I shall now proceed briefly to describe these *Reptiliferous strata*.

The first or lowest deposit is a finely-laminated, blue, argillaceous rock, being invariably the same all along the margin, from Hantam to the Great Fish River, reposing conformably on the claystone-porphyry, and quite unaltered by heat. A narrow band of soft white slaty rock succeeds to this, which is succeeded by an extensive bed similar to the first, but containing abundance of plant-remains*.

The only fault I have ever discovered in this country is found among those slaty beds where they begin to alternate with sandstones at Buffels River, as shown in Section 7 (Plate XXI.). Near this part also the rocks are very much contorted, which does not appear to be the case where the three general sections pass through the reptiliferous strata.

In my communication of 1844, before the idea struck me of the lacustrine origin of these rocks, I have already described the other divisions of the formation, which

* The specimens from the Ecca Valley, in the collection of 1847, and a large stem of a plant found at Potatas River, in the Western Karoo, now sent, will illustrate this part of the section.

I need not here repeat, as the specimens in my collection of 1847 will illustrate the whole, there being no difference in all the three sections traversing the reptiliferous series.

I ought, however, to add, that I discovered a number of fossil plants (Pl. XXVIII. fig. 1) in the Middle Roggeveld, which I have not met with in the more eastern sections, and two specimens of which I send with my present collection. These occur in the sandstone and schistose strata of that locality to the thickness of 1200 feet. They somewhat resemble the *Asterophyllites* of the coal-measures, and, like the *Sphagnum palustre* of the peat-bogs, seem to have thrown out fresh branches as the lower parts became enveloped in mud. I arrived at this conclusion by finding the plants invariably in a vertical position, and the stalk passing through several distinct beds of stratification, with something at the bottom resembling roots.

Among the fossil plants of Roggeveld, a species of *Lycopodium?* was frequently recognized, but could not be extracted from the rock. At Little Table Mountain, Kleine Roggeveld, I discovered the silicified stem of a large tree about 20 feet long, and in a very perfect state of preservation.

Towards the northern end of Section No. 3, I discovered in 1846 an extensive tract of country which, in addition to the remains of Dicynodonts and other reptiles, contained great masses of siliceous wood, imbedded in its horizontally stratified white sandstones, together with thin beds of coal. None of the coal-beds, of a quality fit for use, were thick enough to be worked. It is frequently anthracitic, and much of it is deficient in bitumen.

At Wittebergen, near the upper branches of the Orange River, I found a large sandstone slab, of about 8 feet square, with the branch of a tree imbedded therein, in all its beautiful and extensive ramifications, just as it grew, the wood having completely partaken of the nature of its siliceous matrix; it was, however, impossible to remove this splendid fossil.

A remarkable feature in the geology of South Africa is the immense numbers of

Trap Dikes

that reticulate throughout the whole of the reptiliferous strata; their erupted matter, on reaching the surface, being generally found capping the highest mountains, with huge irregular prismatic columns. The most wonderful of these dikes is that gigantic mass which protrudes from the Spitzkop, as seen in Section No. 2, Plate XXI., and rises to the height of 10,000 feet above the sea. The horizontality of the stratified rocks is never in the least disturbed by the intrusion of the trap; nor are faults, as in Europe, produced by this cause: the only difference it makes is in indurating or honeycombing the strata through which it passes. At Spitzkop, above mentioned, the sandstone in contact with the huge dike is meta-

morphosed for a distance of 40 or 50 yards, and sometimes converted into perfect hexagonal columns. The slaty rocks likewise, which are within its influence, from being of a dark blue colour, have been changed to black, much resembling in appearance fine-grained basalt. There are many smaller dikes in various parts of the country, protruding through the sandstone in a similar manner, and shaped like the Spitzkop. These also, being harder than the horizontal strata, have longer withstood the action of the elements, which have disintegrated and worn away the softer sedimentary deposits.

I have endeavoured to show some of the principal dikes in the sections, but have not attempted it in the map; for, without a proper survey of the whole country, even an approximation to the truth could not be attained, as the dikes appear to run in every direction, forming an irregular network, which would only disfigure the map, and look like a confused mass of roads*.

Having now briefly, though very imperfectly, sketched the different formations of South Africa, and to the best of my ability laid down the same on my map and sections (Pl. XX. XXI.) in such a manner as, I trust, will be intelligible, it will be seen that I have been so far successful in tracing at least a part of the Dicynodon's habitat, with that of the other wonderful reptiles with remains of which my collections abound. The existence of a great lake or inland sea, occupying the major part of the South African promontory, was never once dreamt of by me when I first discovered those singular relics, but subsequent researches have convinced me that such was the case, and moreover that the period of its existence was shortly after the deposition of what I have called in this sketch the "Carboniferous formation," the "claystone-porphyry" only intervening between it and the Reptiliferous deposits. I have arrived at the conclusion of the lacustrine origin of this extensive area from the fol.owing facts, viz.:—

1st. The general uniformity and homogeneity of the deposits.

2nd. The great abundance of fossil wood, and the similarity of the vegetable remains found throughout the range of these beds.

3rd. The large quantity of freshwater plants traversing the strata in the vertical position on the spot where they grew.

4th. The peculiar characters of the reptiles found fossil in these strata, and unknown elsewhere.

5th. The general absence of marine exuviæ, and the presence of small freshwater shells†.

* See also Capt. Charters's observations on the vast extent of greenstone in South Africa, Proc. Geol. Soc. vol. iii. p. 102.—Ed.

† Mr. Bain's collection does not afford certain evidence on this point. A piece of rock with minute

In my former communication of 1844, so frequently alluded to, I offered some conjectures as to the probable age of the Reptiliferous strata, being in a great measure misled in the opinion then offered by having received an *Ammonites planulatus, said* to have been found *in situ* by the donor at the foot of the Spitzkop; circumstances which I need not here relate, coupled with a subsequent better acquaintance of that elevated part of the country, led to the discovery that this was quite a mistake,—the fossil having been brought from Europe. Professor Owen appears to consider the Bidental Reptiles to be of the age of the New Red Sandstone; and, from extensive researches made among the Reptiliferous strata since the transmission of my first collection to England, at which time I erroneously assigned to them an Oolitic origin, I now perfectly concur with the learned Professor, that they are at least as old as, if not older than the New Red period.

I have in my possession a fine specimen of the *heterocercal* tail of a fish, found at Styl Krantz in the upper Reptiliferous slates; and I have seen various other ichthyolites of a similar description, found near Fort Beaufort in the lowest part of the same formation;—and perhaps, from the presumed palæozoic character of such fish-remains, we may find another argument in favour of the inference that these beds are at least as old as the New Red Sandstone.

But I am inclined to assign to them even an older date. Although I have classed my "Carboniferous formation" among the marine formations, yet I am by no means certain that they are such, for no marine exuviæ, as far as I am aware, have ever been discovered in them. Lithologically they differ much from the Carboniferous series of Europe, but I think they are their true African equivalents; and the great resemblance between their fossil flora and that of my "lacustrine" deposits which contain such extensive beds of coal, even in their upper parts, irresistibly lead me to the conclusion that they are also nearly related to the Carboniferous series, and hence that the Dicynodon, with its numerous and wonderful congeners, are amongst the oldest of reptiles.

Before concluding, I shall offer a few general remarks on the *Superficial deposits* of South Africa.

Very extensive deposits of calcareous Tufa are found along the coast (see Section No. 4); these are composed principally of the detritus of the Tertiary formations, which I have no doubt at a former period everywhere fringed the

shells, some of which may have been estuarine (see Pl. XXVIII. figs. 8–25), was said doubtfully to have come from Snieuwberg, but it is a part of the lowest Zwartkop rock. Another rock with casts of minute (Cyclas-like) shells is unfortunately without a label, and may correspond to some specimens from Kat River referred to in Mr. Bain's MS. Catalogue: if so, it might have aided the author's arguments.

The freshwater fossils from near Graaf Reinet (Pl. XXVIII. figs. 2–7), in the Society's collection, constitute at present all the direct evidence we have on this point.—Ed.

coast. In some places it attains a thickness of upwards of 100 feet, and contains imbedded shells of the common land-snail in great abundance, as well as various recent animal and vegetable remains*. At Cape Agulhas the new lighthouse has been built of this rock, but it is generally used merely for lime-burning.

Thin beds of calcareous tufa are also found overlying the Reptiliferous strata in all parts of the interior, and are invariably used by the inhabitants for lime, there being no regular stratified limestones in South Africa.

The Cango Caverns† in the Division of George are famous for their large and beautiful stalactites and stalagmites, which afford a very pure carbonate of lime, much superior to the tufas. Smaller caves of the same are found in different parts of the colony.

Frequently, resting on the above or on the older rocks below, are found beds of recent marine shells exactly the same as those at present inhabiting the Indian and Atlantic Oceans,—some specimens accompany my collection of 1847. I have found them near the mouth of the Great Fish River, Kowie, Port Elizabeth, Van Staaden's River, Mossel Bay, and Lion's Head, Cape Town (see Section, No. 4); and they are also to be seen all along our western coast. In some parts they occur in beds of considerable thickness, imbedded in loose sand mixed up with bones of recent land-animals, and even many specimens of native pottery and other works of man; so that this raised beach, for such it must be, has been uplifted to its present height during the historical period. Its height varies from 20 to 300 feet above the sea-level‡.

A superficial ferruginous deposit, which is found in the greatest abundance on the Cape Flats, and there covering the clayslate, consists of an oxide of iron, derived either from the clayslates themselves or from the neighbouring sandstone mountains§. In some places it reaches the thickness of 10 feet, and is much used for road-purposes. This ironstone is found in small patches on many of the marine formations throughout the colony. At Kalga Springs, near Port Elizabeth, it is curious to observe the ferruginous deposits forming and indurating, as it were, before our eyes, as the water charged with the iron flows away from the source; this is illustrated by some specimens in my collection of 1847.

Hot, tepid, and cold chalybeate springs are found in various parts of the colony, and are much resorted to by the inhabitants as a cure for all diseases. None of

* See also Capt. Nelson's observations on the "Æolian" beds at Algoa Bay, Quart. Journ. Geol. Soc. vol. ix. p. 206, note.—Ed.

† For a detailed description and illustration of these Caverns see G. Thompson's 'Travels in Southern Africa,' vol. i. p. 275, &c. 1827, 8vo. 2 vols.—Ed.

‡ See also the Rev. Mr. Clarke's Observations, Proc. Geol. Soc. vol. iii. p. 420.—Ed.

§ See also Mr. Darwin's Observations, 'Volcanic Islands,' p. 143.—Ed.

them appear to be of volcanic origin, the existence of true volcanic rocks being unknown in this country.

On the Cape Flats, near Tygerberg, I discovered in 1846 a small bed of white sandstone, resting unconformably on the clayslate, and containing beautiful casts or impressions of what I took to be fucoids. My late talented friend Col. Michell, our former Surveyor-General, kindly took home some specimens, which he presented to the Society in my name.

The Rev. Dr. Adamson, now in England, informed me last year that he had, some time ago, discovered in the neighbourhood of Wynberg, some stalk-like bodies in a small bed of white sandstone, also resting on the clayslate, perhaps of the same age as the Fucoidal bodies above mentioned. Some specimens which he showed me were very obscure. My present collection contains a specimen of what resembles a Calamite (?), which I got at Buffeljugts River, near Swellendam, also in white sandstone, lying on the clayslate*.

I ought perhaps also to mention that I have frequently heard of animal remains being discovered in the alluvium, differing from those of existing animals; and I discovered at Bloemhoff in the Division of Graaf Reinet, about 10 feet below the surface, in a marly alluvial soil, some remains of an extinct ruminant, consisting of a skull, with the core of one horn attached, the former being of an extraordinary length in proportion to its breadth. It forms part of the collection of 1847, and must speak for itself†.

I have no doubt that a diligent search in the deep ruts or ravines that everywhere intersect the great plains of the interior would produce a vast number of extinct mammalian remains perfectly new to science.

* The specimens above referred to comprise both casts of some aloe-like plants and semicylindrical stem-like bodies. For observations on the calcareous casts of plant-remains near Simons Town and elsewhere, see also Darwin's 'Volcanic Islands,' p. 146; Clarke, Proc. Geol. Soc. vol. iii. p. 421; and C. Abel's Voyage, p. 308.—Ed.

† See also Proc. Geol. Soc. vol. iii. p. 152; and Trans. vol. vii. p. 59.—Ed.

Description of Fossils from the Secondary Rocks of Sunday River and Zwartkop River, South Africa, collected by Dr. ATHERSTONE *and* A. G. BAIN, Esq. *By* D. SHARPE, Esq., F.R.S., Pres. G.S. &c.

[PLATES XXII. XXIII. XXVIII.]

Pinna Atherstoni, Sharpe. Pl. XXII. fig. 1.

P. testâ brevi, triangulari, subarcuatâ, longitudinaliter costatâ et medio angulatâ, anticè subquadratâ: costis numerosis inæqualibus, undulatis; lineis concentricis irregularibus decussatis.

Shell triangular, short, slightly curved, with a longitudinal keel below the middle of each valve, which is more prominent anteriorly, giving the anterior end of the shell a rhomboidal section: valves covered with numerous unequal, slightly waving, longitudinal ribs; crossed by undulating, irregular lines of growth.

Length $4\frac{1}{2}$ inches; breadth $2\frac{1}{2}$ inches; thickness $1\frac{1}{4}$ inch.

From Sunday River; found at C. Roe's drift, in a grit with fragments of shells and wood.

This *Pinna* is nearly related to *P. Hartmanni* of Zieten, Goldf. t. 127. fig. 3, which occurs in the Lias of Würtemberg.

Fig. 1 *a*, side view; fig. 1 *b*, transverse section of the anterior part.

Modiola Bainii, Sharpe. Pl. XXII. figs. 2 & 3.

M. testâ transversim elongatâ, subrectâ, concentricè costatâ: costis medio divisis.

Shell transversely elongated, with the back straight and the ventral edge very slightly curved: ornamented with numerous concentric ribs, which are sloping and very strong near the back, but divide into two or three branches before reaching the middle of the valves; these reunite on the lateral transverse keel and then continue small and parallel to the ventral margin. The umbo not having been seen, the proportions of the shell cannot be accurately ascertained; the length was probably more than eight times the breadth.

From Sunday River; found at C. Roe's drift, in a grit with fragmentary shells and wood.

This elegant shell has some resemblance to *M. plicata*, Sow., of the Middle Oolites; but it is straighter, much more elongated, and more regularly ornamented.

Fig. 2, fragment of a large specimen; fig. 3 *a*, fragment of younger shell; fig. 3 *b*, section of fig. 3 *a*.

Perna Atherstoni, Sharpe. Pl. XXII. fig. 4.

P. testâ triangulari, subglabrâ: cardinis ligamenti foveis numerosis, confertis.

Shell nearly triangular, smooth, anterior side sloping, posterior side rounded:

valves of moderate thickness. Hinge-area of moderate depth; ligamental hollows broader than the spaces between them.

Length 2 inches; breadth $1\frac{1}{4}$ inch; thickness $\frac{1}{2}$ inch.

Found at Geelhoutboom, in greenish grit with fragmentary shells.

An inconspicuous shell, with no marked characters, which it would be difficult to distinguish from several European species.

Fig. 4, left valve; fig. 4 *a*, interior of right valve of another specimen; fig. 4 *b*, anterior side of fig. 4.

Trigonia Vau, Sharpe. Pl. XXII. fig. 5.

T. testâ ovato-trigonâ, inflatâ, tuberculato-costatâ: latere antico brevi, rotundato; latere posteriori producto: costis obliquis subtuberculatis, anterioribus retrorsum, posterioribus antrorsum inclinatis, medio angulatis: areâ magnâ, declivi, bi-excavatâ, transversim lineatâ.

Shell ovato-triangular, short and rounded anteriorly, produced posteriorly: umbones projecting, very near the anterior extremity: area broad, divided in two parts by a slight longitudinal ridge, and crossed by faint lines of growth: sides ornamented with slightly tuberculated ribs, which form an angle of 70° to 90° on the middle of the side of the valve; the anterior ribs, small and numerous, slope diagonally backwards; the posterior ribs, strong and about ten in number, slope diagonally forwards; the meeting of these ribs resembles the form of the letter V, as in the genus *Goniomya*.

Length 2 inches; depth $1\frac{1}{4}$ inch.

Found at Sunday River, in greenish-grey grit, with fragments of wood and shells; and in a shelly grit at the Zwartkop River.

Pholadomya Dominicalis, Sharpe. Pl. XXII. fig. 6.

P. testâ tenuissimâ, transversim ovatâ, costatâ: latere antico brevi, sublævi; posteriori elongato, subrecurvo: umbonibus anticis, incurvis: areâ cardinali angustâ, inconspicuâ: costis 10 retrorsum vergentibus, primâ remotiusculâ, reliquis subæquidistantibus: rugis concentricis inconspicuis.

Shell very thin, transversely ovate; anterior end very short and nearly closed; posterior end produced, with the lower margin rounded off and the upper side slightly recurved, and moderately gaping: umbos forward and incurved: cardinal area narrow and ill-defined: ribs ten, radiating from the umbo and sloping backward; the first widely separated from the rest, which are nearer together and nearly at equal distances from one another.

Length $1\frac{1}{4}$ inch; breadth $2\frac{1}{4}$ inches; thickness 1 inch.

Found at Sunday River, in greenish grit.

This shell is nearly related to *P. Hausmanni*, Goldf., of the Lias of Hanover, from which it may be distinguished by having only one rib (instead of two) more

distant than the rest; by the rounding-off of its lower posterior margin; and its less marked cardinal area: it differs from *P. similis*, Ag., of the Middle Oolite of the Jura, in wanting ribs on the anterior portion of the shell: it is also near to *P. decemcostata*, Römer, of the Upper Oolite of Germany. Should the above-mentioned forms be hereafter united as one species, the African shell must be placed with them.

Myacites? Bainii, Sharpe. Pl. XXII. fig. 7.

M. testâ tenui, transversim ovato-elongatâ; anticè posticèque hiante: umbonibus subanticis, prominulis: margine ventrali recto.

Shell thin, transversely elongated; gaping and rounded at both ends; somewhat compressed in the middle, and with a straight ventral margin: lines of growth irregular.

Length $1\frac{1}{4}$ inch; breadth $2\frac{1}{2}$ inches; thickness $\frac{7}{8}$ths of an inch.

Found at Sunday River, in greenish shelly grit.

An inconspicuous shell, of which the true characters can only be ascertained after the interior of the valves shall have been seen.

Ceromya papyracea, Sharpe. Pl. XXII. fig. 8.

C. testâ tenuissimâ, ovato-rhomboideâ, ventricosâ; anticè abbreviatâ, inflatâ; posticè compressâ, subproductâ; margine cardinali recto: umbonibus anticis, prominentibus, incurvis: lineis concentricis crebris.

Shell very thin, nearly rhomboidal, ventricose; anterior end short and inflated, with large incurved umbos; posterior end somewhat produced and gradually flattened: cardinal margin straight; ventral margin slightly rounded: valves slightly unequal, covered with fine, close-set, regular, concentric lines of growth, which on the middle of the right valve are crossed by a few very faint, radiating lines, which are slightly marked on the internal cast.

Length $1\frac{1}{4}$ inch; breadth $1\frac{1}{2}$ inch; thickness 1 inch.

Found at Zwartkop River.

I place this species in the genus *Ceromya* with some doubt; the extreme thinness of the shell excludes it from *Isocardia*; the slight inequality of the valves, the faint rays on the right valve, and the slightly waved outline of the posterior margin, indicating that it is probably a gaping shell, bring it nearer to *Ceromya* than to *Cardiomorpha*.

Cyprina rugulosa, Sharpe. Pl. XXII. fig. 9.

C. testâ rhomboideo-ovatâ, anticè læviusculâ, declivi, posticè inflatâ; concentricè rugosâ: umbonibus anticis prominulis: dente cardinali laterali obsoleto.

Shell thick, transversely ovato-rhomboidal; inflated in the middle and posterior

portions, thinner anteriorly: valves traversed by numerous concentric lines, which are nearly obsolete in the middle of the shell, but rugose on the posterior side. On the left valve the anterior lateral tooth is nearly obsolete.

Length $1\frac{1}{4}$ inch; breadth $1\frac{1}{2}$ inch; thickness $\frac{3}{4}$ of an inch.

Found at Sunday River, in greenish shelly grit.

Fig. 9 *a*, exterior of the left valve; fig. 9 *b*, hinge of the left valve: the posterior tooth has been partially broken away.

Arca Atherstoni, Sharpe. Pl. XXII. fig. 10.

A. testâ trapezoidali; anticè brevi; medio depressâ; posticè elongatâ, obliquè truncatâ, plicatâ: costis minutis numerosis radiantibus, lineis concentricis decussatis.

Shell trapezoidal; short anteriorly; with a broad depression down the middle, bounded by a broad, rounded, transverse keel; obliquely sloping posteriorly: the anterior and middle portions of the valves are ornamented with numerous fine radiating lines, crossed by irregular lines of growth: the sloping posterior portion is divided into three obliquely-longitudinal furrows.

Length $\frac{3}{8}$ths of an inch; breadth $\frac{7}{8}$ths.

Found at Sunday River, in a shelly sand-rock.

[Neither the radiating lines nor the posterior furrows are sufficiently shown in the figure.]

Psammobia Atherstoni, Sharpe. Pl. XXII. fig. 11.

P. testâ compressâ, ovali; anticè rotundatâ; posticè subcompressâ: rugis concentricis inæqualibus.

Shell oval, flattish, regularly rounded anteriorly, slightly sloping on the posterior dorsal side: valves crossed irregularly by unequal concentric ridges.

Length $\frac{3}{4}$ of an inch; breadth $1\frac{1}{4}$ inch; thickness $\frac{3}{8}$ths of an inch.

Found at Sunday River and near Enon, in a grit sometimes full of the casts of the shell.

Fig. 11 *a*, cast from the impression of the left valve; figs. 11 *b* & 11 *c*, two views of a cast of the interior.

The casts show the hinge to have had two strong teeth on the left valve and one on the right valve, with a sharp edge extending laterally along the dorsal margin of the valves on each side of the cardinal teeth.

Ammonites Atherstoni, Sharpe. Pl. XXIII. fig. 1.

A. testâ subglobosâ, costatâ: anfractibus paucis, rotundato-inflatis, lateribus 15–25-costatis, dorso rotundatis multicostatis: costis rectis, acutis, ad latera 3–4-furcatis, deinde super dorsum continuis: umbilico parvo, profundo: aperturâ semi-ovali.

Shell subglobose, with few inflated whorls, ornamented with numerous straight

sharp ribs: 15 to 25 large ribs near the umbilicus, rising into spines, and then each dividing into 3 or 4 smaller ribs, which cross over the rounded back: umbilicus narrow, deep, and well-defined: aperture semi-oval.

The young shell only differs from the adult in having rather fewer ribs.

Diameter of the figured specimen 5 inches; width of opening $3\frac{1}{2}$ inches; height of the last whorl $2\frac{1}{2}$ inches. Some broken specimens in the collection indicate a much larger size.

Found at Sunday River; some specimens occur in a crushed condition. A fragment of a large individual, of apparently the same species, is from the Zwartkop River.

This Ammonite is related to *A. macrocephalus*, of the Middle Oolite of Europe, and to *A. Herveyi*, of the Lower Oolite. Our specimens do not show the septa.

Ammonites Bainii, Sharpe. Pl. XXIII. fig. 2.

A. testâ subglobosâ, costatâ: anfractibus paucis, rotundato-inflatis, lateribus 15-costatis, dorso rotundatis, 40-costatis: costis acutis, antrorsum subincurvis, ad latera 2–3 furcatis, deinde super dorsum continuis: umbilico parvo, profundo: aperturâ semicirculari, interdum contractâ.

Shell subglobose, with few inflated whorls; ornamented with numerous, slightly bent, sharp ribs, about 15 in number near the umbilicus; the ribs divide on each side of the whorl into 2 or 3, which continue across the round back: umbilicus narrow, deep, and well-defined: aperture semicircular, from time to time contracted; and the contractions marked by a stouter rib, projecting forward more than the rest.

Diameter 2 inches; width of opening $1\frac{1}{4}$ inch; height of the last whorl $\frac{3}{4}$ of an inch.

Found at Sunday River.

With some general resemblance to *A. Atherstoni*, this species is not only distinguished by having fewer ribs, but also by the periodical contractions of the mouth, which connect it with *A. Humphriesianus*, *A. Brackenridgii*, and *A. linguiferus* of the Lower Oolite of Europe.

Gryphæa imbricata, Krauss, sp. Pl. XXIII. fig. 3.

Exogyra imbricata, Krauss, Acad. Nat. Cur. xxii. pl. 50. fig. 2.

G. testâ ovato-oblongâ, crassissimâ, squamoso-rugosâ: valvâ inferiori naviculari, apice sinistrorsum incurvo, sulco laterali obsoleto; superiori concaviusculâ, apice recurvo.

Shell ovate-oblong, very thick, externally scaly, attached when young: lower

valve boat-shaped, with an obscure lateral lobe and the apex incurved towards the left; a small scar on the left side of the apex, marking its original attachment; upper valve squamose, slightly concave, with the apex bent back towards the left, so that the beginning of the ligamental pit is exposed.

Length 3 inches; breadth $2\frac{1}{4}$ inches; depth of lower valve $1\frac{1}{2}$ inch.

Found at Sunday River and Zwartkop River.

Dr. Krauss places this shell in the genus *Exogyra*, comparing it to *E. Couloni*: it is, however, a *Gryphæa*, as the upper valve has not the spiral turn nor the lateral hinge-tooth which distinguish the former genus: the species nearest to it in form is the *G. incurva* of the Lias, from which it is readily distinguished by the recurved apex of the upper valve.

Fig. 3 *a*, side view of shell, with both valves; fig. 3 *b*, exterior of the upper valve of another specimen.

Gastrochæna Dominicalis, Sharpe. Pl. XXIII. fig. 4.

G. testâ ovato-oblongâ, anticè inflatâ abbreviatâ, posticè angustatâ: valvis concentricè costulatis; costis nodulosis: tubo brevi, subinfundibuliformi.

Shell oblong, round and shortened anteriorly, tapering posteriorly: valves covered with numerous fine concentric ribs, which are ornamented with a row of small closely-set tubercles: tube short, enlarging rapidly from a small opening, and blunt at the lower end.

Length of the tube $\frac{1}{3}$rd of an inch; greatest diameter $\frac{1}{5}$th.

Found at Sunday River, near Enon. Other specimens of *Gastrochænæ* are found in wood, and others (one of them 1 inch long) in an old massive shell of a *Trigonia*; all from Sunday River. wood

Fig. 4 *a*, a fragment of ~~bone~~ bored all round by *Gastrochænæ*, of the natural size; fig. 4 *b*, dorsal view of a pair of valves, twice their natural size.

Neritopsis ? turbinata, Sharpe. Pl. XXIII. fig. 5.

N. testâ depresso-globosâ, crassâ; longitudinaliter lineis insculptis, transversim sulcis obsoletis ornatâ.

Shell thick, globose, with four rounded whorls, separated by a deep furrow, and ornamented with fifteen equidistant deeply impressed lines, which are crossed by numerous, unequal, slightly impressed lines of growth.

Height $\frac{5}{8}$ths of an ineh; breadth $\frac{3}{4}$.

Found at Sunday River.

The aperture not having been seen, the genus is left in doubt.

Avicula Bainii, Sharpe. Pl. XXVIII. fig. 10.

A. testâ subrhomboidali, obliquâ, lævigatâ, medio gibbosâ; anticè abbreviatâ, tumidiusculâ; posticè alatâ, depressâ.

Shell somewhat rhomboidal, oblique, nearly smooth; gibbous in the middle; anterior portion short and tumid; posterior expanded into a broad flat wing.

Length $\frac{1}{6}$th of an inch; breadth the same.

Found in the lowest strata of the Zwartkop crag.

Only one imperfect specimen of the left valve has been seen.

Modiola Atherstoni, Sharpe. Pl. XXVIII. fig. 11.

M. testâ transversim oblongâ, gibbosâ, concentricè striatâ, anticè obtusâ, posticè rotundatâ expansâ.

Shell transversely oblong, gibbous, concentrically striated, short and obtuse in front, widened and rounded posteriorly.

Length $\frac{1}{10}$th of an inch; breadth $\frac{1}{5}$th of an inch.

Abundant in the lowest strata of the Zwartkop crag.

Sanguinolaria? Africana, Sharpe. Pl. XXVIII. fig. 12.

S.? testâ transversim oblongâ, depressâ, anticè abbreviatâ rotundatâ, posticè expansâ, concentricè rugosâ striatâque.

Shell thin, transversely oblong, depressed; umbos near the anterior end, which is short and rounded; posterior end broad and somewhat flattened, with a shallow furrow near the dorsal margin: ornamented with eight or ten broad concentric folds, which are visible in the cast, between which are fine concentric striæ.

Length $\frac{2}{10}$ths of an inch; breadth $\frac{1}{10}$th of an inch.

Found in the lowest strata of the Zwartkop crag.

Cyrena? Bainii, Sharpe. Pl. XXVIII. fig. 13.

C.? testâ transversim ovatâ, gibbosâ, concentricè striatâ; umbonibus prominentibus submedianis.

Shell transversely ovate, gibbous, slightly inequilateral, concentrically wrinkled; umbos large, a little in advance of the middle.

Length $\frac{3}{8}$ths of an inch; breadth $\frac{1}{2}$ an inch.

Found in the lowest strata of the Zwartkop crag.

Trochus Bainii, Sharpe. Pl. XXVIII. fig. 14.

T. testâ minutâ, pyramidali, imperforatâ; anfractibus angulatis, longitudinaliter undato-striatis; infra transversim rugosâ: aperturâ subquadratâ: angulo spirali 50°.

Shell minute, pyramidal, imperforate, with four angular whorls which are

indistinctly keeled at their lower edge, and crossed by numerous longitudinal undulations. Angle of the spire 50°.

Length $\frac{1}{10}$th of an inch.

Found in the lowest strata of the Zwartkop crag.

Turbo Atherstoni, Sharpe. Pl. XXVIII. figs. 15 & 16.

T. testâ minutâ, turbinatâ: anfractibus 4, angulatis; supernè planis, longitudinaliter striatis; medio bicarinatis: angulo spirali 75°.

Shell minute, turbinated: whorls four, angular; nearly flat and longitudinally striated above; with a broad flat band round the middle, bounded by two strong keels: angle of the spire 75°.

Length $\frac{1}{10}$th of an inch.

Found in the lowest strata of the Zwartkop crag.

Turbo Bainii, Sharpe. Pl. XXVIII. figs. 17 & 18.

T. testâ minutâ, turbinatâ: anfractibus 4, angulatis, longitudinaliter striatis; supernè planis; medio tricarinatis; infra tricarinatis: angulo spirali 65°.

Shell minute, turbinated: whorls four, angular, and longitudinally striated; nearly flat above; with three strong keels on the exposed middle part and three keels on the lower part: angle of the spire 65°.

Length $\frac{1}{8}$th of an inch.

Common in the lowest strata of the Zwartkop crag.

Since the above description was written, some specimens belonging to this species have been found in breaking up some greenish grit with *Ostræa* from Sunday River. These specimens are larger than the above-described; the largest is $\frac{1}{2}$ inch in length.

Acteon Atherstoni, Sharpe. Pl. XXVIII. fig. 19.

A. testâ fusiformi: anfractibus 6, rotundatis; supernè planis; infra transversim impresso-lineatis: angulo spirali 40°.

Shell fusiform, with six rounded whorls, which are smooth on the upper part and ornamented on the lower part with about fifteen impressed transverse lines: angle of the spire 40°.

Length $\frac{1}{6}$th of an inch.

Found in the lowest strata of the Zwartkop crag.

Natica Atherstoni, Sharpe. Pl. XXVIII. fig. 22.

N. testâ oblongâ: anfractibus convexis, medio subangulatis longitudinaliter striatis: angulo spirali 75°.

Shell oblong, finely striated by the lines of growth: whorls four, convex, a little

depressed above, which gives them a slight approach to angularity at the middle: angle of the spire 75°.

Length ½ an inch.

Found in the lowest strata of the Zwartkop crag.

List of the Fossils from the Sunday and the Zwartkop Rivers.

[The Sunday River fossils included in the collections presented to the Geological Society are enveloped in a greenish-grey calcareous earthy rock, sometimes a limestone, and often passing into a sand-rock or a grit; green grains are nearly always present, and sometimes in great abundance.

The fossils from the Zwartkop River district are (excepting the *Astarte*, *Gryphæa*, and *Ostræa*) chiefly casts, often ferruginous, thickly set in a yellowish calcareous rock. For a detailed description of a section of the fossiliferous rocks of the Zwartkop River, see Dr. Krauss's Memoir in the *Nova Acta Acad. Cæs. Leop. Carol. Nat. Cur.* vol. xxii. pars 2, 1850, p. 439; and *Quart. Journ. Geol. Soc.* vol. vi. part 2. Miscell. p. 120.]

Ammonites Atherstoni, *Sharpe*. Pl. XXIII. fig. 1	Sunday and Zwartkop Rivers.
Ammonites Bainii, *Sharpe*. Pl. XXIII. fig. 2	Sunday River.
Nautilus, undeterm. (5½ inches in diameter)	Sunday River.
Neritopsis? turbinata, *Sharpe*. Pl. XXIII. fig. 5	Sunday River.
Small Gasteropods. One like fig. 23, Pl. XXVIII., and ¼ inch long; one like fig. 25, Pl. XXVIII., and ⅝ inch long; and one like fig. 18, Pl. XXVIII., and ½ inch long; these are in a greenish grit from Sunday River, and are evidently finer individuals of the species from "the lowest strata of the Zwartkop crag" (see p. 203).	Sunday River.
Ostræa, spp. Single individuals; attached to shells and wood; and in mass	Sunday River.
Gryphæa imbricata, *Krauss*, sp. (*loc. cit.* pl. 50. fig. 2.) Pl. XXIII. fig. 3	Sunday and Zwartkop Rivers.
Perna Atherstoni, *Sharpe*. Pl. XXII. fig. 4	Sunday River.
Gervillia dentata, *Krauss* (*loc. cit.* pl. 50. fig. 1)	Sunday and Zwartkop Rivers.
Pinna Atherstoni, *Sharpe*. Pl. XXII. fig. 1	Sunday River.
Lima, sp. (undeterm.)	Sunday River.
Modiola Bainii, *Sharpe*. Pl. XXII. figs. 2 & 3	Sunday River.
Arca Atherstoni, *Sharpe*. Pl. XXII. fig. 10	Sunday River.
Cucullæa? cancellata, *Krauss* (*loc. cit.* pl. 48. fig. 2).	Zwartkop River.
Trigonia Vau, *Sharpe*. Pl. XXII. fig. 5	Sunday River.

Trigonia Herzogii, *Hausmann*, sp. (*Krauss, loc. cit.* pl. 48. fig. 3; *Goldfuss, Pet. Germ.* pl. 137. fig. 5)	Sunday and Zwartkop Rivers.
———, sp. (?).	Sunday River.
This variety (or possibly distinct species) is closely allied to *Trigonia Herzogii*, but is more quadrate in outline than the common variety, the anterior edge being truncate; and the costal rows of knobs turn forwards as they approach the ventral border, instead of passing downwards and backwards. These specimens came from Algoa Bay, and apparently have been derived from the Sunday River district, from the aspect of their matrix. They were lately presented to the Society's Museum by J. S. Bowerbank, Esq., F.G.S.	
——— conocardiformis, *Krauss*, sp. (*loc. cit.* pl. 49. fig. 1) .	Sunday and Zwartkop Rivers.
——— ventricosa, *Krauss*, sp. (*loc. cit.* pl. 49. fig. 2)	Zwartkop River.
Anoplomya lutraria, *Krauss* (*loc. cit.* pl. 49. fig. 1)	Zwartkop River.
Pholadomya Dominicalis, *Sharpe*. Pl. XXII. fig. 6	Sunday River.
Myacites Bainii, *Sharpe*. Pl. XXII. fig. 7	Sunday River.
Ceromya papyracea, *Sharpe*. Pl. XXII. fig. 8	Zwartkop River.
Gastrochæna Dominicalis, *Sharpe*. Pl. XXIII. fig. 4	Sunday River.
Psammobia Atherstoni, *Sharpe*. Pl. XXII. fig. 11.	Sunday River.
Cyprina rugulosa, *Sharpe*. Pl. XXII. fig. 9	Sunday River.
Astarte Herzogii, *Hausmann*, sp. (*Krauss, loc. cit.* pl. 47. fig. 2; *Goldf. Pet. Germ.* pl. 149. fig. 10)	Zwartkop River.
———, Bronnii, *Krauss* (*loc. cit.* pl. 48. fig. 1)	Zwartkop River.
Several small Bivalves (undeterm.); from Sunday River and from	Zwartkop River.
Serpula, sp. Large single tube, on *Trigonia Herzogii*	Sunday River.
———, sp. Small numerous winding tubes, on *Gryphæa* . .	Sunday River.
Fucoid? Branching, with clavate branches, 1 inch long; in greenish-grey sandstone containing a small specimen of *Trigonia conocardiformis*?	Sunday River.
Wood; lignite (almost jet), with *Ostreæ* attached	Sunday River.
——— (coniferous); calcareous, from Geelhoutboom . . .	
——— (coniferous); calcareous, perforated by *Gastrochænæ*. Pl. XXIII. fig. 4	
———; calcareous	Lowest strata of Zwartkop crag.

Note.—None of these Mollusks above enumerated can be identified with any known European species; but the forms which they most nearly resemble are those which are found in the middle and lower part of the Oolitic series. Mr. Bain probably places the beds rather too low when he compares them to the Lias; but Dr. Krauss's proposal to place them in the Cretaceous series seems to rest on still weaker grounds.—Daniel Sharpe.

Note.—The following shells are of minute size, and occur together in a hard argillaceous limestone of a reddish colour, labelled "Snieuwberg?" by Mr. Bain, but lately recognized (since the figures were drawn) as identical with a fragment, marked "Lowest strata of the Zwartkop crag," in Dr. Atherston's collection. The latter label has been adopted. This shelly rock contains also fragments of wood and bone, and is probably of estuarine origin, as, with some fluviatile or lacustrine shells, it contains a number of very minute marine mollusks, of genera often found in brackish water: these may be dwarfish individuals of species which would have reached a larger size in purely marine waters*. Believing this to be the case, I have not ventured to compare them with any published species; nor do I think that any conclusions as to the age of the bed in which they occur can safely be drawn from the shells themselves.—Daniel Sharpe.

Avicula Bainii, *Sharpe.* Pl. XXVIII. fig. 10.	Lowest strata of the Zwartkop crag.
Modiola Atherstoni, *Sharpe.* Pl. XXVIII. fig. 11	
Sanguinolaria? Africana, *Sharpe.* Pl. XXVIII. fig. 12 . .	
Cyrena? Bainii, *Sharpe.* Pl. XXVIII. fig. 13	
Trochus Bainii, *Sharpe.* Pl. XXVIII. fig. 14	
Turbo Atherstoni, *Sharpe.* Pl. XXVIII. figs. 15 & 16 . .	
——— Bainii, *Sharpe.* Pl. XXVIII. figs. 17 & 18 . . .	
Acteon Atherstoni, *Sharpe.* Pl. XXVIII. fig. 19	
Natica Atherstoni, *Sharpe.* Pl. XXVIII. fig. 22	

Description of Palæozoic Fossils from South Africa.

By Daniel Sharpe, Esq., F.R.S., Pres. G.S., and J. W. Salter, Esq., F.G.S.

Introduction.

The few South African fossils originally collected by Dr. Andrew Smith, in the Cedarberg, and referred to in the "Silurian System," are identical with those found by Mr. Bain more to the southward, in the Bokkeveld, and have been illustrated together with the latter in the following pages.

As we are unable to identify any of these South African fossils with species which have been described from districts where the age of the formations has been

* Since the above was written, some of the species of shells occurring in this rock have been found to be represented by large individuals in the greenish-grey shelly grit of the Sunday River: see p. 201.—Editor.

fully ascertained, we can only conjecture their place in the geological series from their analogy with European forms. This comparison, however, while it tends to invalidate the conclusion that any of them are from true Silurian strata, as formerly supposed, makes it very probable that they belong to the Devonian.

This conclusion was indeed arrived at when the specimens were first examined; and a letter to that effect from one of the authors was read at the end of Mr. Bain's paper, which it is not thought necessary to print here. At the same time, and quite independently, the same result was arrived at by Dr. F. Sandberger, and published in the 'Neues Jahrbuch für Min. u. s. w.' for 1852, p. 581, &c.*

We entirely agree with Dr. Sandberger in rejecting as improbable the association of Lower and Upper Silurian species of Trilobites and Shells in the same beds with Devonian types; nor do we think it necessary to suppose that any beds of older date occur in the localities mentioned, which might have afforded such Silurian species; and in the following descriptions we shall point out some fossils which we believe to have been erroneously identified as Silurian by preceding observers.

We cannot, however, follow Dr. Sandberger in referring certain Brachiopods, &c. to European species of Devonian fossils: the only locality where any of these South African species have previously been found is in the Falkland Islands; and it is very remarkable that, of the nine species brought from those islands by Mr. Darwin, and figured in the 2nd volume of our Quarterly Journal, pl. 10 & 11, five are contained in Mr. Bain's collection from the Cape.

This interesting fact teaches us that the Devonian formation had a very wide range in the Southern Hemisphere; but, as far as we yet know, it was peopled by species different from, though nearly allied to, those which lived at the same period in the Northern regions.

This would be in harmony with all that is known of the distribution of fossils in Palæozoic times. Both in the Silurian, Devonian, and Carboniferous epochs we have proof of a geographical limitation of groups of species, perhaps less traceable in the Carboniferous,—but most distinctly so in the Silurian. The fossils above described furnish an additional proof of this limitation during the Devonian period.

General List of the Palæozoic Fossils from South Africa.

Spirifer Antarcticus, *Morris & Sharpe*. Pl. XXVI. figs. 1, 2, & 5 .	Warm Bokkeveld: Falkland Islands.
——— Orbignii, *Morris & Sharpe*. Pl. XXVI. figs. 3, 4, & 6 .	Warm Bokkeveld: Falkland Islands.

* See also Quart. Journ. Geol. Soc. vol. ix. part 2. Miscell. p. 1.

Orthis palmata, *Morris & Sharpe.* Pl. XXVI. figs. 7–10 . .	Cold Bokkeveld, Warm Bokkeveld, Cedarberg, Hottentots Kloof, and Kokmans Kloof: Falkland Islands.
Terebratula Bainii, *Sharpe.* Pl. XXVI. figs. 11 & 12 . . .	Warm Bokkeveld.
Strophomena Bainii, *Sharpe.* Pl. XXVI. figs. 13 & 17 . . .	Warm Bokkeveld.
——— Sullivani, *Sharpe.* Pl. XXVI. figs. 18 & 19	Warm Bokkeveld: Falkland Islands.
Chonetes, sp. Pl. XXVI. fig. 14	Warm Bokkeveld.
———, sp. Pl. XXVI. figs. 15 & 16	Warm Bokkeveld.
Atrypa, sp.	Hottentots Kloof.
Orbicula Bainii, *Sharpe.* Pl. XXVI. figs. 20–23	Cedarberg, Gydow Pass, and Hottentots Kloof.
Solenella antiqua, *Sharpe.* Pl. XXVII. fig. 1	Leo Hoek.
——— rudis, *Sharpe.* Pl. XXVII. fig. 6	Hottentots Kloof.
Cleidophorus Africanus, *Sharpe.* Pl. XXVII. figs. 2 & 4 . .	Cedarberg and Gydow Pass.
——— abbreviatus, *Sharpe.* Pl. XXVII. fig. 3	Gydow Pass, Bokkeveld.
Leda inornata, *Sharpe.* Pl. XXVII. fig. 5	Hottentots Kloof.
Nucula (cast)	Gydow Pass.
Leptodomus? ovatus, *Sharpe.* Pl. XXVII. fig. 7	Leo Hoek.
Sanguinolites? corrugatus, *Sharpe.* Pl. XXVII. fig. 8 . . .	Leo Hoek.
Modiolopsis? Bainii, *Sharpe.* Pl. XXVII. fig. 9	Leo Hoek.
Anodontopsis? rudis, *Sharpe.* Pl. XXVII. fig. 10	Leo Hoek.
Bivalves, some undetermined.	Leo Hoek, Hottentots Kloof, and Gydow Pass.
Littorina? Bainii, *Sharpe.* Pl. XXVII. figs. 11 & 12 . . .	Gydow Pass.
Conularia Africana, *Sharpe.* Pl. XXVII. fig. 13	Cedarberg.
———, sp.	Cedarberg.
Bellerophon quadrilobatus, *Salter.* Woodcut, p. 214, figs. 1 & 2	Warm Bokkeveld.
Theca subæqualis, *Salter.* Woodcut, p. 214, figs. 3 & 4 . .	Warm Bokkeveld.
Homalonotus Herschelii, *Murchison.* Pl. XXIV.	Warm Bokkeveld, Gydow Pass, and Leo Hoek.
Phacops Africanus, *Salter.* Pl. XXV. figs. 1–9	Cedarberg, Gydow Pass, and Hottentots Kloof.
——— Caffer, *Salter.* Pl. XXV. figs. 10–13	Gydow Pass and Leo Hoek.
———, 2 spp.	Gydow Pass and Leo Hoek.
Typhloniscus Bainii, *Salter.* Pl. XXV. fig. 14	Gydow Pass.
Tentaculites crotalinus, *Salter.* Pl. XXV. figs. 15–18 . . .	Hottentots Kloof and Warm Bokkeveld.
Serpulites Sica, *Salter.* Pl. XXV. fig 19.	Warm Bokkeveld.

Encrinital joints and stems. Pl. XXV. figs. 21–28	Warm Bokkeveld, Cold Bokkeveld, Cedarberg, Gydow Pass, and Kokmans Kloof.
Ophiocrinus Stangeri, *Salter*. Pl. XXV. fig. 20	?

Description of Palæozoic Mollusca from South Africa.

By Daniel Sharpe, Esq., F.R.S., Pres.G.S.

Spirifer Antarcticus, Morris and Sharpe, Quart. Journ. Geol. Soc. vol. ii. pl. xi. fig. 2. Pl. XXVI. figs. 1, 2, & 5.

S. testâ crassâ semicirculari, costis 20–24 rotundatis elevatis concentricè subimbricatis: costâ mediâ ventrali magnâ, elevatâ, imbricatâ: sulco medio dorsali lato, profundo, rotundato: areâ cardinali latitudine valvarum; dorsali elevatâ, triangulari, longitudinaliter lineatâ; ventrali elevatâ, rectâ.

Shell transversely semicircular, with twenty to twenty-four prominent, rounded ribs, slightly imbricated by the concentric lines of growth: mesial ridges of the ventral valve large, elevated, and imbricated; mesial furrow of the dorsal valve large, deep, and rounded. Hinge-area of the breadth of the shell; on the dorsal valve high and triangular, with strongly marked longitudinal lines; on the ventral valve high and bounded by parallel lines.

Breadth $2\frac{1}{2}$ inches; length of dorsal valve $1\frac{1}{2}$ inch, of ventral valve $1\frac{1}{4}$ inch; height of hinge-area on the dorsal valve $\frac{1}{2}$ inch, on the ventral valve $\frac{1}{4}$ inch.

Found in the Warm Bokkeveld; occurring abundantly as casts in a hard grey siliceous rock, together with casts of *Sp. Orbignii*, *Terebratula Bainii*, *Orthis palmata*, and *Chonetes*, chiefly on the bedding-planes of the rock; also in a light-coloured soft sandstone of the same locality.

It has been also found in the Falkland Islands by Mr. C. Darwin.

The better preservation of the African specimens enables me to improve the description originally given of this species; but it is still far from complete: its most marked feature is the height of the hinge-area on both valves.

Fig. 1, cast of the interior of the dorsal valve; fig. 2, cast of the interior of the ventral valve, with the exterior of the dorsal area; fig. 3, exterior of the dorsal valve, from a gutta-percha mould of an impression of the shell.

Von Buch has described a species of *Spirifer* brought by Dr. Krauss from Kok-

man's Kloof* in the Cape of Good Hope, which has considerable affinity to this shell; it is *S. Capensis*, Von Buch, 'Bären-Insel,' p. 12. fig. 1. It differs from *S. Antarcticus* in having the mesial fold and sinus broader than in our species, and in having the beak of the dorsal valve bent over, and the area deeply curved; it also wants the imbricating lines of growth.

Spirifer Orbignii, Morris & Sharpe, Quart. Journ. Geol. Soc. vol. ii. pl. xi. fig. 3. Pl. XXVI. figs. 3, 4, & 6.

S. testâ semi-ovali, subæquivalvi: costis 16 rotundatis, elevatis, concentricè imbricatis: costâ mediâ ventrali latâ, elevatâ, imbricatâ, medio sulcatâ; sulco medio dorsali lato, profundo, rotundato, medio costato: areâ cardinali angustâ, latitudine valvarum.

Shell transversely semi-oval, nearly equivalved; with about sixteen prominent, rounded ribs, imbricated by strong concentric lines of growth: mesial ridge of the ventral valve large, prominent, and imbricated†, and marked by a slight medial furrow; mesial furrow of the dorsal valve broad, deep, and rounded, with a very slight medial rib: hinge-area of the breadth of the shell, narrow.

Breadth $2\frac{1}{2}$ to 3 inches; length 1 to $1\frac{1}{4}$ inch.

Found abundantly in the hard grey siliceous rock of the Warm Bokkeveld, with the preceding species; and also found in the Falkland Islands by Mr. C. Darwin.

I presume that this is the species which Dr. F. Sandberger has referred to *Spirifer macropterus*, Goldf., var. *mucronatus*, but I cannot concur in that view. All the African specimens have the uniformly curved outline represented in the figures, while *S. macropterus* has the outline of each wing in a curve more or less sigmoidal: the interiors of the valves are also different; *S. Orbignii* has a greater thickening of the interior of the dorsal valve towards the hinge, having the casts of the muscular impressions more prominent. The slight rib in the middle of the mesial furrow and the furrow in the mesial ridge of *S. Orbignii* (which should be more marked in the figures) are also distinguishing characters.

Fig. 3, cast of the interior of the dorsal valve; fig. 4, cast of the interior of the ventral valve; fig. 6, exterior of the ventral valve, from a gutta-percha mould of an impression of the shell.

Orthis palmata, Morris & Sharpe, sp. Pl. XXVI. figs. 7–10.

Atrypa palmata, Morris & Sharpe, Quart. Journ. Geol. Soc. vol. ii. pl. x. fig. 3.

O. testâ subhemisphæricâ, radiatim costatâ: valvâ ventrali depressâ, dorsali gibbosâ: costis 14–16 rotundatis, elevatis, simplicibus, sulcis rotundatis intermediis subæqualibus: lineâ cardinali subrectâ, breviusculâ.

* Kokman's Kloof is a pass in the mountains north of Swellendam.

† In the specimen fig. 6 the imbrication has been rubbed off the mesial ridge, and the furrow down it is also lost.

Shell nearly hemispherical, ribbed: ventral valve nearly flat, with the edges a little depressed; dorsal valve convex: both valves ornamented with fourteen to sixteen prominent, rounded, simple ribs, radiating from the umbo to the margin, and nearly equal in width to the rounded furrows between them. Hinge-line nearly straight, shorter than the breadth of the shell, which is rounded off at the extremities of the back.

Length $\frac{3}{4}$ of an inch; breadth 1 inch.

Found abundantly as casts in a ferruginous rock, together with casts of *Strophomena Bainii* and Encrinital joints, in the Cold Bokkeveld. *Orthis palmata* occurs also (with *Homalonotus* and *Tentaculites*) in the dark schists of the Warm Bokkeveld; with *Conularia* in the Cedarberg; in the light-coloured schists of Hottentots Kloof; and (with *Encrinites*) in a light-coloured schist from Kokman's Kloof, presented to the Geological Society's Museum by Major Colebrooke.

It has been also found in the Falkland Islands by Mr. C. Darwin.

Fig. 7, exterior of the ventral valve, from a gutta-percha mould of an impression of the shell; fig. 8, exterior of the dorsal valve, from a gutta-percha mould of an impression of the shell; fig. 9, interior of the ventral valve; fig. 10, interior of the dorsal valve.

Terebratula Bainii, Sharpe. Pl. XXVI. figs. 11 & 12.

T. testâ ovatâ, sublævi, concentricè rugatâ; valvâ dorsali convexâ, ventrali subdepressâ.

Shell ovate, nearly smooth, with a few deep concentric wrinkles; dorsal valve elevated; ventral valve slightly convex.

Length 1 inch; breadth $\frac{3}{4}$ of an inch; thickness about $\frac{3}{8}$ths of an inch.

Found plentifully as casts in a dark-grey siliceous rock, in the Warm Bokkeveld, together with casts of Spirifers and of *Orthis palmata*.

The specimens of this species in Mr. Bain's collection are all more or less crushed, and do not afford good materials for defining the species.

Fig. 11, exterior of the ventral valve, from a gutta-percha mould of an impression of the shell; fig. 12 *a*, cast of the interior of the ventral valve; fig. 12 *b*, cast of the interior of the dorsal valve.

Strophomena Bainii, Sharpe. Pl. XXVI. figs. 13 & 17.

S. testâ transversim semi-ovatâ, depressâ, subtiliter radiatâ: radiis numerosis simplicibus, alternatim minoribus; ad marginem 120–130: lineâ cardinali rectâ, valvarum latitudinem æquante.

Shell transversely semi-oval, depressed, covered on both valves with numerous, fine, simple rays, increasing in number as the shell enlarges by the insertion of smaller rays between the others, until they reach the number of 120 or 130 at the

margin: hinge-line of ventral valve straight, equal in length to the greatest width of the shell: ventral valve with a slight elevation near the umbo, below which is a mesial depression extending to the margin.

Length 1 inch; breadth $1\frac{3}{4}$ inch.

Found in the Warm Bokkeveld, in a nodule of ferruginous rock, together with casts of *Orthis palmata*; and in black schist and yellowish micaceous sand-rock of the same locality.

I take the specific characters from the ventral valve, fig. 13: if fig. 17 represent a dorsal valve, the hinge-area must be small. This shell much resembles *Strophomena Bechei*, M'Coy, sp., Carb. Foss. Ireland, pl. 22. fig. 3.

Fig. 13, exterior of ventral valve, from a gutta-percha mould of an impression of the shell; fig. 17, exterior of dorsal ? valve, from a similar mould.

Strophomena Sulivani, Morris & Sharpe, sp. Pl. XXVI. figs. 18 & 19.

Orthis Sulivani, Morris & Sharpe, Quart. Journ. Geol. Soc. vol. ii. pl. x. fig. 1.

S. testâ semi-ovatâ, striatâ; valvâ ventrali subplanâ, dorsali subgibbosâ: omninò striis numerosis radiantibus, bifurcantibus, ad marginem 150, lineisque paucis concentricis ornatâ: areâ cardinali altâ, triangulari, latitudinem valvarum æquante; foramine clauso.

Shell semi-ovate; ventral valve nearly flat, dorsal valve slightly gibbose: surface covered with fine sharp bifurcating rays, increasing at the margin to about 150 in number, and crossed by two or three ill-defined concentric lines: hinge-line nearly of the breadth of the shell: hinge-area high and triangular, with the large triangular foramen covered with a deltidium.

Width $1\frac{5}{8}$ inch; length $1\frac{1}{2}$ inch.

Found in dark-coloured schist and in reddish argillaceous rock in the Warm Bokkeveld; and also found in the Falkland Islands by Mr. C. Darwin.

Fig. 18, exterior of the ventral valve and hinge-area of the dorsal valve, from a gutta-percha mould of an impression of the shell; fig. 19, exterior of the dorsal valve, from a similar mould.

Chonetes, species undetermined. Pl. XVI. fig. 14.

Interior of the ventral valve, perhaps of the same species as the following.

From the Spirifer-rock of the Warm Bokkeveld.

Chonetes, species undetermined. Pl. XVI. figs. 15 & 16.

These figures probably represent the interior and exterior impressions of the dorsal valve of one species; but, having no positive proof of this, I have not ventured to name them. They are clearly distinct from *Chonetes sarcinulata*, Schloth., being much more finely striated than that species. Dr. F. Sandberger

quotes *C. sarcinulata* from the same formations at the Cape of Good Hope, but we have not found it among our specimens.

From the Spirifer-rock of the Warm Bokkeveld.

Some larger specimens of *Chonetes*? occur in a nodule of reddish rock from the Warm Bokkeveld.

Orbicula Bainii, Sharpe. Pl. XXVI. figs. 20–23.

Orbicula, sp., Quart. Journ. Geol. Soc. vol. ii. pl. x. fig. 5.

O. testâ ovato-circulari, depresso-conicâ, apice excentricâ, concentricè subrugatâ, radiatim subtilissimè striatâ.

Shell nearly circular, depressed-conical, with the apex slightly excentric, both valves covered with fine concentric wrinkles, which are crossed by very fine radiating striæ, scarcely visible to the naked eye.

Longest diameter $1\frac{1}{4}$ inch; shortest diameter $1\frac{1}{8}$ inch; height $\frac{3}{8}$ths of an inch.

Found in black schist at Gydow Pass (with *Littorina*); in soft light-coloured argillaceous rock (with *Strophomena Bainii*?) at Hottentots Kloof; and in nodules of dark-coloured rock at the Cedarberg (in one instance with *Chonetes*); and found in the Falkland Islands by Mr. C. Darwin.

Fig. 20 *a* & *b*, upper valve of a small specimen; fig. 20 *c*, part of the surface of 20*a*, magnified; fig. 21 *a* & *b*, upper valve of a larger specimen, which has lost nearly the whole of its shell; fig. 22, lower valve; fig. 23 *a*, fragment of the upper valve with the shell well preserved.

Solenella antiqua, Sharpe. Pl. XXVII. fig. 1.

S. testâ transversim ovatâ, concentricè rugoso-lineatâ; anticè rotundato-abbreviatâ; posticè subproductâ, rotundatâ, propè dorsum sinuatâ: cardine subarcuato; dentibus anterioribus 10 parvis, posterioribus numerosis minoribus.

Shell transversely ovate; anterior end broad, short, and rounded; posterior end somewhat produced, broad, with a small sinus near the dorsal margin: valves covered with fine concentric wrinkles: hinge-line slightly arched, with about ten small anterior, and more than twenty very small posterior teeth.

Length $1\frac{1}{2}$ inch; breadth $2\frac{1}{4}$ inches; thickness 1 inch.

Found at Leo Hoek, in a fine micaceous sandstone. There are five specimens in the collection, four of which have the valves united.

As the ligament of this and the following species was external, it is obviously incorrect to place them in the genus *Nucula*; the small posterior sinus shows their relation to *Solenella*, and proves them to have had a sinus in the pallial line.

Fig. 1 *a*, right valve; fig. 1 *b*, hinge of the same specimen.

Solenella rudis, Sharpe. Pl. XXVII. fig. 6.

S. testâ transversim rhomboideo-ovatâ; concentricè lineatâ et corrugatâ; anticè rotundato-abbreviatâ; posticè ad dorsum subproductâ, marginem ventralem versus truncatâ et sinuatâ.

Shell transversely rhomboido-ovate; anterior end broad, short, and rounded; posterior end broad, a little produced near the back, and diagonally truncated with a small sinus near the ventral margin: a slight depression extending from the umbo to the middle of the ventral margin: valves with fine concentric lines and a few unequal concentric wrinkles.

Length $1\frac{1}{4}$ inch; breadth 2 inches.

Found at Hottentots Kloof, in a light-coloured soft micaceous rock. This is the most abundant of the palæozoic lamellibranchiate species in this collection; of the others there are often but one or two specimens, of this there are above twenty. Two-thirds are separate valves, and one-third consists of specimens having the valves united.

Cleidophorus, Hall.

Gen. Char. An equivalved, inequilateral, lamellibranchiate bivalve, transversely oblong: hinge nearly straight, with numerous small crenulations, extending on both sides of the umbo: ligament external: each valve furnished internally with a strong plate in front of the beak and behind the anterior adductor.

I have followed the authority of Mr. Salter and Mr. Morris in uniting together the genera *Cleidophorus* of Hall and *Cucullella* of M'Coy, which were stated to differ in the former having no teeth in the hinge, and the latter having the "hinge-line entirely crenulated." This is done on the supposition that Mr. Hall's specimens were not in a condition to show the hinge, a case unfortunately only too common among the fossil bivalves from the palæozoic rocks.

Cleidophorus Africanus, Salter, MSS. Pl. XXVII. figs. 2 & 4.

C. testâ transversim elongato-ovali, concentricè inæqualiter subcorrugatâ: laminâ internâ magnâ: cardine recto, dentibus minutis, verticalibus, numerosissimis.

Shell transversely elongato-oval, covered with unequal and irregular concentric lines and wrinkles: internal plate large: hinge straight; teeth small, vertical, and very numerous.

The condition of the specimens does not admit of an accurate description of the external form. This is the largest species yet known of the genus.

Length $1\frac{1}{4}$ inch; breadth $2\frac{1}{4}$ inches.

Found at Cedarberg by Dr. A. Smith, and by Mr. Bain in the dark-coloured schist of Gydow Pass, Bokkeveld, South Africa.

Cleidophorus abbreviatus, Sharpe. Pl. XXVII. fig. 3.

C. testâ transversim triangulato-ovatâ: laminâ internâ maximâ: cardine arcuato; dentibus minutis.

Shell transversely ovate with prominent beaks; anterior and posterior ends regularly rounded: internal plate very large, and nearly reaching to the margin: hinge-line arched; teeth small. The external surface has not been seen.

Length $\frac{3}{4}$ of an inch; breadth 1 inch.

Found at Gydow Pass, in hard dark-coloured schist.

Leda inornata, Sharpe. Pl. XXVII. fig. 5.

L. testâ depressâ, transversim lanceolato-ovatâ, valdè inæquilaterali, concentricè striatâ, anticè rotundatâ, posticè productâ, subacuminatâ.

Shell depressed, transversely lanceolato-ovate, very inequilateral; anterior end broad and rounded; posterior end produced: ventral margin regularly rounded: valves covered with fine concentric lines of growth.

Length $\frac{3}{4}$ of an inch; breadth $1\frac{1}{2}$ inch.

Found at Hottentots Kloof, in a soft light-coloured micaceous sandstone.

Leptodomus? ovatus, Sharpe. Pl. XXVII. fig. 7.

L.? testâ transversim ovatâ, anticè abbreviatâ, truncatâ, tumidâ, posticè productâ, rotundatâ, concentricè lineatâ: umbonibus magnis anticis.

Shell transversely ovate; anterior end thick and truncated; posterior end produced and gradually thinning down to the rounded posterior margin: two very slight furrows extend from the beak to the posterior end: beaks large, rounded, and close to the anterior end: valves covered with concentric lines of growth.

Length $1\frac{1}{4}$ inch; breadth $1\frac{5}{8}$ inch; thickness 1 inch.

Found at Leo Hoek.

The specimen does not show sufficient characters to determine the genus.

The slight furrows on the posterior end are not sufficiently shown in the figure.

Sanguinolites? corrugatus, Sharpe. Pl. XXVII. fig. 8.

S.? testâ transversim rhomboideâ, medio depressâ, concentricè corrugatâ: umbonibus prominentibus, anticis: carinâ obtusâ, ab umbone ad angulum ventrali-posteriorem extendente.

Shell transversely rhomboidal, with a depression down the middle of each valve, bounded by a broad, obtuse keel, which reaches from the umbo to the posterior ventral margin: beaks prominent and close to the rounded anterior end: valves covered with coarse concentric wrinkles and finer lines of growth.

Length $\frac{1}{2}$ inch; breadth 1 inch; thickness $\frac{1}{2}$ inch.

Found at Leo Hoek, in a nodule of hard dark-coloured siliceous rock.

Having only seen the impression of one pair of valves, a cast of which is figured, I must leave the genus doubtful.

Modiolopsis? Bainii, Sharpe. Pl. XXVII. fig. 9.

M.? testâ subrhomboidali: umbonibus anterioribus: carinâ depresso-rotundatâ, ab umbone ad marginem ventrali-posteriorem, valvam transversè dimidiante: extremitate anteriore truncato-abbreviatâ; posteriore latâ, declivi.

Shell nearly rhomboidal: beaks close to the anterior end: each valve divided into two nearly equal portions by a rounded ridge which reaches from the beak to the ventral-posterior margin: anterior end very short and truncated; posterior end broad and sloping away from the central ridge.

Length 1 inch; breadth 2 inches; thickness $\frac{7}{8}$ths of an inch.

As the generic characters of this shell cannot be seen in the only specimen in the collection, it is placed in the genus *Modiolopsis*, with which its general form corresponds. The cast shows some traces of concentric lines of growth over the whole valve, and of several lines radiating backwards from the beak over the anterior portion.

Found at Leo Hoek.

Anodontopsis? rudis, Sharpe. Pl. XXVII. fig. 10.

A.? testâ subquadratâ, anticè umbonem versus subtruncatâ, medio depressâ, concentricè corrugato-lineatâ: umbonibus medianis.

Shell nearly square: beaks central: anterior side slightly truncated near the beak: posterior side nearly straight: a slight depression down the middle of each valve, reaching to the ventral margin: valves wrinkled with irregular concentric lines of growth.

Length $1\frac{3}{4}$ inch; breadth $1\frac{3}{4}$ inch; thickness $\frac{7}{8}$ths of an inch.

Found at Leo Hoek.

The collection only contains an imperfect specimen of this species, which does not exhibit any characters by which its genus can be correctly ascertained.

Littorina? Bainii, Sharpe. Plate XXVII. figs. 11 & 12.

L.? testâ heliciformi: anfractibus paucis, rotundatis, transversim rugosis: aperturâ rotundatâ, supernè angulatâ.

Shell heliciform; whorls few, rounded, and transversely wrinkled; aperture angular above, rounded beneath.

Largest diameter 1 inch.

Found at Gydow Pass, in dark-coloured schists and nodules.

Fig. 11, a cast, somewhat restored; fig. 12, fragment of a cast.

The specimens are all broken internal casts, too imperfect to allow of a proper description of the species; but, being the only Gasteropod from the formation, they could not with propriety be omitted.

Conularia Africana, Sharpe. Pl. XXVII. fig. 13.

C. testâ pyramidali; lateribus æqualibus, transversim radiatis, medio depressis, angulis rotundatis; radiis binis, æqualibus, arcuatis, junioribus medio laterum interruptis, adultis continuis: radiorum interstitiis lævibus?

Shell pyramidal with equal sides, each of which has a depression down its middle; transverse section nearly rectangular, with the corners rounded off and deeply indented: sides ornamented with numerous parallel projecting ribs, which in the internal cast are formed of two sharp ridges enclosing a rounded furrow (see fig. 13 *b*): the ribs slope upwards from the corners towards the middle of the sides, and in the young shell meet at an angle, cross the mesial depression, and slightly overlap one another; but in older shells they are continuous across the side of the shell in a curve: the interstices between the ribs appear to be smooth?

Found at the Cedarberg, in nodules of dark-coloured rock, weathering ferruginous; in one instance the *Conularia* is associated with casts of *Orthis palmata*.

Fig. 13 *a*, fragment of the internal cast of an old specimen; fig. 13 *b*, enlarged portion of fig. 13 *a*; fig. 13 *c*, section of another specimen, slightly crushed.

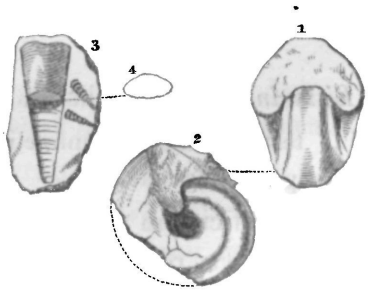
Besides the species above described, the collection contains some imperfect specimens of another species of *Conularia*, which is more nearly related to *C. quadrisulcata* of the Coal-measures of Coalbrook-dale, figured in the Trans. Geol. Soc. 2nd Series, vol. v. pl. 40. fig. 2; but the specimens are not in condition to admit of a good comparison.

There are also a *Bellerophon* and a *Theca*, which have been accidentally omitted in the plates, and of which woodcuts (figs. 1–4) and descriptions have been added by Mr. Salter.

Bellerophon (*Euphemus*) *quadrilobatus*, Salter. Woodcut, figs. 1 & 2.

B. modicus, involutus, umbilico parvo rotundato; anfractibus tumidis 3-lobatis, lobo dorsali multo majore, utrinque rotundato, per medium planato et quasi depresso; aperturâ latâ, lunatâ, utrimque emarginatâ.

Involute, with a very small umbilicus, the edges of which are rounded. Whorls thick, broader than deep, with a concentric sulcus on each side, and with a very broad, flattened, and almost two-



Figs. 1 & 2. *Bellerophon quadrilobatus.*
Fig. 3. *Theca subæqualis*; a portion of the internal cast remaining. (With *Tentaculites.*)
Fig. 4. Transverse section of *Theca subæqualis.*

lobed dorsal margin. Keel probably none. Aperture semilunar, indented on each side above by the sulci, and more than twice as broad as deep. Diameter of the shell $\frac{3}{4}$ of an inch.

This is closely allied to such forms as *B.* (*Euph.*) *trilobatus*, Sow., and *B. bisulcatus*, Röm., from both of which its broad, flattened, and almost double dorsal lobe distinguishes it. There is no appearance of a band; and we think that this group of smooth and but slightly expanded Bellerophons may be distinguished by the subgeneric name formerly applied by Prof. M'Coy (see *Pal. Foss. Cambridge Mus.* p. 308).

Locality.—Warm Bokkeveld.

Theca subæqualis, Salter. Woodcut, figs. 3, 4.

T. conica, compressa, nec trigona; facie dorsali rotundatâ, ventrali lentè convexâ; testâ crassiusculâ? sublævi, striis arcuatis obscuris.

Length $\frac{3}{4}$ inch, width 3 lines. Shell rather thick, quickly tapering, smooth or crossed only by lines of growth; ventral side gently convex, the dorsal more convex and subangular, but with the angles quite rounded off.

It is difficult to distinguish accurately the species of this genus. The present appears distinct from any published. It might have been referred to the *T. lanceolata*, Sowerby and Morris, from New South Wales*, but that species has a more trigonal internal cast, as particularly mentioned by Sowerby, and distinct regular transverse striæ. Both species appear to have had rather a stouter shell than usual in the genus.

Locality.—Occurs as a ferruginous cast, together with *Bellerophon quadrilobatus* and *Tentaculites crotalinus*, in a nodule of dark-grey rock from the Warm Bokkeveld.

Description of Palæozoic Crustacea and Radiata from South Africa.

By J. W. SALTER, Esq., F.G.S.

Homalonotus Herschelii, Murchison, Silurian System, pl. 7 bis, fig. 2; Burmeister, Organ. Trilob. (ed. Ray Soc.) p. 87. Pl. XXIV. figs. 1–7.

H. longus, pedalis, spinosus; capite triangulato, fronte in apiculum curvum producto; thorace armato; caudâ convexissimâ, trigonâ, acutâ, annulis sexdecim, nonnullis spinosis.

Of this fossil, which we previously knew only from fragments, Mr. Bain has collected a fine series, showing the upper and under side of the head, with its

* Strzelecki's 'New South Wales,' 1845, p. 289.

curious beak-like process in front, the body-joints in connexion with the tail, and two or three varieties of the tail itself. From the size of fragments which occur with the more perfect specimens, it must have been a very large Trilobite,—probably more than a foot in length. The species is sufficiently distinct from *H. armatus*, figured by Burmeister from the Devonian rocks of the Rhine; it is nevertheless very closely allied to it.

The entire form was elongate, pointed at both ends, and broadest at the base of the head; tapering thence gradually backwards. The head, of which we have good specimens, is convex; the body is also very convex (the fine specimen, fig. 4, has been rather flattened on the middle of the back), and the sides are steeply bent down, so that the entire form was convex and subcylindrical. It was ornamented with large scattered spines along the thorax, the base of the tail, and, in some specimens, even on the head (see the large specimen, fig. 3).

The head is subtriangular and but little rounded on the sides, broader than long in the proportion of thirteen to eight, flattened out in front towards the beak, and highly convex behind, so as to present a triangular outline in a side view (fig. 1 *b*). The cheeks are very convex, almost inflated, and bent down so steeply as to appear, when seen from above, much narrower than the glabella;—they are however about the same breadth, and have at their inner margin, close to the base of the glabella, an oval flattened space* (fig. 1 *c*).

The glabella itself is urceolate, broadest below, contracted above, and blunt at its well-defined front margin. The basal, middle, and upper lobes show themselves distinctly. It is separated from the prominent neck-margin by a strong furrow, and is bounded in front by the broad concave margin, beyond which the strong curved apiculus projects from the thickened edge. This apiculus is the tubercle† upon the hypostome or rostral shield,—the latter being conspicuous in this species as a triangular large plate beneath the front margin (fig. 2). A similar, but much smaller, tubercle is seen in the hypostome of *Calymene* and of *Encrinurus*.

The facial sutures are very distinct, and there is a marginal suture along the outer edge of the cheeks. The eyes are small, round, and prominent; and are placed on the middle of the very tumid cheeks, less than half-way up the head. The cheeks are not distinctly margined, except posteriorly, where the strong neck-furrow separates a thickened and often spinose margin (figs. 1 *a* & 1 *b*).

The whole of the head is covered with a strong granulation, which is less conspicuous in the furrows, but is not absent from any part of the upper surface;

* A similar depressed oval space occurs at the same spot in *Illænus Barriensis*. See Memoirs Geol. Surv. Decade 2. pl. 4. fig. 8 *a*.

† A double tubercle is seen on the hypostome of a species from the lowest Devonian of the Hartz Mountains. It is the *H. Schusteri* of Römer, Palæontographica, vol. v. t. 3.

even the impressed oval space (fig. 1 *c*) is granulated. The hypostome is smooth, or nearly so; but the beak is rough.

We have two perfect specimens of the body and many fragments. Each of the thirteen rings is convex, almost subcylindrical in its posterior portion, and has generally one large spine on each side at a short distance *within* the fulcral point (see fig. 1), and none on the pleuræ. In other varieties, however, (fig. 5) two spines occur on each side, both within and beyond the fulcrum, and scattered spines appear on the middle part of the axis; but these are rare exceptions. The fulcrum is but slightly marked, and placed far outwards; and beyond it the pleuræ slope gently outwards for a short distance and then bend abruptly down at a right angle, with a wide and strong facet. Fig. 5. Pl. XXIV. represents these pleuræ flattened out by pressure; their true form is indicated in the figure of a more perfect specimen, fig. 4.

The specimen illustrated by fig. 6, if not a distinct species, is at least a very remarkable variety, with broader segments more deeply trilobate,—the trilobation taking place *within*, and not *at*, the fulcral point. It is probably a distinct species.

The length of the body is not twice that of the tail, and it is rather flattened down the middle. The anterior segments are much arched backwards at their extremities, and the tips of all the pleuræ are broad, rounded, and recurved.

The tail is long-triangular, longer by one-fifth than the width, and so convex that the depth is nearly equal to the width. The axis is highly arched, not so wide as the sides, which are almost vertical, and scarcely marked off at all from them. The tail of the young animal (fig. 8) is shorter and broader, and has fewer ribs.

The ribs are all continuous across. There are sixteen or seventeen on the axis of our largest specimen; and the front seven or eight of these have tubercles on each side, and a few tubercles also down the middle. About ten or eleven show themselves distinctly on the sides; but the lowest ones are faint, and more arched forwards than the rest. A few only of the upper ones bear any tubercles at the base. Occasionally there are more tubercles.

The apex is blunt-pointed, and a little abruptly produced from the tip of the axis, which reaches nearly all the way down.

The incurved margin (fig. 7 *c*) is not broad; and, like the whole of the upper surface of the tail, is rough with granulations. The anterior facet (see fig. 7 *b*) is large and sharply defined.

This species differs at a glance from the related species *H. armatus*, Burm., in the much larger glabella and broader axis of the body. The tail, in proportion to the body, is twice as long; has double the number of rings; and ends in a blunt short point; while in *H. armatus* it is a prolonged spine. Nor do we know of any other published species of at all similar character, except *H. Pradoanus*, De

Vern., from Spain, which has a roughly tubercular body, a rounded and not highly convex tail, and fan-like side ribs, spinous near their ends; the axis is roughly tubercular, as well as spiny. There is indeed no near resemblance. Both the last species belong to a group of *Homalonoti* only known in the Lower Devonian rocks.

The quotation of this species from the Rhenish rocks, by D'Arch. and De Vern. (Trans. Geol. Soc. 2nd Ser. vol. vi. p. 381), is erroneous. *H. armatus*, Burm., is intended. And there is some mistake in Dr. Sandberger's supposing that the *H. Knightii*, Sow., had been identified by De Verneuil as from these rocks. The South African specimens are all of one, or at most two, species, neither of them identical with European forms.

Localities.—In black and grey hard schists, in light-coloured softer micaceous rock, and in dark-coloured nodules, weathering ferruginous, at Gydow Pass and at Leo Hoek; and in ferruginous nodules and light-coloured argillaceous schists in the Warm Bokkeveld.

Next to the *Homalonotus*, the commonest Trilobite is a new species of *Phacops*, —of the section *Cryphæus*:—it is the

Phacops (*Cryphæus*) *Africanus*, sp. nov. Pl. XXV. figs. 1-9.
Calymene Blumenbachii, Murchison, Sil. Syst. p. 654.

P. 2–5-uncialis, convexus; axi quam lateribus latiore; capite subtrigono; oculis parvis; glabellâ productâ subparallelâ, sulcis sinuosis, basali profundiore lunato sursum curvato; caudâ laciniis utrimque quinque robustis, et mucrone centrali brevi lato; axi obtuso, 6–7-annulato.

The species is in general found of 2–3 inches long, as shown in our figures 2, 6, and 9, and at that age may be easily recognized by its convex form, sharp-pointed pleuræ, and spinose tail. It is unlike the generally depressed form of the subgenus to which it belongs, and which it connects with the ordinary forms of *Phacops* (*Acaste*, Goldf.). The head is nearly a right-angled triangle; the length nearly two-thirds the width. The glabella is blunt-pointed, and is much broader than the sloping cheeks, and divided from them by only shallow parallel furrows. The glabella-furrows are as follows:—the upper one sigmoid, and extending above the eye; the second short, arched down, and recurved at the tip; the basal one deeper, longer, and arched upwards; neck-furrow strong, and much arched upwards in the middle. The neck-segment is convex and has a central spine. Posterior head-angles short, spinous (fig. 8); eye small, lunate, rather prominent, placed near the glabella and more than half-way up the cheek; (it is not represented far enough forward in fig. 6, *b*). Surface of head smooth? Facial suture very forward at its outward termination.

The axis of the thorax is nearly parallel-sided, very convex, and rather wider than the sides, which are curved steeply downwards at a short distance from it. The fulcrum is at less than one-third in front, and much closer behind; and the tips of the nearly direct pleuræ have sharply recurved points (see fig. 9). The axis in some specimens (fig. 3) has blunt spines along the middle,—it is difficult to say if this be general or not, as most of our specimens are internal casts.

The tail is rounded and convex; its outline is arched in front; the axis prominent, especially at the blunt tip, somewhat conical, and reaching nearly to the margin; it has six distinct rings; the sides have four or five distinct furrows, which do not reach the margin; they are faintly interlined on the outer portion; the edge is serrated,—five teeth on each side, and a short obscure terminal lobe. (The margin is not sufficiently rounded in our fig. 4.)

The form nearest akin to this species is perhaps one from the summit of the Andes, described by M. D'Orbigny, and of which, through his kindness and that of Mr. Pentland, we have been able to compare the specimen. This rare fossil, the *Phacops* (*Calymene*) *Verneuilii*, D'Orb., differs, however, in some essential points. It has a wider glabella, and the two lower pairs of furrows do not form an oval as in *P. Africanus*, but are short and direct. The pleuræ are spinose, as in ours; but the tail has much fewer (two or three) ribs on the axis, and the same number on the sides. The specimen does not show the margin of the tail.

I have little doubt that the *Calymene Tristani*, quoted by D'Archiac and De Verneuil from the Cedarberg Mountains (Trans. Geol. Soc. 2 Ser. vol. vi. p. 381), was a crushed individual of this or of the following species. The *Calymene Blumenbachii* of the same list was identified from our figured specimen, fig. 9. It is rather remarkable that De Koninck should lay stress upon it as the "true species."

Localities.—In light-coloured soft micaceous rock, black schists, and ferruginous nodules, at Gydow Pass; in light-coloured soft rock and hard dark schist, at Hottentots Kloof; and in dark-coloured schist and nodules, at Cedarberg. It is associated with *Orthis palmata* in one specimen from Gydow Pass.

The specimens illustrated by figs. 6, 7, and 9 were collected by Dr. A. Smith in the Cedarberg, and were presented by Sir R. I. Murchison to the Museum of Practical Geology.

Phacops Caffer, sp. nov. Pl. XXV. figs. 10–13.

P. ferè 4-uncialis, subdepressus, axi quam lateribus latiore; capite transverso granulato; fronte apiculato; oculis majoribus; glabellâ subparallelâ, sulcis radiatis rectis æqualibus, lobis convexis; caudæ axi conico, haud elevato, multi-annulato; margine spinoso.

This species when perfect must have been 4 inches long, judging from the

proportions of the head to the body in the smaller perfect specimens. It is much less convex than the species last described; it has larger eyes, and swelled lobes to the glabella (figs. 10 & 11); and both the pleuræ and tail had probably much shorter spines. Head somewhat semicircular, rounded in front, with a small blunt apiculus, and nearly twice as wide as long. The glabella is wider than the cheeks and distinctly divided from them; it is convex, wider in front; the furrows are radiating, and straight, compared with those of the last species; the middle and basal ones only arching a little towards each other. Posterior head-angles rounded. Eyes large, conical (fig. 12), placed nearly on the middle of the cheeks, which are pitted in a radiate fashion.

The glabella is covered with small scattered granules (not shown in our figure), mixed with larger ones on the forehead-lobe.

Thorax granulose, gently convex, the axis about as wide as the pleuræ, the joints slightly tubercular at the sides, but not elevated in the middle. The fulcrum is in the same position as in the last species, and the pleuræ are pointed, but do not curve down steeply.

The tail is semicircular and but little convex; the axis of five distinct and three obscure ribs, rapidly conical and pointed, not blunt or prominent, at the apex. The sides have six strong lateral furrows (including the articular one), distinctly interlined; but the strong furrows do not reach the margin. The edge is spinose, but too imperfect for its characters to be ascertained.

Localities.—In dark-coloured and greenish-grey schists and light-coloured softer rocks at Gydow Pass; and in ferruginous nodules at Gydow Pass and Leo Hoek.

Phacops; sp.

There are perhaps two more species of *Phacops* in Mr. Bain's collection.

No. 1, represented by a caudal shield, is certainly distinct. The specimen is short-triangular, and has a *very prominent* blunt axis, with seven distinct ribs,—even nine in a large specimen. The sides slope rapidly away from it, and are obscurely marked; with about five side-ribs, faint in the cast, not sharp and distinct as in *P. Africanus.* The axis seems to be as broad as in that species.

Locality.—In black schist at Gydow Pass.

No. 2.—Of the other species we have only one specimen, and that consisting of the thorax only, which has the axis *much narrower* than the pleuræ.

It is in a light-coloured argillaceous rock from Leo Hoek.

No. 3.—A specimen, which may belong to one or other of these two species. The head differs from that of *P. Africanus* in the following particulars:—

It is longer in proportion to the width, and the glabella is blunt and rounded in

front. The furrows are equal in strength, and the upper one straight instead of sigmoid; and there is a central pit in the large forehead-lobe. The pleuræ are strongly facetted. The axis not very convex. These characters will enable future observers to recognize it in better specimens.

Locality.—Gydow Pass, in a soft argillaceous sandstone.

Typhloniscus, genus nov.

Body elongate, distinctly trilobed, 10?-ringed, with strongly bent and facetted pleuræ, produced into short spines. Glabella with radiating furrows, the forehead-lobe produced. Cheeks scrobiculate, entire. Eyes and facial suture none. A distinct rostral shield beneath. Tail consisting of few segments; the pleuræ free at the ends.

Typhloniscus Bainii, sp. nov. Pl. XXV. fig. 14.

T. $2\frac{1}{2}$-uncialis; glabellâ depressâ, sulcis æqualibus; pleuris quam axi latioribus; pygidio utrimque quadrilobo.

So much has this the appearance of *Placoparia*, a Lower Silurian genus found in Spain and Bohemia, that one is at first tempted to believe it must have been derived from different strata to those in which the other Trilobites above-described occur. There is the same radiating arrangement of the glabella-furrows as in *Placoparia*; and the same triangular scrobiculate and margined cheeks, on the forward angle of which the eye, minute if it existed at all, was placed: and there are the abruptly-bent pleuræ and an obtuse many-lobed tail. In all these points there is the closest resemblance. But there are also some differences of importance. The front lobe of the glabella is larger and produced forwards (not truncate), and the place of the eyes, if there were any, is indicated only by a tubercle at the extreme front of the cheek, and this is subtended by no transverse furrow like that of *Placoparia*. There appears to have been really *no* facial suture, and probably only a minute eye.

Then again, the pleuræ, though abruptly bent down, are furrowed, not nodular, as in *Placoparia*, and their distal ends are bent backwards as well as downwards. There were probably fewer body-rings than in the latter genus,—ten instead of twelve: this however is uncertain.

If the above characters separate it from *Placoparia*, there is no section of *Cheirurus* with which it can be closely compared; though it is nearer to *Eccoptochile* than to the rest. Especially does it differ from the Devonian type of the genus (*Crotalocephalus*, Salter), in which the furrows run right across the glabella, and the eyes are well developed.

Locality.—In a dark schist from Gydow Pass.

Annelida.

Two species only—one belonging to *Serpulites* and the other to *Tentaculites*—have been yet observed. The latter is abundant; and is in all probability the species referred to by Dr. Sandberger, who identifies it with the *T. annulatus* of the Rhenish provinces.

Tentaculites crotalinus, sp. nov. Pl. XXV. figs. 15–18.

T. uncialis, testâ tenui, intus vix annulatâ, annulis externis rectis transversis, primùm crebris; dein validis remotioribus, striis interstitialibus ferè nullis; apice lævi.

Rather a small species; three-quarters of an inch in length and about a line thick; slowly tapering and with nearly direct prominent rings, very variable in distance from one another, but always more than their diameter apart in the older portions. In the younger parts the rings are closer and less prominent, and the apex is frequently bare of them for a variable space (fig. 16). At other times the young tube is closely annulated nearly to the tip, but there is always some irregularity in the rings there, and there are some intermediate striæ (fig. 18). The latter are very rare indeed among the older rings; one or two are represented in fig. 16.

Fig. 17 shows the internal cast; it has scarcely any trace of the rings which are so conspicuous in *T. annulatus* of the Rhenish rocks*. That species too (and its internal cast, *T. scalaris* of Schlotheim) is larger; and its rings are a little oblique,—a frequent character in the genus.

There is a beautiful Tentaculite in the Devonian rocks of Armenia, which has been shown to us by Prof. Abich, and which is a good deal like the *T. crotalinus*; but it has a thick shell, and striæ between the rings.

Localities.—In a nodule of hard dark-grey rock, exhibiting ferruginous casts of *Tentaculites*, *Bellerophon*, &c., from the Warm Bokkeveld. The *Tentaculites* also occur in the light-coloured micaceous rock of the Hottentots Kloof, together with *Solenella rudis*.

Serpulites Sica, sp. nov. Pl. XXV. fig. 19.

S. calcareus, unciam longus, compressus, lentè curvatus, striis obliquis.

There are not many available characters in the smooth shelly envelopes of Annelids. The specimens before us, however, are a group of short tubes about an inch long, compressed laterally, and curved like the sheath of an Indian dagger. The striæ of growth are conspicuous and oblique, retreating from the inner curve of the tube.

Locality.—In dark-coloured schist, Warm Bokkeveld.

* The species termed "T. annulatus" in the "Silurian System," and indeed in all British works on Silurian fossils, has *longitudinal* striæ, and is clearly distinct. It should be called *T. anglicus*.

Echinodermata.

Remains of *Crinoidea* are so abundant in Mr. Bain's collection as to promise to future observers a rich harvest of species. The specimens sent to England by Mr. Bain are from the Warm Bokkeveld and Kokman's Kloof *. It would of course be idle to give names to the numerous varieties of stems and joints (Pl. XXV. figs. 21-28), unless the bodies to which they belong had been determined. They much resemble those of *Rhodocrinus*, as figured by Goldfuss.

There is one tolerably perfect species, however, which we dedicate to the late Dr. Stanger, who brought it to England on his last visit. We are obliged to propose a new genus for it.

Ophiocrinus Stangeri, nov. gen. et sp. Pl. XXV. fig. 20.

The calyx is cup-shaped, and rather wider than high, with prominent radial and brachial pieces, somewhat depressed inter-radial areas, and twenty simple arms a little longer than the calyx. We have only three rays and two inter-radial areas, one lateral and one anal (?).

The stem is stout, consisting of alternating thick and thin rings (fig. 23 may very possibly belong to it). The five† basals are prominent, overhanging the stem, hexagonal, and alternating with the pentagonal first radials.

Radial pieces broader than long, three in the two posterior rays,—five in the other (antero-lateral?) ray. Brachials of similar size; two and three in the posterior arms, three in the antero-lateral.

Inter-radial spaces filled with numerous, twenty to thirty, hexagonal pieces; the upper ones very small, the lower two or three nearly as large as the radials. Interbrachial pieces eight or nine, very small.

Arms simple, cylindrical, consisting of a single series of wedge-shaped joints.

* Encrinital remains (or impressions of joints and stems) are common in the dark schists of the Gydow Pass, and in the rock which abounds with *Orthis palmata* (from the Cold Bokkeveld). A specimen of *Phacops Africanus* from the Cedarberg, collected by Dr. A. Smith, is also associated with Encrinital casts.

The Editor has lately received from the Cape of Good Hope a few portions of Encrinital stems (in a ferruginous condition, similar to some in Mr. Bain's collection, but differing from the figured specimens), which were picked up by a soldier of Sir G. Cathcart's army, near the most easterly branch of the Orange River. The Encrinital remains are associated with ferruginous casts of small turrited shells, with fragments of agates, quartz, and fossil wood, and with crystals of mundic.

Amongst some gravel, collected twelve years ago near the mouth of the Orange River, and sent to the Editor at the same time with the above, another fragment of Encrinital stem occurs. This is also ferruginous and resembles one of the above-mentioned specimens. The gravel contains agates, siliceous rocks, black schist, and copper-ore.

† Goldfuss, Nova Acta Acad. Curios. vol. xix. 1838; Petref. Germ. vol. i. p. 193.

They are convex and bear pinnæ alternately on each side,—the lower joints are transverse and flatter.

I should have thought this to have been a *Rhodocrinus*, although it has more brachial pieces, and even more radials on the anterior rays; but that genus, besides having an equal number of radial pieces in all the rays, is characterized as having compound arms; our genus has simple arms and unequal radii. It is, however, a close ally of *Rhodocrinus*; and I cannot help thinking, with M. Römer, that the five large pieces which in that genus, as in ours, alternate with the first radials are the true basal or *pelvic* pieces (see Goldfuss's figure of *Rhod. crenatus*, Petref. Germ. vol. i. pl. 64. fig. 3).

As we have but one species, and that not quite complete, it was thought better to give a full description rather than a generic character.

The original specimen is a very complete intaglio in dark-coloured sandstone, in the collection of the late Dr. Stanger. The exact locality is not known; but the specimen was accompanied by *Homalonotus Herschelii*. Fig. 20 *a* is taken from a gutta-percha cast.

Conclusion.

It will be seen by the palæontological reader, that, of the twenty-seven species here described, all, with two exceptions, belong to genera known in Devonian strata, and some of them to forms of those genera peculiarly characteristic of such rocks. This is especially to be noted in the case of the broad-winged *Spiriferi*,—the spinose *Homalonoti*,—the fan-tailed species of *Phacops*,—and the *Tentaculites*, which looks so like *T. annulatus* of the Rhenish Provinces, that it has been identified as such.

In no other formation can such an association as of the above forms with species of *Cucullella*, *Bellerophon*, *Conularia*, *Chonetes*, and *Strophómena*, be discovered; and hence, in the absence of any true Silurian species, or even of any purely Silurian genus, we are compelled to regard the formation as Devonian.

Of the two undescribed genera, one (*Typhloniscus*) is a remarkable Trilobite, so closely resembling a Lower Silurian genus, that it was long before its true characters were made out. Yet, when closely examined, it turns out to be one of the many forms of the family *Cheiruridæ*,—a group especially abundant at or near the base of the Devonian system.

The other, a Crinoid, which we have called *Ophiocrinus*, is more nearly related to Devonian forms of *Rhodocrinus* than to any other. These genera do not therefore invalidate the above conclusion.

Notes on some Fossils from the Karoo Desert and its Vicinity. By Daniel Sharpe, Esq., F.R.S., Pres. G.S., Dr. Hooker, F.R.S., F.G.S., and Sir P. De M. Grey Egerton, Bart., M.P., F.R.S., F.G.S.

Fossils from the Karoo Series, South Africa.

Iridina? rhomboidalis, *Sharpe.* Pl. XXVIII. fig. 2	Graaf Reinet.
Iridina? ovata, *Sharpe.* Pl. XXVIII. figs. 3 & 4	Graaf Reinet.
———? Pl. XXVIII. fig. 5	Graaf Reinet.
———? Pl. XXVIII. fig. 6	Graaf Reinet.
Cyrena? Pl. XXVIII. fig. 7	Graaf Reinet.

Note.—The above-mentioned fossils are in a ferruginous sandstone from Graaf Reinet (in the Collection of the Geological Society); they are referred with some doubt to freshwater genera, and are not associated with any marine species.—[D. Sharpe.]

Asterophyllites? Pl. XXVIII. fig. 1	Roggeveld (Fish River).
Fossil Wood and Plant-remains	*passim.*
Palæoniscus Bainii, *Egerton.* (Scales.) Pl. XXVIII. figs. 26, 27, 31, 33, 34, 37, 38	Styl Krantz.
——— sculptus, *Egerton.* (Scales.) Pl. XXVIII. figs. 28, 29, 30, 32, 35, 36, 39, 40	
——— (Scales.) Pl. XXVIII. figs. 41, 42	
Ichthyolites (undeterm.)	Brak River, Fort Beaufort.
Dicynodon lacerticeps, *Owen.* Pl. III., Pl. IV., p. 62 . . .	Beaufort, Blinkwater, Tarka, Styl Krantz, and Modder River (*D. testudiceps*).
——— testudiceps, *Owen.* Pl. V., Pl. VI. fig. 1, p. 71 . .	
——— strigiceps, *Owen.* Pl. VI. figs. 2 & 3, p. 75 . . .	
——— Bainii, *Owen.* p. 76	
——— tigriceps, *Owen.* Plates XXIX.–XXXIV. p. 223 . .	

Description of some Remains of Mollusca from near Graaf Reinet.
By Daniel Sharpe, Esq., F.R.S., Pres.G.S.

Iridina? rhomboidalis, Sharpe. Pl. XXVIII. fig. 2.

I.? testâ transversim rhomboidali, anticè subrotundatâ, posticè truncatâ: margine ventrali recto: lineâ cardinali subarcuatâ, dentibus 15 parvis, verticalibus, uniseriatis, inæqualibus.

Shell transversely rhomboidal; anterior end somewhat rounded, posterior end truncated; ventral margin straight: hinge-line curved with about fifteen small,

unequal, vertical teeth, closely set in one series. (Only an internal cast has been seen.)

Length $\frac{1}{3}$ inch; breadth $\frac{3}{4}$ inch.

Found at Graaf Reinet. (From the Geological Society's Collection.)

Fig. 2*a*, hinge-line of 2*b*. Fig. 2*b*, internal cast of the right valve (reversed in the plate).

Iridina? ovata, Sharpe. Pl. XXVIII. figs. 3 & 4.

I.? testâ transversim ovatâ, anticè rotundatâ, posticè productâ et obliquè truncatâ, concentricè rugulosâ: margine ventrali medio depresso: umbonibus prominentibus: lineâ cardinali arcuatâ, dentibus 12 parvis, verticalibus, uniseriatis.

Shell transversely ovate; anterior end rounded; posterior end somewhat produced and obliquely truncated; middle of the ventral margin slightly depressed: valves ornamented with numerous unequal concentric wrinkles: umbones prominent: hinge-line arched with about twelve small vertical teeth, closely set in one series.

Length $\frac{1}{2}$ inch; breadth $\frac{8}{10}$ inch.

Found at Graaf Reinet. (From the Geological Society's Collection.)

Fig. 3, an internal cast, with teeth like those of fig. 2*a*: left valve (reversed). Fig. 4, exterior, somewhat restored: left valve (reversed).

Note on the Fish-remains from Styl Krantz, South Africa.

By Sir P. De M. Grey Egerton, Bart., M.P., F.R.S., F.G.S. &c.

[Plate XXVIII. figs. 26–42.]

I have examined the fish-remains forwarded by Mr. Bain to the Geological Society from South Africa. The materials are very scanty, as the specimens only exhibit scattered scales; but I am inclined to believe that they are all referable to the genus *Palæoniscus*.

If I am correct in this inference, the characters of the individual scales indicate two species, both of which appear to be new:—one having the surfaces of the scales profusely ornamented with sinuous grooves, and their posterior margins deeply incised,—the other having the surfaces comparatively smooth, and the posterior margins only slightly serrated.

The specimens figured 41 and 42 of the plate are from the series of elongated, imbricated, fulcral scales covering the base of the upper lobe of the tail.

If provisional names are advisable until further evidence is obtained, the former may be designated *Palæoniscus sculptus*; the latter, *Palæoniscus Bainii.*

Figs. 26, 27, 31, 33, 34, 37, 38, belong to *P. Bainii*; figs. 28, 29, 30, 32, 35, 36, 39, 40, belong to *P. sculptus*; figs. 41, 42, imbricated scales from the upper base of the tail.

The figures represent the specimens magnified two diameters.

P. M. Grey Egerton.

Note on a Fossil Plant from the Fish River, South Africa.

By J. D. Hooker, M.D., F.R.S., F.G.S. &c.

[Plate XXVIII. fig. 1.]

The remarkable fossil discovered by Mr. Bain in the Roggeveld (Fish River), and figured on Plate XXVIII., presents no resemblance to any plant with which I am acquainted; and, though the specimens are in excellent condition, I am wholly unable to suggest a probable affinity for them. The general appearance of the plant is that of an elongated stem, giving off at intervals whorls of linear, lanceolate, blunt leaves. These leaves are seven or fewer in a whorl; are all united at the base; are of unequal length and breadth; and are marked with six to ten straight, undivided, unbranched, free ribs or veins, with intervening narrow grooves; in this respect resembling the leaves of some American *Cycadeæ*, and of some *Coniferæ*, as *Dammara* and *Podocarpus latifolius*.

Mr. Bain has found some truncated conical bodies, not unlike the bases of stems, in a position that appears to indicate the probability of their having been the bases of the stems of this fossil; but they do not present any characters of structural or systematic importance.

I have shown the specimens to many of my botanical friends, amongst others to one well-versed in fossil botany also (Dr. Lindley), but none of them are able to suggest any plausible affinity amongst living plants.

Joseph D. Hooker.

Note.—Whilst this sheet was passing through the press, an opportunity was afforded, by the kindness of Col. Portlock, of examining a small series of fossil plants forwarded by Mr. R. N. Rubidge from the ~~Dicynodon-strata of Smithfield, Orange River Sovereignty~~. In Mr. Morris's opinion, these fossils are essentially "Secondary" in character, from the preponderance of the remains of *Cycadeæ*, and probably represent a Triassic or a Jurassic flora.—Edit.

Jackall's Kop, on the Eastern Side of the Stormberg Range — See Q. J. G. S. vol. xii. p. 237.

EXPLANATION OF PLATES XXII.—XXVIII.

Plate XXII.

Fig. 1. *Pinna Atherstoni*, Sharpe. From Sunday River. p. 193.
1 *a*. Cast, with some of the shell remaining.
1 *b*. Transverse section of the anterior part.
Figs. 2 & 3. *Modiola Bainii*, Sharpe. From Sunday River. p. 193.
2. Fragment of a large specimen.
3 *a*. Fragment of a young shell.
3 *b*. Transverse section of fig. 3 *a*.
Fig. 4. *Perna Atherstoni*, Sharpe. From Geelhoutboom, Sunday River. p. 193.
4. Left valve.
4 *a*. Interior of the right valve of another specimen.
4 *b*. Anterior side of fig. 4.
Fig. 5. *Trigonia Vau*, Sharpe. From Sunday River. p. 194.
Figs. 6 *a* & 6 *b*. *Pholadomya Dominicalis*, Sharpe. From Sunday River. p. 194.
Figs. 7 *a* & 7 *b*. *Myacites*? *Bainii*, Sharpe. From Sunday River. p. 195.
Fig. 8. *Ceromya papyracea*, Sharpe. From Zwartkop River. p. 195.
Fig. 9. *Cyprina rugulosa*, Sharpe. From Zwartkop River. p. 195.
9 *a*. Exterior of the left valve.
9 *b*. Hinge of the left valve.
Fig. 10. *Arca Atherstoni*, Sharpe. From Sunday River. p. 196.
Fig. 11. *Psammobia Atherstoni*, Sharpe. From Sunday River. p. 196.
11 *a*. Cast of the impression of the left valve.
11 *b* & 11 *c*. Internal cast.

Plate XXIII.

Figs. 1 *a* & 1 *b*. *Ammonites Atherstoni*, Sharpe. From Sunday River. Reduced to two-thirds its diameter. p. 196.
Figs. 2 *a* & 2 *b*. *Ammonites Bainii*, Sharpe. From Sunday River. p. 197.
Fig. 3. *Gryphæa imbricata*, Krauss sp. From Sunday River. p. 197.
3 *a*. Side view of the valves united. 3 *b*. Exterior of the upper valve.
Fig. 4. *Gastrochæna Dominicalis*, Sharpe. From Sunday River. p. 198.
4 *a*. Fragment of wood* perforated by *Gastrochænæ*.
4 *b*. Dorsal view of the valves, magnified two diameters.
Fig. 5. *Neritopsis*? *turbinata*, Sharpe. From Sunday River. p. 198.

Plate XXIV.

Homalonotus Herschelii, Murchison. p. 215.

Fig. 1 *a*. The head, with the crust preserved. From Leo Hoek.
1 *b*. The same specimen, side view.
1 *c*. The oval space beneath the eye; magnified, to show that it is granulated like the rest of the head.

* This is by mistake described as "bone" at p. 198.

Fig. 2. Under-side of the head of another specimen; the crust lost: the rostral shield, with the projecting tubercle, and the suture along the *margin* of the cheek, are well seen here: the suture is visible also in fig. 1*b*. From Leo Hoek.

Fig. 3. Outline of the head of a very large specimen. This variety has spines on the lower glabella-lobes. From the Warm Bokkeveld.

Fig. 4. Entire body and tail of a specimen with but few tubercles. From Gydow Pass.

Fig. 5. Two segments of the body of a many-spined variety. From Gydow Pass.

Fig. 6. A segment broader, in proportion to the width, than usual, and trilobed further inward; probably belonging to a distinct species. From the Warm Bokkeveld.

Fig. 7 *a*. A fine tail of a moderately spiny variety. From Leo Hoek.

7 *b*. A side view of the same, showing the large facet.

7 *c*. The incurved under portion of the tail.

7 *d*. A portion of the surface, magnified.

Fig. 8. The tail of a young individual; without spines. From Gydow Pass.

Plate XXV.

Fig. 1. *Phacops Africanus*, Salter; p. 218: a specimen of the largest size, with the crust removed. From Gydow Pass.

Fig. 2. Body and tail of another specimen; the axis is rather depressed, so as to appear broader than it really is. From Gydow Pass.

Fig. 3. Segments of a specimen, with dorsal spines on each segment. From Hottentot's Kloof.

Fig. 4. Tail of the same species. From Hottentot's Kloof.

Fig. 5. Head of the same species; showing the elevated eye. From Gydow Pass.

Fig. 6. Head of the same species. Cedarberg. (Mus. Pract. Geology.)

6 *a*. Seen from above. 6 *b*. Side view.

Fig. 7. Under-side of head of the same specimen.

Fig. 8. A small head, showing the lateral spines very perfectly. From Gydow Pass.

Fig. 9. Body of an individual belonging to the same species. Cedarberg. (Mus. Pract. Geology.)

9 *a*. Side view. 9 *b*. View of the caudal extremity.

9 *c*. Some body-rings, with the curved and spinose pleuræ.

Fig. 10. *Phacops Caffer*, Salter, young. p. 219. Head. From Gydow Pass.

10 *a*. Side view. 10 *b*. Seen from above.

Fig. 11. The head of a much larger specimen. From Leo Hoek.

Figs. 12 *a* & 12 *b*. The eye of the same specimen, magnified.

Fig. 13. Nearly perfect specimen of the same species. From Gydow Pass.

Fig. 14 *a*. *Typhloniscus Bainii*, Salter; p. 221.

14 *b*. One of the body-segments, with the terminal spine [the latter is too long in the drawing].

Fig. 15. *Tentaculites crotalinus*, Salter; p. 222; nat. size. From the Warm Bokkeveld.

Fig. 16. External shell, magnified.

Fig. 17. Internal cast, magnified.

Fig. 18. Portion of a variety, with more rings in the youngest portion; magnified.

Fig. 19 *a*. *Serpulites Sica*, Salter; p. 222.

19 *b*. A specimen magnified. From the Warm Bokkeveld.

Fig. 20. *Ophiocrinus Stangeri*, Salter; p. 223; enlarged to twice the size: the line indicates the natural length: at *a*, some of the wedge-shaped arm-joints are magnified.

Figs. 21–28. Various stems of *Encrinites*, very characteristic of these strata. p. 223. They appear to be allied to those of *Rhodocrinus*. From the Warm Bokkeveld and Kokman's Kloof.

Plate XXVI.

Figs. 1, 2, & 5. *Spirifer Antarcticus*, Morris and Sharpe. p. 206.

1. Dorsal valve, interior.
2. Ventral valve, interior.
5. Dorsal valve, exterior.

Figs. 3, 4, & 6. *Spirifer Orbignii*, Morris and Sharpe. p. 207.

3. Dorsal valve, interior.
4. Ventral valve, interior.
6. Ventral valve, exterior.

Figs. 7–10. *Orthis palmata*, Morris and Sharpe, sp. p. 207.

7. Ventral valve, exterior.
8. Dorsal valve, exterior.
9. Ventral valve, interior.
10. Dorsal valve, interior.

Figs. 11 & 12. *Terebratula Bainii*, Sharpe. p. 208.

11. Ventral valve, exterior.
12 *a*. Ventral valve, interior.
12 *b*. Dorsal valve, exterior.

Figs. 13 & 17. *Strophomena Bainii*, Sharpe. p. 208.

13. Ventral valve, exterior.
17. Dorsal? valve, exterior.

Figs. 14, 15, & 16. *Chonetes*, undetermined. p. 209.

Figs. 18 & 19. *Strophomena Sulivani*, Morris and Sharpe, sp. p. 209.

18. Ventral valve.
19. Dorsal valve.

Figs. 20–23. *Orbicula Bainii*, Sharpe. p. 210.

20 *a* & 20 *b*. Upper valve of a small specimen.
20 *c*. Part of the surface of 20 *a*, magnified.
21 *a* & 21 *b*. Upper valve of a large specimen, which has lost nearly the whole of the shell.
22. Lower valve.
23. Fragment of upper valve, with the shell well preserved.

Plate XXVII.

Fig. 1. *Solenella antiqua*, Sharpe. p. 210.

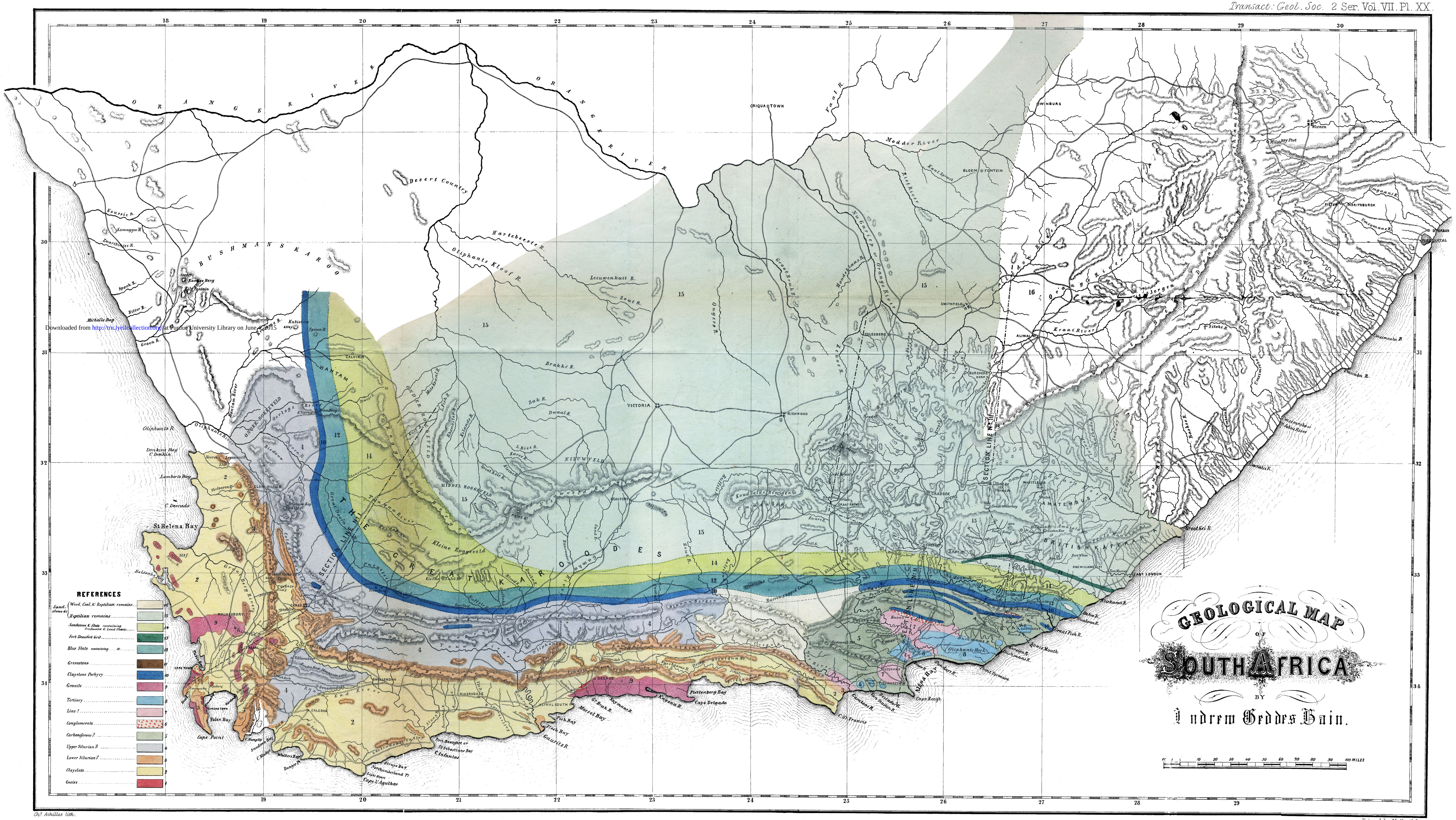
1 *a*. Right valve.
1 *b*. Hinge of 1 *a*.

Figs. 2 & 4. *Cleidophorus Africanus*, Salter, MSS., p. 211.
2. Left valve, with the surface partially preserved.
4. Hinge-line of an imperfect specimen of both valves.
Fig. 3. *Cleidophorus abbreviatus*, Sharpe. Internal casts of both valves, p. 212.
Fig. 5. *Leda inornata*, Sharpe, p. 212.
Fig. 6. *Solenella rudis*, Sharpe, p. 211.
Fig. 7. *Leptodomus*? *ovatus*, Sharpe, p. 212.
Fig. 8. *Sanguinolites*? *corrugatus*, Sharpe, p. 212.
Fig. 9. *Modiolopsis Bainii*, Sharpe, p. 213.
9 *a*. Cast of left valve.
9 *b*. Dorsal view of 9 *a*.
Fig. 10. *Anodontopsis*? *rudis*, Sharpe, p. 213.
Figs. 11 & 12. *Littorina*? *Bainii*, Sharpe, p. 213.
Fig. 13. *Conularia Africana*, Sharpe, p. 214.
13 *a*. Fragment of natural size of an internal cast.
13 *b*. Portion of 13 *a*, magnified.
13 *c*. Section of another specimen.

Plate XXVIII.

Fig. 1. Fossil plant; natural size. From the Roggeveld. p. 227.
Fig. 2. *Iridina*? *rhomboidalis*, Sharpe. From Graaf Reinet. p. 225.
2 *a*. Hinge-line; magnified.
2 *b*. Internal cast of valve; nat. size.
Figs. 3 & 4. *Iridina*? *ovata*, Sharpe. From Graaf Reinet. p. 226.
3. Internal cast; nat. size.
4. Exterior, somewhat restored; nat. size.
Fig. 5. Undetermined shell; nat. size. From Graaf Reinet.
Fig. 6. Undetermined shell; nat. size. From Graaf Reinet.
Fig. 7. *Cyrena*?, internal cast; nat. size. From Graaf Reinet.
Fig. 8. *Cyrena*?, magnified 6 diameters. From Zwartkop.
Fig. 9. *Cyrena*?; magnified 8 diameters. From Zwartkop.
Fig. 10. *Avicula Bainii*, Sharpe, left valve; magnified 3 diameters. From Zwartkop. p. 199.
Fig. 11. *Modiola Atherstoni*, Sharpe; magnified 3 diameters. From Zwartkop. p. 199.
Fig. 12. *Sanguinolaria*? *Africana*, Sharpe; p. 199. From Zwartkop.
12 *a*. Internal cast of the left valve (reversed by the artist); magnified 3 diameters.
12 *b*. External markings, magnified, of another specimen.
Fig. 13. *Cyrena*? *Bainii*, Sharpe; natural size. From Zwartkop. p. 199.
Fig. 14. *Trochus Bainii*, Sharpe; magnified 12 diameters. From Zwartkop. p. 199.
Figs. 15 & 16. *Turbo Atherstoni*, Sharpe. From Zwartkop. p. 200.
15. Internal cast, magnified 8 diameters.
16. Exterior, magnified 8 diameters.
Figs. 17 & 18. *Turbo Bainii*, Sharpe. From Zwartkop. p. 200.
17. Internal cast (with portion of the shell remaining), magnified 6 diameters.
18. Exterior, magnified 6 diameters.

Fig. 19. *Acteon Atherstoni*, Sharpe; magnified 3 diameters. From Zwartkop. p. 200.
Fig. 20. *Ampullaria* ?, undetermined; magnified 12 diameters. From Zwartkop.
Fig. 21. *Ampullaria* ?, undetermined; magnified 10 diameters. From Zwartkop.
Fig. 22. *Natica Atherstoni*, Sharpe; natural size. From Zwartkop. p. 200.
Fig. 23. *Natica*, undetermined; magnified 15 diameters. From Zwartkop.
Fig. 24. *Cylindrites* ?, undetermined; magnified 12 diameters. From Zwartkop.
Fig. 25. *Acteon* ?, undetermined; magnified 8 diameters. From Zwartkop.
Figs. 26, 27, 31, 33, 34, 37, 38. Scales of *Palæoniscus Bainii*, Egerton: magnified 2 diameters. From Styl Kranz. p. 226.
Figs. 28, 29, 30, 32, 35, 36, 39, 40. Scales of *Palæoniscus sculptus*, Egerton; magnified 2 diameters. From Styl Kranz. p. 226.
Figs. 41 & 42. Fulcral scales from the base of the tail of *Palæoniscus*; magnified 2 diameters. From Styl Kranz. p. 226.



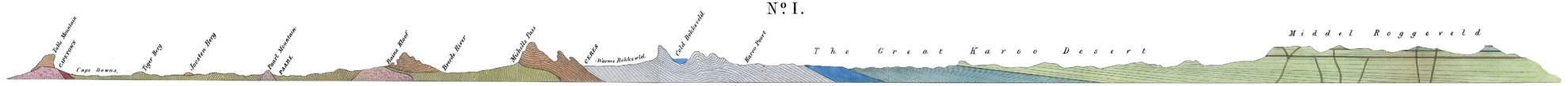
Chs. Achilles lith.

Printed by Malby & Sons.

GEOLOGICAL SECTIONS OF SOUTH AFRICA.

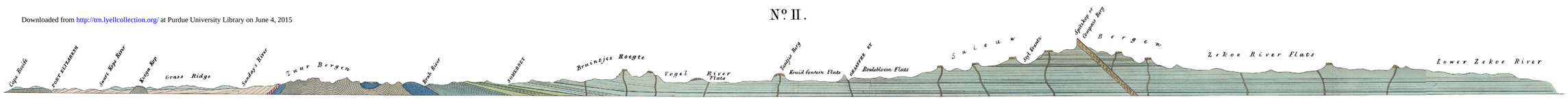
BY ANDREW GEDDES BAIN.

Nº I.



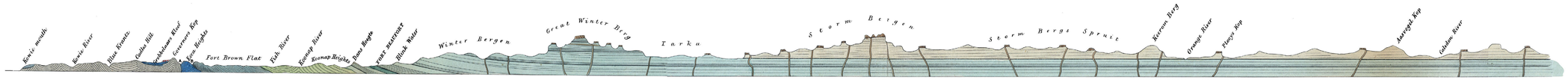
Section from Table Mountain to Middel Roggeveld

Nº II.



Section from Cape Recife to Lower Zekoe River near Orange River

Nº III.

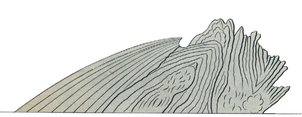


Section from Kowie mouth to Caledon River

Nº V.

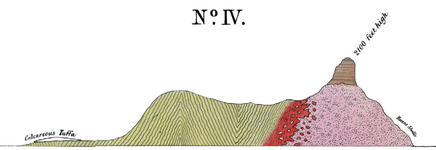
Contorted upper Silurian Sand-stone, Karoo Poort

Nº VI.



Contorted Carbonaferous Sandstone, Burnt Kraal *near* Grahams Town.

Nº IV.



Sections of Lion's Hill.

Nº VII

Fault in the Lacustrine Strata, Buffels River, Great Karoo.

Nº VIII.

Mountain in the Amatembu *Country, shewing 2 beds of Greenstone & 2 dikes of different ages.*

REFERENCES.

- Tertiary
- Lias?
- Conglomerate
- Carboniferous?
- Upper Silurian?
- Lower Silurian?
- Clayslate
- Gneiss

Scale for Vertical extents.

Scale for Horizontal extents: 0 3 6 12 18 24 30 36 Miles

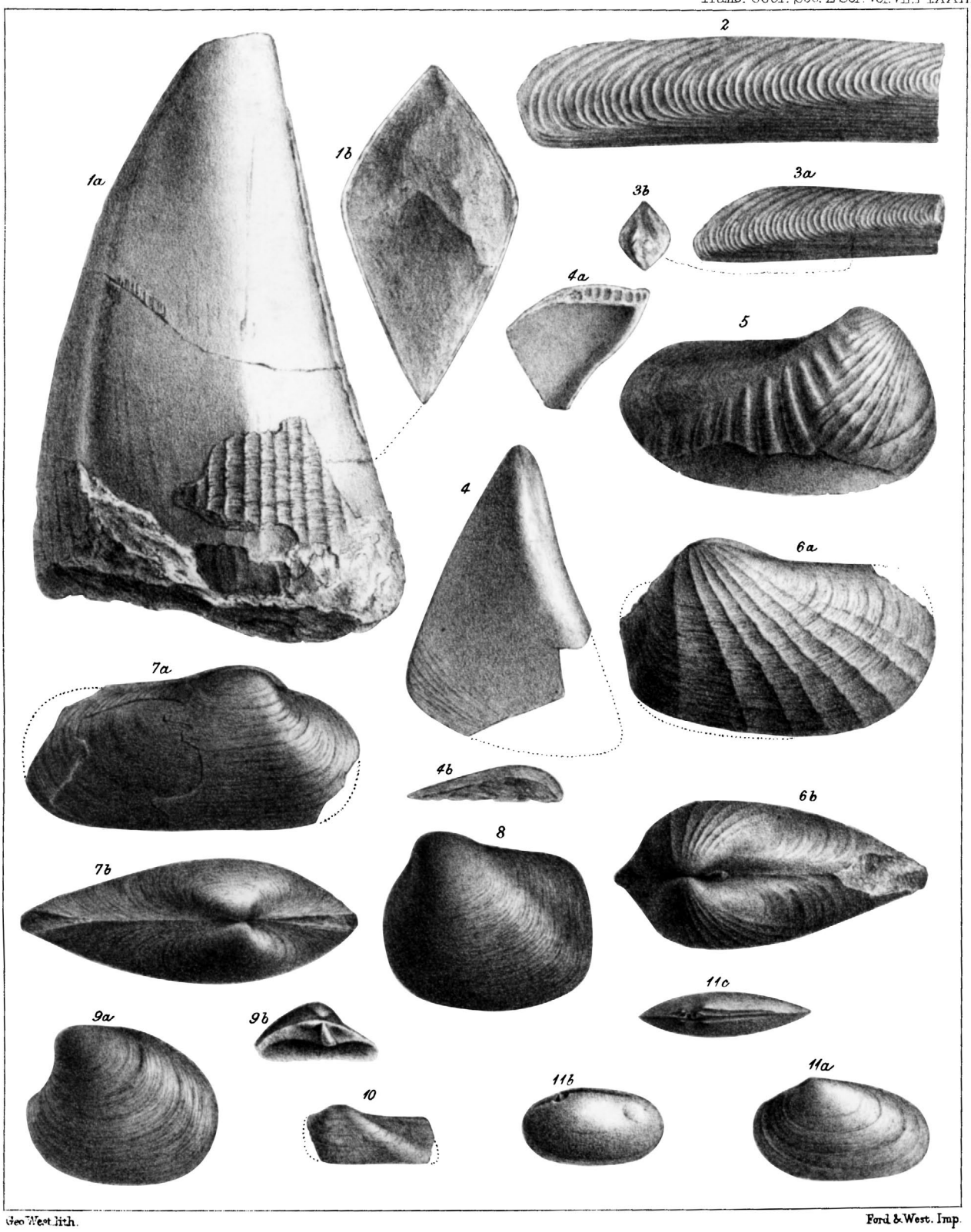
NOTE. The above scales are only applicable to sections Nº I. II. & III.

REFERENCES.

- Sandstone &c. { Wood, Coal, & Reptilian remains. / Reptilian remains
- Fort Beaufort Grit
- Sandstone &c. Plant-remains
- Greenstone
- Claystone Porphyry
- Granite

Addles lith.

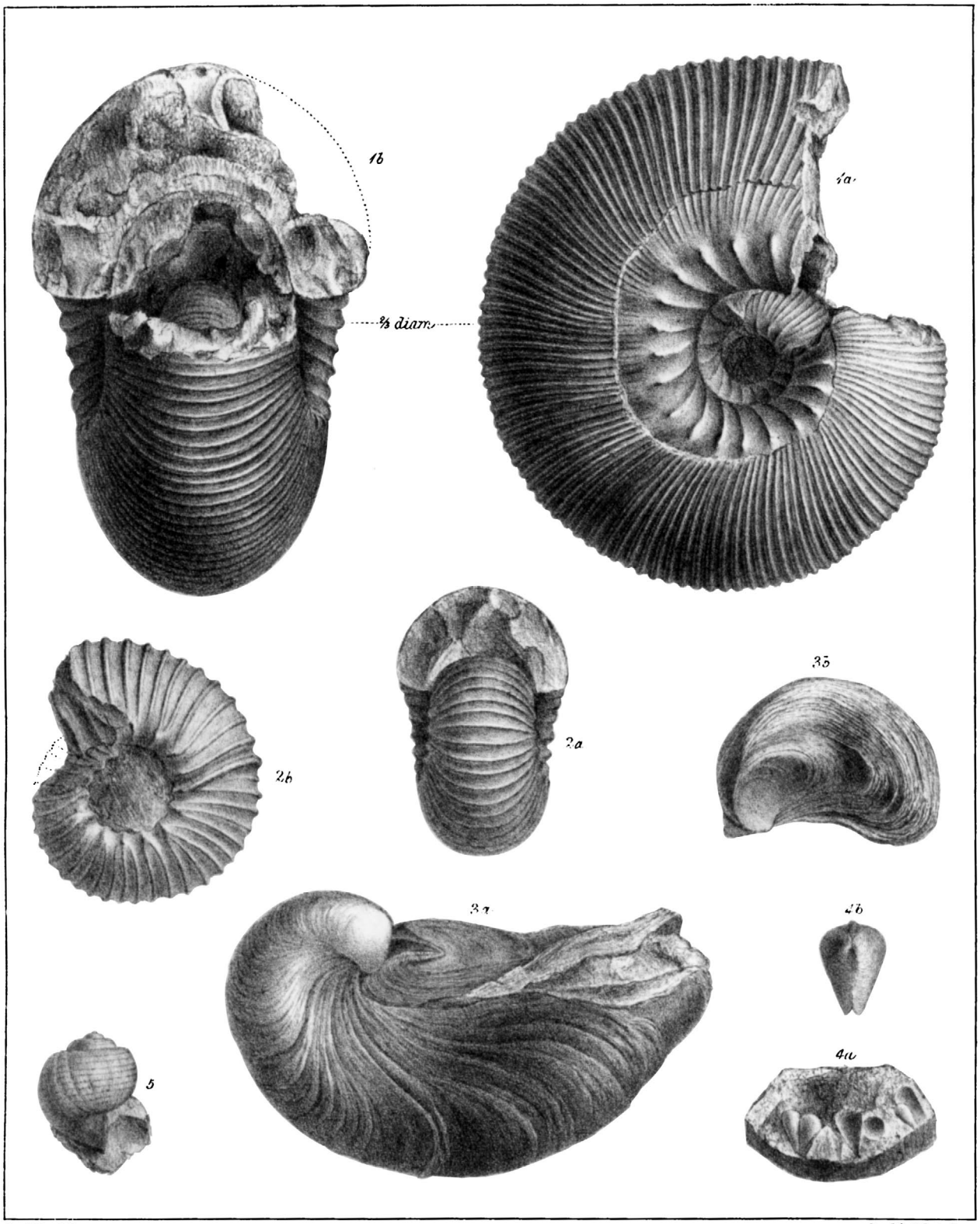
Printed by Malby & Sons.



Geo. West lith.

Ford & West. Imp.

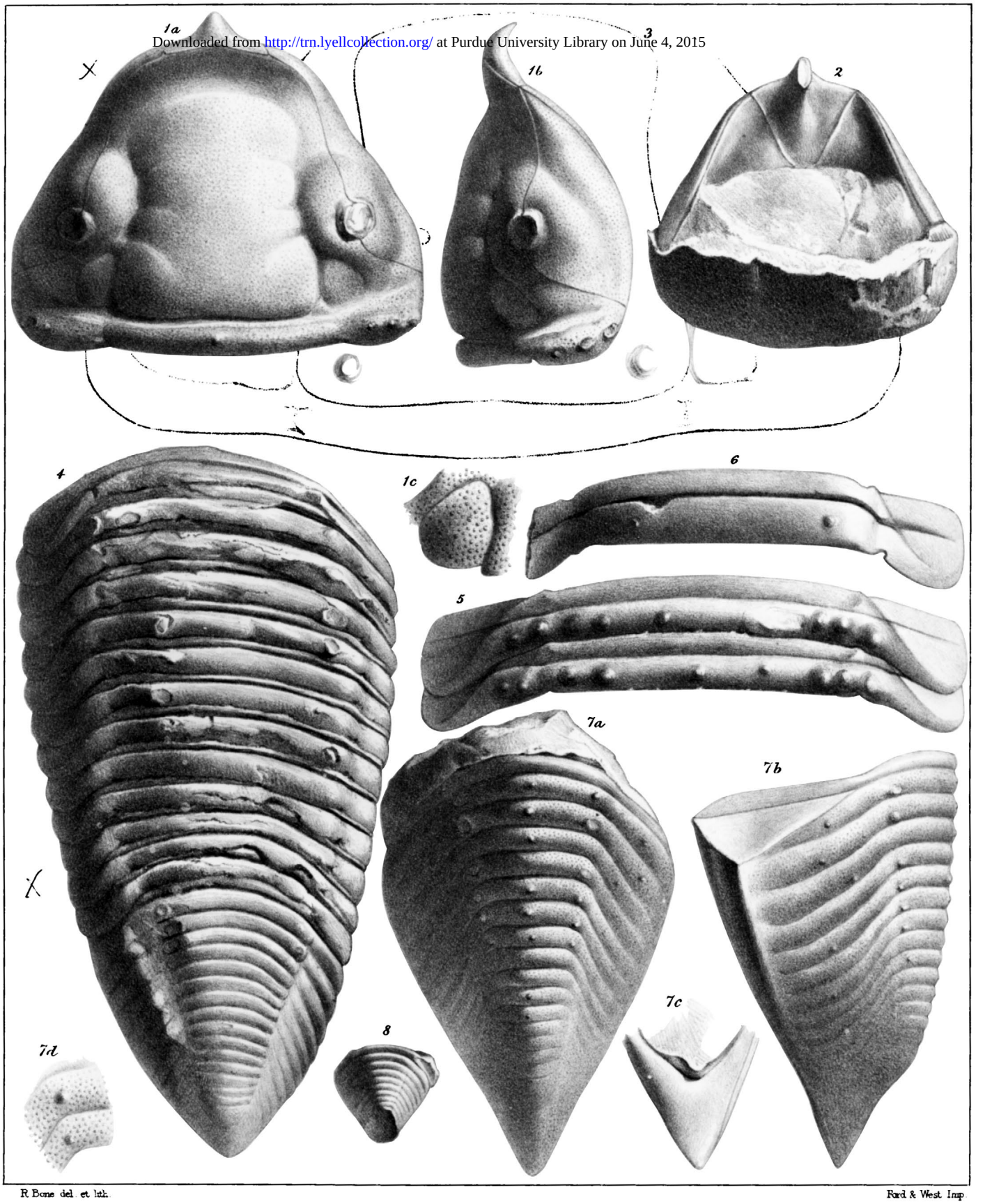
FOSSILS FROM SOUTH AFRICA *(Secondary)*



Geo. West. Lith.

Pari & West. Imp.

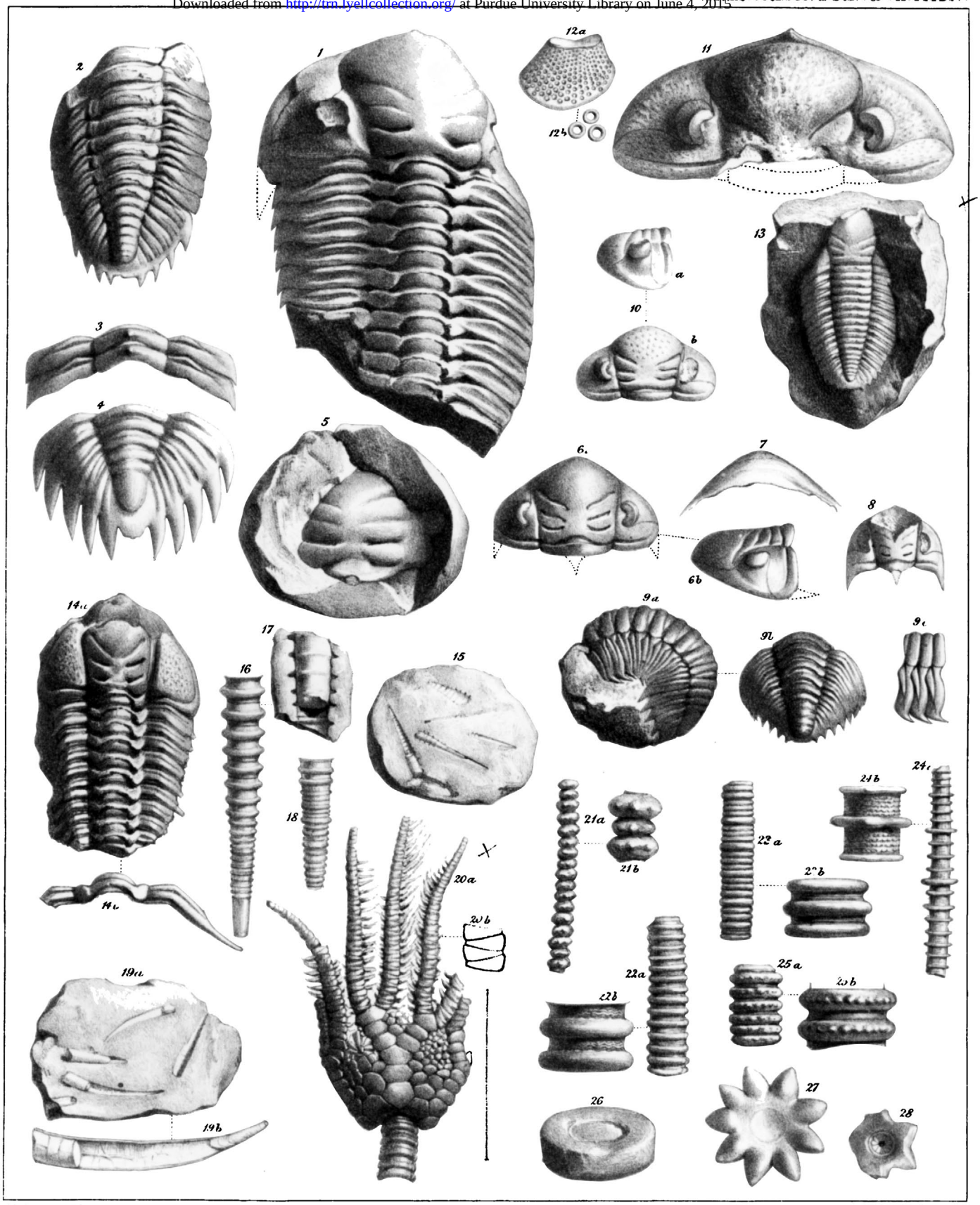
FOSSILS FROM SOUTH AFRICA. *(Secondary.)*



R. Bone del. et lith.

Ford & West Imp.

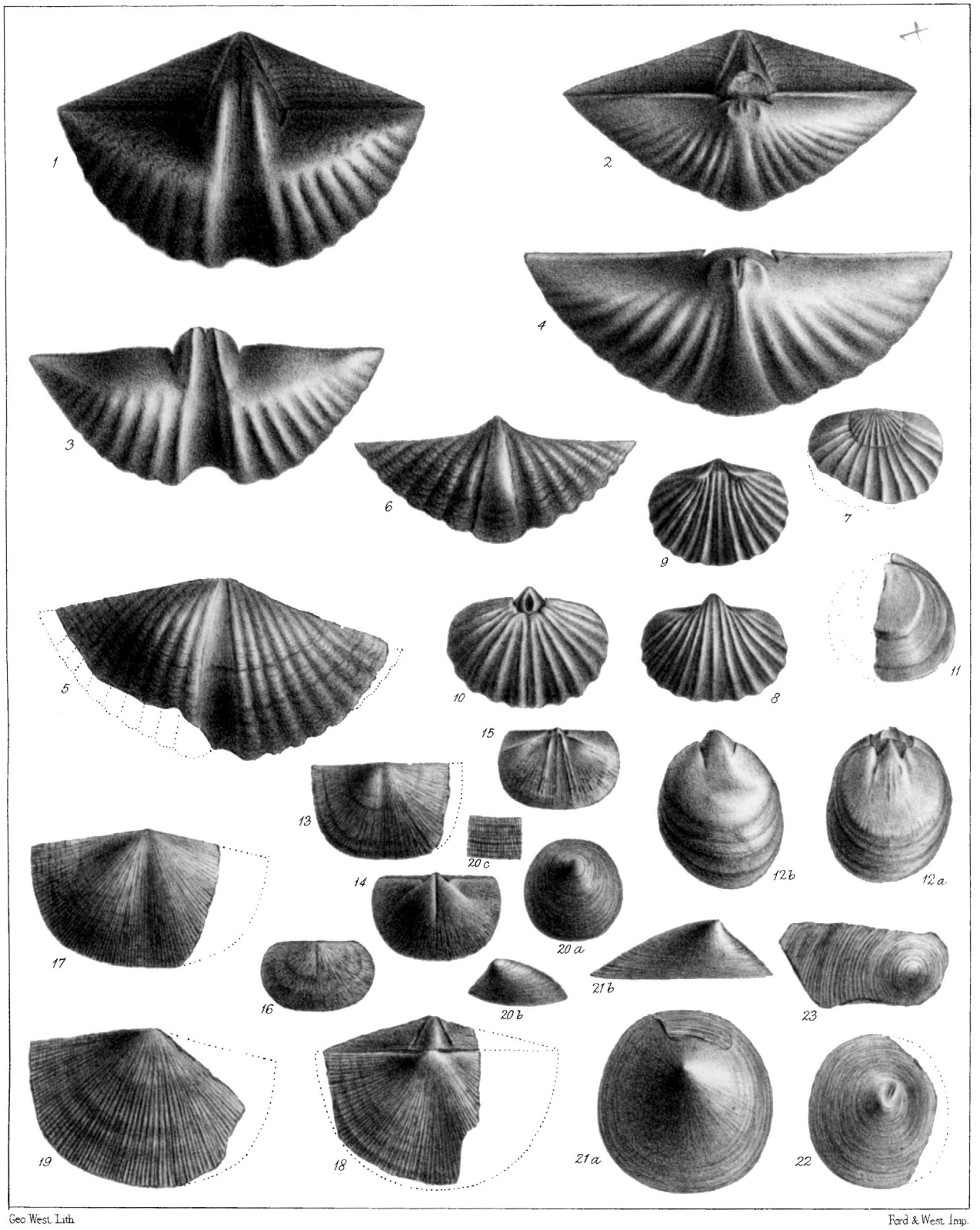
FOSSILS FROM SOUTH AFRICA (*Palæozoic.*)



G. K. Bone del. et lith.

Ford & West Imp.

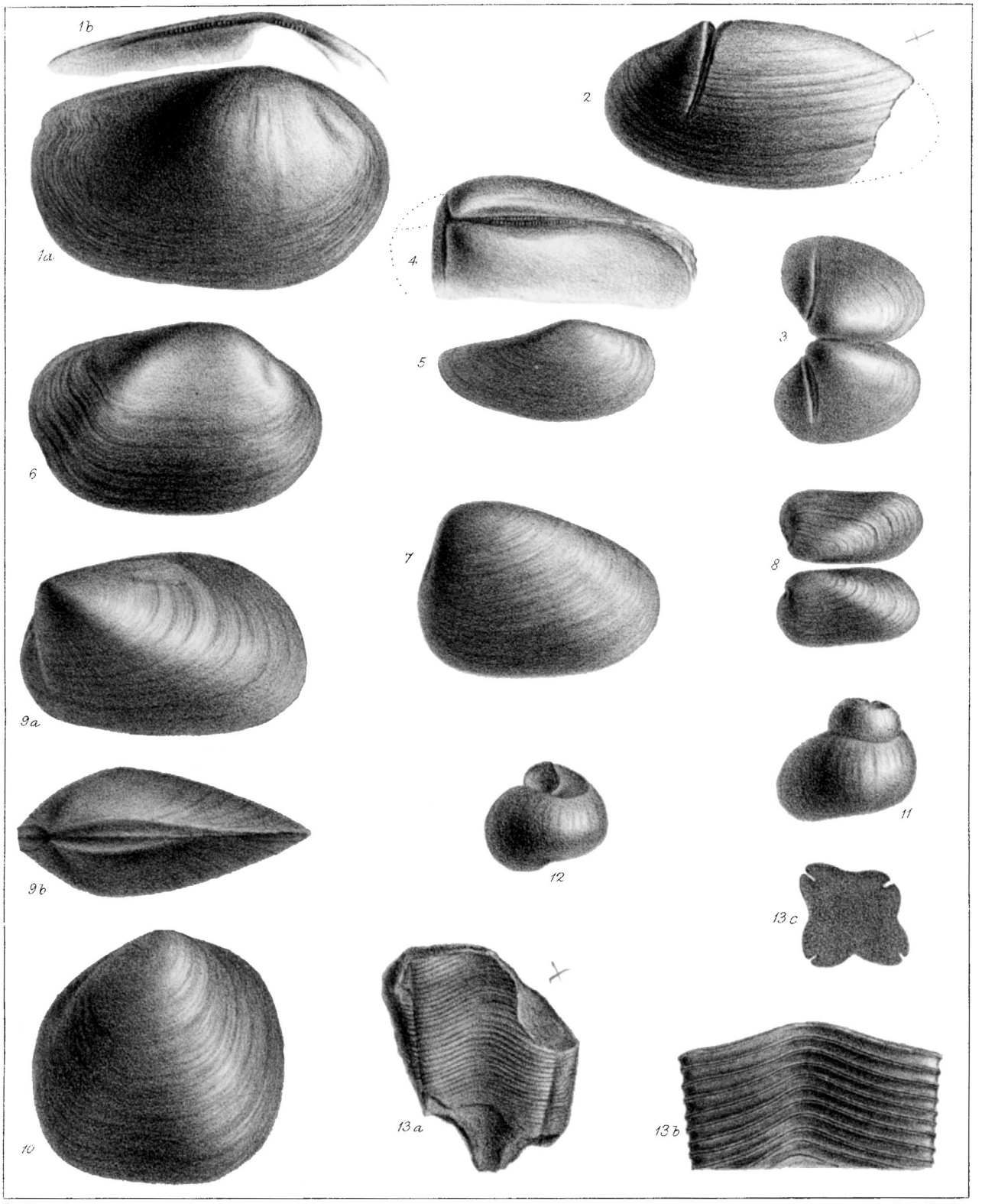
FOSSILS FROM SOUTH AFRICA. *(Palæozoic)*



Geo. West. Lith.

Ford & West. Imp.

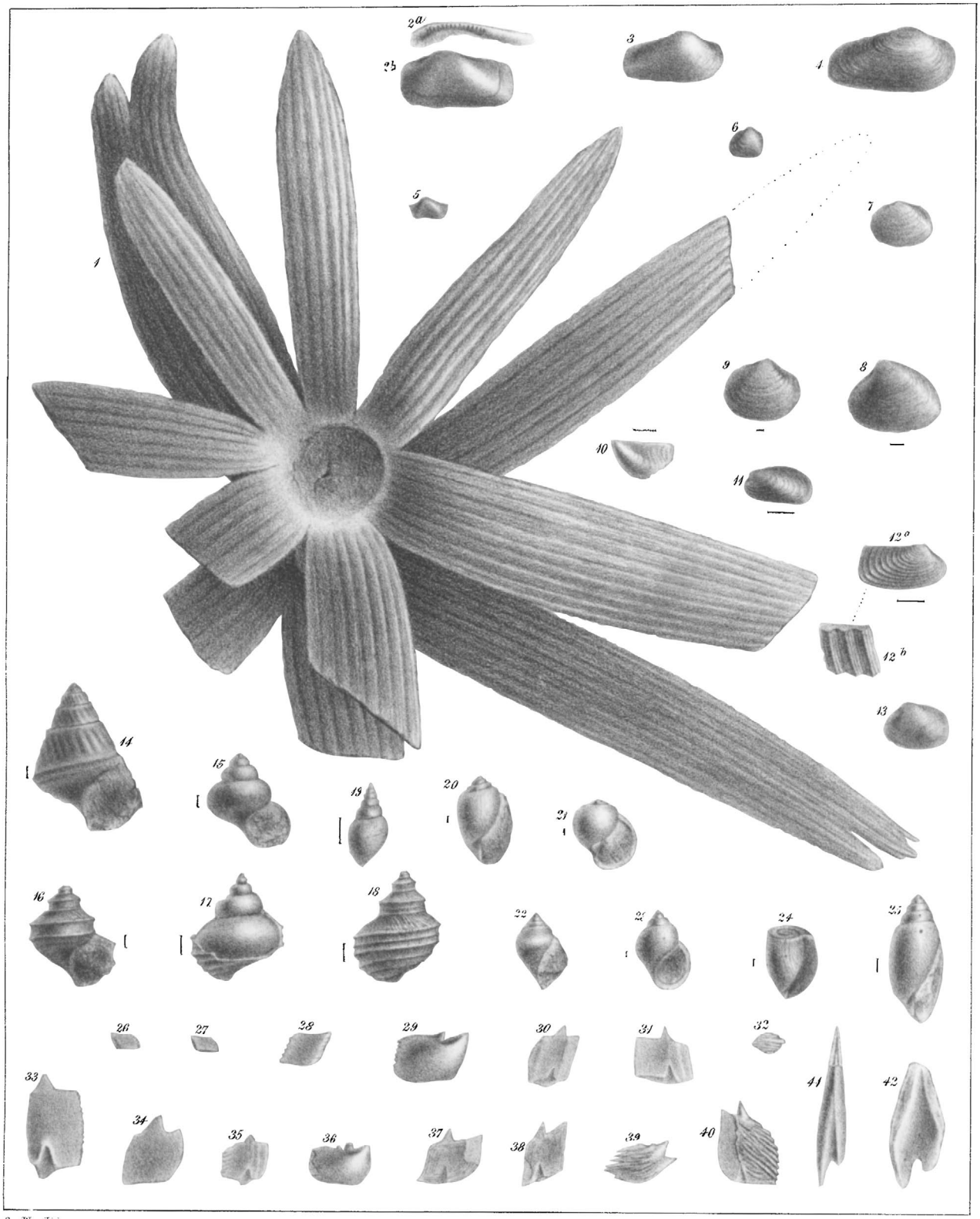
FOSSILS FROM SOUTH AFRICA. *(Palæozoic.)*



Geo. West Lith.

Ford & West Imp.

FOSSILS FROM SOUTH AFRICA. *(Palæozoic)*



Geo West Lith

Ford & West Imp

FOSSILS FROM SOUTH AFRICA *(Secondary)*