GALATHEA REPORT

Volume 6

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Scientific Results
of The Danish Deep-Sea Expedition
Round the World 1950-52

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To the memory of

THE SCIENTIFIC LEADER
OF THE GALATHEA EXPEDITION

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*1901 †1961

THE SYSTEMATICS AND BIOLOGY OF BATHYAL AND ABYSSAL ISOPODA ASELLOTA

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CONTENTS

(* indicates species collected by the *Galathea* Expedition)

I. PREFACE

The present work arises from a study of bathyal and abyssal[1] Isopoda Asellota, collected mainly during the Danish *Galathea* Deep-Sea Expedition Round the World 1950-52 at depths between about 200 and 6000 m. Since the Asellota is by far the most abundant suborder of Isopoda in the deep-sea, the present investigation was confined to this group. The hadal[1] isopods from the *Galathea* have been dealt with previously (WOLFF 1956 a), and it is intended to publish at a later date in the *Galathea Report* results obtained from an examination of the remaining suborders from bathyal and abyssal depths.

Much of the systematic literature on deep-sea isopods – both old and new – is inadequate, owing to descriptions being too short and incomplete, and lack of, or far too few illustrations. In order to evaluate systematic relationships and to arrive at the greatest possible degree of certainty when dealing with e.g. the zoogeography of the species of a genus, I have deemed it necessary, in many cases to consult previously examined material from other sources. In this respect the Copenhagen Museum houses many rich collections from earlier Danish expeditions, principally, that of the *Ingolf*. In addition, I have borrowed material from several other museums and have on three occasions visited the British Museum (Natural History), to study types from the *Challenger* Expedition. It was found necessary to re-describe and revise much of this borrowed material, and even to establish a number of new species or subspecies.

The study is essentially morphological and taxonomical. For obvious reasons, deep-sea collec-

1. Definitions of these terms are given on p. 16.

tions are generally restricted in number of specimens. However, as far as was possible with the material available, other aspects have also been considered.

Since very little is known on the general biology and ecology of asellotes (those from the deep-sea in particular) the *Galathea* and additional material was utilized for investigations on development, propagation, hermaphroditism, food content, etc.

Up to the present time the Asellota have not been used for purposes of monographic treatment[1]. A general survey of the distribution of the many species of the suborder – regional as well as bathymetrical – was therefore not available. With regard to the zoogeography of material dealt with in this paper, I thus considered it appropriate to gather data from all available literature on distribution, depth records, etc.; this providing at the same time, a basis for comparison between the distribution of littoral, sublittoral, bathyal, abyssal and hadal asellotes. Unfortunately, our knowledge of the bathyal and abyssal isopods is still so fragmentary that their contribution to a general conception of the zoogeography of the deep-sea is very limited.

Acknowledgments

In presenting this work it is my privilege to thank all those who have been of assistance to me. In the first place, I wish to express my gratitude to colleagues from the *Galathea,* in particular the leader, the late Dr. ANTON F. BRUUN, for friendly and fruitful discussions both onboard and during subsequent treatment of the material.

1. NIERSTRASZ's compilation (1941) deals with Indo-Pacific species only. In addition, several species are not mentioned and the paper contains many errors in records of distribution and depth.

My thanks are also due to Dr. HENNING LEMCHE (the Zoological Museum), for advice on problems of nomenclature, to Professor K. G. WINGSTRAND (the Anatomical Institute) for valuable help in microscopical sectioning and interpretation of the gonads of *Haploniscus,* to Mr. TYGE CHRISTENSEN (the Botanical Museum), for advice on questions of terminology, and on determination of plant material in intestine contents, and to Mr. JENS SMED (the Hydrographic Office), for assistance with references to temperature records.

A considerable number of colleagues in foreign museums and other institutions have been very helpful in placing material at my disposal. The aid of the following is particularly appreciated: Dr. CHARLOTTE HOLMQUIST (Stockholm), Professor O. NYBELIN (Gothenburg), Mr. N. KNABEN (Oslo), Dr. ISABELLA GORDON and Mr. R. W. INGLE (London), Dr. H.-E. GRUNER (Berlin), Dr. A. CAPART (Brussels), Professor J. A. BIRSTEIN (Moscow), Dr. ELIZABETH DEICHMANN (Harvard) and Drs. FENNER A. CHACE and T. E. BOWMAN (Washington). My thanks are also due to Dr. BOWMAN, Dr. GORDON and Mr. INGLE for providing sketches of a few type specimens which could not be borrowed, and to the latter two for their assistance during my three visits to the British Museum (Natural History) in London. I am also grateful to Dr. R. J. MENZIES (Los Angeles) for permission to go through the proof of his paper on the systematics of the rich collections of the *Vema* Expeditions in the Atlantic Ocean, to Professor CLAUDE LÉVI (Strassbourg) who identified sponge material in gut contents of various isopods, and to Professor ELLSWORTH C. DOUGHERTY (Berkeley) for suggestions regarding discussions on terminology.

Finally, I thank Mrs. M. GOODFELLOW for careful revision of the English text and my wife for invaluable help with proof-reading, etc.

II. INTRODUCTION

HISTORICAL REVIEW

The main contributions to our knowledge of the bathyal, abyssal and (recently) hadal asellote isopods come from the reports of the great oceanographical expeditions. But important work has also been published as a result of dredgings undertaken on the continental slope, particularly in the vicinity of universities and marine institutes in Western and Northern Europe.

The first reports on asellotes from outside the shelf area date back almost a hundred years, when the great Norwegian carcinologist G. O. SARS described and recorded several new or previously described species from the upper slope area in the outer part of Oslo (Christiania) and Hardanger Fjord and off Lofoten (SARS 1869, 1870, 1872, and 1879). In 1885 G. O. SARS published his large paper on the Crustacea from the Norwegian North Atlantic Expedition 1876-1878 and described the first known, truly bathyal asellotes. The following year came BEDDARD's important work on the Isopoda of the British *Challenger* Expedition 1872-1876, which dealt with 34 asellotes, 32 of which were new to science (two species from less than 200 m, fourteen from 200-2000 m and sixteen from 2000 to 5011 m, the latter being for the next seventy years the greatest known depth for any asellote!). BEDDARD gave also a survey of the zoogeography of deep-sea isopods known at that time and discussed their special peculiarities.

For obvious reasons, the German Plankton-Expedition obtained only a few Asellota, the great majority being benthic. In connexion with the description of these species HANSEN (1895) pointed out the difference between *Asellus, Stenetrium* and the remaining asellotes, and supported CLAUS' division between Isopoda and Tanaidacea. BONNIER (1896) reported on the Cumacea, Isopoda and Amphipoda collected by the *Caudan* in the Gulf of Gascony and described eight species of asellotes, all from 950 m depth.

In 1899 appeared G. O. SARS' volume on the isopods in his outstanding "Crustacea of Norway", in which the diagnoses of all hitherto described and several new genera and species from Northern Europe are given together with observations on swimming methods, etc. The monograph includes 21 species from the shelf and as many again from the lower sublittoral and upper bathyal zones. OHLIN (1901) described a single abyssal species from the Arctic Ocean and supplied temperature records for this and the other, sublittoral species dealt with in his report. TATTERSALL (1905) recorded nineteen bathyal species from off Ireland, seven of which were new, taken by the Irish fishing vessel, *Helga*.

The bathyal and abyssal isopods collected by the American *Albatross* Expeditions, mainly in North American waters, were described by several authors (HANSEN 1897, BENEDICT (in RICHARDSON 1901), and mainly by RICHARDSON (1905, 1908a, 1908b, 1909, 1911b, and 1912b)); out of twenty asollotes, nine bathyal and ten abyssal species were new. RICHARDSON (1911a) also gave descriptions (but no figures) of three new bathyal and two new abyssal species from the East Atlantic, taken by the French *Travailleur* and *Talisman* (1880-1883), STEBBING (1913) and STEPHENSEN (1915) contributed with descriptions of a few abyssal or bathyal asellotes from the expeditions of the British *Porcupine* (1869-1870) and the Danish *Thor* (1904-1910).

In 1914 VANHÖFFEN published his large paper on the isopods of the German South Polar Expedition of the *Gauss* (1901-1903). This is the first report on deep-sea isopods in the Antarctic area (apart from a few from the *Challenger)* and contains descriptions of 63 asellote species. Of the twenty shelf species twelve were previously known, although this applied to only five of thirty slope and one of ten abyssal species. Unfortunately, the entirety of the descriptions and the accuracy of the figures are not always satisfactory in this important work; it also contained a survey of the zoogeography of the Antarctic isopods. In 1914 came the first of K. H. BARNARD's papers on South African crustaceans in which bathyal asellotes are also mentioned; this paper and its successor (1920), contain descriptions of fourteen new species from the continental slope.

Probably the most important paper on deep-sea isopods is HANSEN's report (1916) on the collections from the Danish *Ingolf* and *Thor* Expeditions to the North Atlantic (in 1895-1896 and 1904-1910, respectively). His revision of the classification of the Asellota is that generally accepted today. A total of 105 species belonging to this group, are excellently described, their relationship discussed, and the bottom temperatures recorded. Seventeen of them are from the shelf, 36 from bathyal depths, 27 from abyssal depths and 5 ranged from bathyal into abyssal depths. There are 10 new genera and 61 new species, in spite of the fact that the Eastern North Atlantic was then – and still is – the most thoroughly investigated area. Finally, the paper includes a survey of the regional and bathymetrical distribution.

MONOD (1926) recorded eight slope species from the Antarctic. Although NORDENSTAM's large paper (1933) on the isopods from the Swedish Antarctic Expedition in 1901-1903 deals with only a few species from depths exceeding 200 m, it is important insofar as it revises the systematics of isopods from this area. GURJANOVA gave (1933b) a useful survey of all marine isopods known from Arctic and Subarctic waters, based partly on the results of a number of (mostly Russian) expeditions or collectors, partly on the literature. The paper includes short diagnoses of the genera, keys to genera and species, and a chapter on the zoogeography of the Arctic Sea and adjacent areas. It should be noted that the majority of calculations of the original records from fathoms to metres are incorrect.[1] In

1. This is probably in part due to the fact that a Danish fathom (as e. g. used by HANSEN and SARS) is notably longer than an English fathom, thus causing considerable error where depths of several thousand metres are concerned.

1933a GURJANOVA described four bathyal asellotes from the Bering Sea, the Sea of Ochotsk and the Sea of Japan, and in 1936 she reviewed the zoogeography of these and all other species from that area. STEPHENSEN (1936) mentioned a few asellotes from bathyal depths from the Danish *Godthaab* Expedition to West Greenland in 1928.

The only contribution to our knowledge of the ecology of soft bottom isopods (almost exclusively asellotes) is HULT's very important paper (1941). A total of 28 asellotes was secured in the Skagerrak and adjacent deep fjords, 23 from depths exceeding 200 m. Besides the regional and bathymetrical distribution of the species, their relation to temperature, salinity, oxygen, type of bottom, etc. is discussed and the dredging methods evaluated.

NIERSTRASZ (1941) worked up some of the isopods from the Dutch *Siboga* Expedition and gave fairly complete lists of all Indo-Pacific marine isopods (excl. of Flabellifera and Epicaridea), including distribution and depth records; unfortunately, the deeper depth records have all been calculated erroneously from fathoms to metres. Probably due to the untimely death of Professor NIERSTRASZ 1937, the Siboga material of Asellota was, unfortunately, not treated.

GURJANOVA (1946) recorded two shelf species, six slope species and two abyssal species, collected in the Arctic Ocean by the *Sadko* in 1935 and 1937-38 and by the *Sedov* in 1937-38. Gorbunov (1946) listed 26 previously described asellotes from the slope and abyssal depths, procured by the same vessels, and discussed the composition of the fauna.

In 1955 NORDENSTAM described the first isopod known from depths exceeding 5000 m, this being a new genus and species of an asellote dredged by the Swedish Deep Sea Expedition in 1948 in and close to the Puerto Rico Trench at depths between 5500 and 7900 m. NORDENSTAM also included a somewhat incomplete list of isopods recorded from depths greater than 3000 m. MENZIES (1956a, 1956b) described two new asellotes from 1250 m and five from 5100 m in the West Indies, all collected by the American *Vema* Expedition; in both papers MENZIES also supplied information on the nutrition of the species.

WOLFF (1956a) dealt with the hadal representatives of the collections of the Danish *Galathea* Expedition 1950-1952, recording eleven asellotes from depths exceeding 6000 m and down to 9790 m[1] in the Philippine Trench, the greatest depth so far from where isopods have been described[1]. In addition, eleven other deep-sea species were revised. The regional and vertical distribution of the genera with hadal species was recorded in detail, and the relationship, possible origin, special peculiarities, and nutrition of the hadal species discussed; the first evidence of possible gigantism in deep-sea isopods was given.

1. This depth was later revised to 9820-10.000 m.

In 1957 BIRSTEIN published the first descriptions of asellotes from the Russian *Vitjaz* Expeditions in the N.W. Pacific, including seven new species and subspecies of the genus *Storthyngura*, from depths between 5670 and 8430 m. He also discussed the distribution of this genus, the origin of the abyssal and hadal faunas, and the gigantism of the species, ascribing this phenomenon to the effect of hydrostatic pressure on the metabolism. Later (1960), BIRSTEIN treated the Ischnomesidae, recording eleven new and one previously described species and subspecies from the deeper abyssal and the hadal zones. Moreover, the distribution of the genera was evaluated and the bipolar and amphiboreal distribution of the deep-sea fauna discussed. A new genus and species of an abyssal isopod was described and its systematic position discussed in detail by BIRSTEIN (1961).

Finally, MENZIES & TINKER (1960) described a single abyssal species of *Haploniscus* from the East Pacific and a short time ago MENZIES (1962b)[2] published his large work on the systematics of the abyssal isopod fauna of the Atlantic Ocean. The paper was based upon the remarkable results of 84 trawlings, carried out primarily by the *Vema*, and initiated by the Lamont Geological Observatory, New York. A total of 176, mainly abyssal species from the North and South Atlantic, including the Arctic Ocean and Caribbean Sea, are diagnosed; the majority, 159 species, are Asellota. Fifty-nine of the latter have been previously described; besides a short diagnosis, one or more of the original figures have

1. BELJAEV *et al.* (1958) recorded "isopods" from 10.415-10.687 m in the Tonga Trench and WOLFF (1960) "isopods" from 9995-10.002 m in the Kermadec Trench and 8980-9043 m in the New Britain Trench, in all three cases collected by the Soviet research vessel "*Vitjaz*".
2. Since the publication of this monograph was already anticipated by the Columbia University Press by June 1961, Dr. MENZIES kindly allowed me to go through the final proof on receiving it. Unfortunately, the publication was considerably postponed with the result that I have been unable to make full use of the important results brought about by that paper.

been traced. No less than 100 asellote species and 7 genera are new (1 sublittoral, 10 bathyal, and 89 abyssal species). This more than doubles the number of deep-sea species from the Atlantic. Keys are given to most of the species and genera dealt with. It is intended to publish the monograph in two parts, the second dealing with the zoogeographical, ecological, and phylogenetical relationships of the collections.

MATERIAL AND METHODS

The *Galathea* material of isopods was collected with various kinds of trawls, described by BRUUN (1959). The types of gear are recorded in the following paragraph. Both when using large otter trawls and sledge trawls, a canvas bag was attached to the cod end of the net in order to retain samples of ooze and the more minute animals. The bottom material was subsequently washed through sieves with a mesh diameter of 1 mm (occasionally $\frac{1}{2}$ mm). However, when making a comparison between the average size of isopods obtained by the *Galathea* and the *Vema* (MENZIES 1962b), it seems that the efficacy of this method may be questionable; the number of specimens measuring less than 2-3 mm being much smaller in the *Galathea* than in the *Vema* material. The latter was obtained by sorting the entire sample[1], which usually consisted of a quart of sediment and animals, under a binocular microscope. The samples were collected by a small trawl or dredge; the orifice was 1 m wide and 10 cm high and the bag was 3 m long and had a mesh diameter of only 0.5 mm. See WOLFF (1961, p. 155) on a discussion of the very variable results obtained with different types of gear within a limited area of the abyssal zone.

A total of 23 species of bathyal and abyssal asellotes (15 different genera) were collected by the *Galathea*. There were 83 specimens in all. No less than 15 species were represented by a single specimen only.

The isopods were sorted onboard the ship and preserved in 70 % alcohol as soon as I had taken notes of colour, etc.

Dissection during the working up was done under microscope while the specimens were immersed in ethylene glycol, which has a high viscosity. Small specimens were dissected on a microscope slide. As far as was possible, dissected mouthparts etc. were preserved in minute vials of alcohol instead of being mounted on slides, as the latter method prohibits a thorough study (especially of the mandibles), at a later date. Only the dissected parts of very small species were mounted (in Faure-Berlese medium, with a slight red staining of Lignin Pink to make the transparent parts visible).

1. This method was highly recommended by HULT (1941, p. 6).

Measurements were made with an ocular micrometer. Body lengths were measured from the anterior end of the frontal area (or projection, if present), to the posterior tip of the pleotelson, thus excluding the uropods. If spines reached beyond the posterior end of the pleotelson, the length was measured to the tips of the spines; in doubtful cases it is stated exactly what the measurement covers.

The descriptions are rather extensive, since I personally found detailed descriptions to be of great help during the study – and this not only for purely taxonomic reasons. Reasonably detailed descriptions are especially important in groups such as the asellotes, in which a satisfactory systematic division has not yet been reached. Diagnoses are applied in all cases where they were considered adequate. Attention has been paid to avoid repetition in inferior taxons, of characters which have already been covered in the diagnoses of the superior taxon(s).

Keys had been prepared to all genera dealt with prior to receiving the proof of Dr. MENZIES' paper (cf. above), which includes his keys to the majority of the same genera. The many new species he described have been included in my keys. These are worked out in such a way that each couplet, whenever practicable, is based on more than one character (preferably three) to make the use of the key more reliable. In addition, the use of characters such as legs, uropods, etc. have been avoided to the greatest possible extent, since these are very often lost in deep-sea material. Characters requiring dissection of mouthparts have only been applied when absolutely necessary. In several cases insufficient descriptions and illustrations, or the fragmentary condition of the specimen described, made it very difficult to incorporate such species in the key.

As in the paper on the hadal species (WOLFF 1956a), lectotypes have been selected in several of those species studied from the *Ingolf*, the *Challenger* and the American *Albatross* Expeditions.[1]

1. Throughout the *Vema* paper MENZIES (1962b) has selected type localities not only for the new species but also for all previously described Atlantic abyssal species mentioned. However, none of the old carcinologists (SARS, RICHARDSON, HANSEN, etc.) selected holo- and allotypes, and today

The illustrations consist of drawings and photographs. The former were made in pencil with the aid of a camera lucida and I later inked them in. A few of the drawings have been "shadowed" by the artist, Mr. POUL H. WINTHER. All drawings are based on the holotype when not otherwise stated. The photographs were included in cases where they were considered the best means of illustration and where it was found unnecessary to prepare time-consuming drawings of certain species. They were almost all taken by Mr. H. V. CHRISTENSEN.

Methods used for examining contents of intestines are explained on p. 239.

Records of bottom temperatures were obtained in the same way as for hadal isopods and tanaids (WOLFF 1956a, p. 86; 1956b, p. 188).

LIST BY STATION OF *GALATHEA* ASELLOTA

(Bathyal, abyssal, and hadal[1])

Abbreviation of gear used (cf. BRUUN 1959, p. 22): HOT: herring otter trawl; SOT: shrimp otter trawl; ST 300 and ST 600: sledge (Agassiz, Sigsbee) trawl, 3 m and 6 m wide; PGI 0.2: Petersen grab (bottom sampler) covering 0.2 sq. m.

Stations

52. Bay of Guinea (1°42'N, 7°51'E), 2550 m, *c.* 3.0°C., 30.XI.1950, SOT
    Janthura abyssicola n. gen., n. sp.; 1 ♂
241. Off Kenya (4°00'S, 41°27'E), 1510 m, *c.* 3.2°C., 15.III.1951, HOT
    Munnopsis mandibularis n. sp.; 1 ♀
435. Philippine Trench (10°20'N, 126°41'E), 9820-10.000 m, 2.6°C., 7.VIII.1951, ST 300
    Macrostylis galatheae Wolff; 2 ♀, 2 ♂
490. Bali Sea (5°25'S, 117°03'E), 545-570 m, *c.* 6.5°C., 14.IX.1951, ST 300
    Munnopsis bathyalis n. sp.; 2 ♀, 4 ♂
496. Banda Trench (5°36'S, 131°06'E), 7270 m, 3.6°C., 23.IX.1951, PGI 0.2
    Macrostylis hadalis Wolff; 1 ♀, 1 ♂
554. Great Australian Bight (37°28'S, 138°55'E). 1320-1340 m, *c.* 3.5°C., 5.XII.1951, ST 300
    Haploniscus helgei n. sp.; 9 ♀, 5 ♂
575. Tasman Sea (40°11'S, 163°35'E), 3710 m, *c.* 1.1°C., 19.XII.1951, SOT
    Ischnomesus anacanthus n. sp.; 1 ♀
    Ischnomesus sp.; 1 ♀
601. Tasman Sea (45°51'S, 164°32'E), 4400 m, *c.* 1.1°C., 14.I.1952, HOT
    Storthyngura abyssalis n. sp.; 2 ♀
    Munneurycope harrietae n. sp.; 2 ♂
    Bathyopsurus nybelini Nordenstam; 1 ♀
    Paropsurus giganteus n. gen., n. sp.; 1 ♀
602. Tasman Sea (43°58'S, 165°24'E), 4510 m, *c.* 1.1°C., 15.I.1952, ST 300
    Stenetrium abyssale n. sp.; 1 ♀
626. Tasman Sea (42°10'S, 170°10'E), 610 m, *c.* 7.6°C., 20.I.1952, HOT
    Mixomesus pellucidus n. gen., n. sp.; 1 ♀
639. Off E. New Zealand (37°31'S, 177°08'E), 213 m, *c.* 14.7°C., 26.I.1952, PGI 0.2
    Ilyarachna aspidophora n. sp.; 1 ♀
    Eurycope gibberifrons n. sp.; 1 ♂
650. Kermadec Trench (32°20'S, 176°54'W), 6620-6730 m, 1.3°C., 15.II.1952, ST 600
    Storthyngura benti Wolff; 1 ♀
    Storthyngura furcata Wolff; 1 ♀
    Storthyngura pulchra kermadecensis n. subsp., 5 ♀, 3 ♂
651. Kermadec Trench (32°10'S, 177°14'W), 6960-7000 m, 1.3°C., 16.II.1952, HOT
    Ischnomesus bruuni Wolff; 1 ♂
    Ischnomesus spärcki Wolff; 1 ♂
    Ilyarachna kermadecensis n. sp.; 3 ♀, 2 ♂
    Storthyngura benti Wolff; 18-21 ♀, 2-4 ♂
    Eurycope galatheae Wolff; 1 ♂, 1 spm.
    Eurycope madseni Wolff; 1 ♂
    Munneurycope menziesi n. sp.; 1 ♀
654. Kermadec Trench (32°10'S, 175°54'W), 5850-5900 m, 1.2°C., 18.II.1952, HOT
    Storthyngura benti Wolff; 1 ♀
    Storthyngura furcata Wolff; 3 ♀
    Bathyopsurus nybelini Nordenstam, 1 ♂
658. Kermadec Trench (35°51'S, 178°31'W), 6660-6770 m, 1.3°C., 20.II.1952, ST 600
    Ischnomesus spärcki Wolff; 1 ♂, 1 spm.
    Ilyarachna kermadecensis n. sp.; 2 ♂
    Storthyngura benti Wolff; 2 ♀, 3 ♂
    Storthyngura furcata Wolff; 2 ♀, 1 ♂

it is impossible to designate a type locality, except when the material on which the description was based originates from one locality only – or when a lectotype is selected from the original material. Since MENZIES has not seen any of the original material, he has been unable to select lectotypes. Moreover, while in the "Copenhagen Decisions" (HEMMING 1953) it was recommended (p. 27) that it should "be open to that taxonomist, acting as first reviser, to specify a restricted portion of the region or area cited by the original author to be the locality for the nominal species concerned" (provided that a holo- or lectotype was available), this paragraph was not entered in the Rules (1961 – as accepted by the Congress in London 1958) and is, therefore, now invalid.

1. The hadal species were treated in WOLFF 1956a.

661. Kermadec Trench (36°07'S, 178°32'W), 5230-5340 m, 1.1°C., 23.II.1952, ST 600
Dendromunna mirabile n. sp.; 1 ♀
Storthyngura benti Wolff; 1 ♀
663. Kermadec Trench (36°31'S, 178°38'W), 4410 m, 1.2°C., 24.II.1952, HOT
Ischnomesus birsteini n. sp.; 1 ♀
664. Kermadec Trench (36°34'S, 178°57'W), 4540 m, 1.1°C., 24.II.1952, HOT
Stenetrium abyssale n. sp.; 1 ♂
Haploniscus kermadecensis n. sp.; 1 ♂
Ilyarachna kermadecensis n. sp.; 1 ♀
716. East Pacific Ocean off Costa Rica (9°23'N, 89°32'W), 3570 m, *c.* 1.9°C., 6.V.1952, HOT
Ischnomesus planus n. sp.; 1 ♀
Ischnomesus roseus n. sp.; 1 ♀
Storthyngura pulchra pulchra (Hansen); 3 ♂
Paropsurus giganteus n. gen., n. sp.; 3 ♂
Munnopsis longiremis Richardson; 4 ♀, 33 ♂
724. Gulf of Panama (5°44'N, 79°20'W), 2950-3190 m, *c.* 2.0°C., 12.V.1952, ST 600
Storthyngura pulchra pulchra (Hansen); 1 ♀
Storthyngura serrata n. sp.; 1 ♀
726. Gulf of Panama (5°49'N, 78°52'W), 3270-3670 m, *c.* 2.0°C., 13.V.1952, HOT
Janira operculata n. sp.; 1 ♀
Ischnomesus roseus n. sp.; 1 ♀
Acanthocope galatheae n. sp.; 1 ♀
771. Bay of Biscay (47°48'N, 8°26'W), 1920 m, 3.4°C., 18.VI.1952, PGI 0.2
Eurycope complanata Bonnier; 1 ♂

III. TERMINOLOGY

Morphological terms

In a previous paper (1956b) I discussed certain aspects of the terminology of the external morphology of tanaids and isopods, i.a. adopting the spelling per*ae*on and per*ae*opod and introducing the words peraeonite and pleonite for the segments (somites) of the peraeon and the pleon. Subsequent comments and suggestions from other carcinologists have prompted the following remarks.

1. The spelling. As previously stated (l. c., p. 189) the words *pereion* and *pereiopod*[1] were introduced by SPENCE BATE (1856) who transcribed the Greek combining form (from the verb περαιόω) in this incorrect way. The right transcription should have been *paraeo-* according to the classical Latin rules or *pereo-* if transcribed in the mediëval-latinized form. Although at that time, I would have preferred the latter transcription, I concluded that since the form *pereon* had had practically no usage, it would be appropriate to adopt the spelling *peraeon* and *peraeopod.*

STEINBERG & DOUGHERTY (1957) discussed the same problem. They adopted the spelling *pereon* (and *pereopod)* in accordance with the – especially American-English – tendency to reduce the classical diphthong "æ" of Latin and "ai" of Greek to "e". But as mentioned above, this is also well in accordance with the mediëval latinizing of the Greek diphthong. As pointed out by STEINBERG & DOUGHERTY this spelling was already used by GURJANOVA (1951, p. 24) as respective Latin equivalents of the Russian переон and of переопод, and it has recently been adopted by several carcinologists, i.a. T. E. BOWMAN and J. L. BARNARD.

After much consideration I have also decided to use the spelling *pereon* and *pereopod* for the following reasons: (1) in contradistinction to *pereion* it is linguistically correct, and (2) it is shorter than both *pereion* and *peraeon.* On the other hand, I am well aware that *pereion* and *pereiopod* are at present the most commonly employed spellings, especially among British and French workers. Although I admit the importance of usage, it should be pointed out that both many older carcinologists (S.J. SMITH, STEBBING, CALMAN, etc.) and contemporary authors (i.a. LANG, MENZIES, HURLEY, BIRSTEIN, and K.H. BARNARD) use *peraeon* and *peraeopod.* Finally, the change from *pereion* and *peraeon* to *pereon* eliminates or reduces the risk that non-specialists might consider the two first versions unequivalent items.

2. Pereonite and pleonite. In 1957 STEINBERG & DOUGHERTY pointed out that they had previously (DOUGHERTY & STEINBERG 1953 and 1954), introduced the word *pereod* (then spelled *peraeod)* for segments of the pereon, and *pleod* for those of the pleon. The first word was construed "as derived from the Greek words περαιοῦν *(to bring across* – thence the combining form περαιο) and εἶδος *(figure, thing* – contracted to the suffix – ωδης, with its declensional ending dropped)" (l. c., p. 270).

1. Actually, SPENCE BATE in 1856 used the spelling *pereipoda;* in 1857 he modified it to *pereiopoda* and in 1859 he introduced for the first time the singular form *pereiopod.*

In a later letter Professor DOUGHERTY mentions that *pereonite* (or originally *peraeonite)* and *pleonite*, as proposed by me, are not based upon Anglicized Greek combining forms, but he adds that "all such points are perhaps trivial since modern neologisms in science are commonly made with indifference to classical rules, yet, fulfilling a need and thus becoming generally accepted, take a justified place in technical vocabularies". DOUGHERTY would prefer *pereod* and *pleod*, since they are shorter and simpler. But at the same time he admits that owing to their close similarity to the words *pereon* and *pleon*, there is an obvious danger of confounding them typographically.

In my opinion this latter objection is rather important. Moreover, the meaning of the original combination resulting in the word *pereod* can only be understood by those familiar with the Greek language. It also occurs to me that there is a certain danger in the words *pereod* and *pleod* being considered abbreviations of the words *pereopod* and *pleopod*.

Pereonite and *pleonite* have recently been adopted by i. a. BOWMAN, DELEMARE DEBOUTTEVILLE, CHAPPUIS, and LANG, but perhaps the matter should at some date be decided by a concensus of carcinological opinion, as suggested by Professor E. C. DOUGHERTY in the said letter.

3. The terms coxal plates, spines, etc. have been found preferable to epimeral plates, etc., since the former expressions can also be understood by non-specialists.

Oceanographical terms

Eulittoral: HEDGPETH (1957, p. 18) gave sound reasons for restricting the term "littoral" to "intertidal limits or seasonal changes in pose". In my discussion of the bathymetrical distribution of asellotes (see later) it was, however, impossible to distinguish between species occurring in the intertidal zone only and those living (also) at a depth of a few metres, since a considerable number of species were recorded as occurring "in shallow (or low) water", "close to the shore line", or from 0-1, 2, 3 or 4 m. Thus, in this paper, eulittoral is defined as including the tidal zone and the most shallow depths down to 3-4 m. Temperatures in boreal and polar regions are extremely varying.

Sublittoral: The shelf area from a few metres' depth to the edge of the continental slope. Generally (and also in this paper), with the lower limit set at about 200 m. Temperatures at higher latitudes somewhat varying. In the open ocean outside the polar region this zone includes the *thermosphere* with temperatures above about 10°C., divided into the *epipelagic zone* (as far down as sunlight penetrates during the day) and the continually dark *mesopelagic zone*, down to the discontinuity layer.

Bathyal: The continental slope between some 200 and 2000 m. The annual variations of temperature at the surface are only noticeable in the upper part of the bathyal zone. The temperatures are between about 10 and 4°C. Thus, in western subtropical and tropical areas the upper limit of the bathyal zone may be placed considerably deeper than 200 m and in the polar regions somewhat higher (cf. MADSEN 1961 b, p. 180). In the open ocean the *bathypelagic zone* is the upper part of the psychrosphere which has temperatures below about 10°C.

Abyssal: The vast regions of the deep-sea, at depths between about 2000[1] and 6000-7000 m, covering more than one-third of the surface of the globe. Except for polar regions where the temperature goes below zero, the range of temperature lies constantly between 1° and 4°C. Thus, the said depths in more enclosed areas such as the Mediterranean, the Sea of Japan, and the Sulu Sea are not included. Here one or more sills with considerably shallower depths prevent the temperature sinking below 4° at depths exceeding about 2000 m. In the free water masses the thermocline of about 4°C. divides the *abyssopelagic zone* from the bathypelagic above it.

Hadal: This term was first introduced by BRUUN (1956) for the greatest depth zone in the oceans, between 6000-7000 m and 11.000 m. The hitherto recorded temperatures vary between 1.2 and 3.6°C. (WOLFF 1960). The equivalent pelagic zone is termed *hadopelagic*. These terms are essentially synonymous with "*super-ozeanische Tiefe*" (Zenkevich 1954) and *ultra-abyssal* and *ultra-abyssopelagic* (BIRSTEIN *et al.* 1954, ZENKEVICH & BIRSTEIN 1956, and subsequent Russian authors). In connexion with VINOGRADOVA's introduction of an "upper-abyssal" and a "lower-abyssal subzone" (1958, 1959), it is suggested here that the term *hadal* is employed for future usage by all deep-sea biologists. This would avoid the obvious confusion of "lower-abyssal" and "ultra-abyssal". Moreover, since it has now been agreed that the latter zone is distinct and well defined (VINOGRADOVA, l. c.), it should "deserve" its own name, hadal, in accordance with the terms littoral, bathyal, and abyssal.

1. Although HEDGPETH (1957, pp. 21 and 23) defines the abyssal as the region below 2000-3000 m, his two diagrams (figs. 1 and 3) place the upper limit of the region at 4000 m.