I. INTRODUCTION

Among the five orders of the class Holothurioidea, the Elasipoda are unique in being confined to the deep sea, i. e. to depths exceeding 200–400 meters.

The four remaining orders (Aspidochirota, Molpadonia, Dendrochirota, and Apoda) all include sublittoral as well as deep-sea groups. These orders will be dealt with in subsequent volumes of the Galathea Report.

The Holothurioidea comprise about 1100 described species (Madsen 1954). Approximately 380 species belong to the deep sea.

Previous to the present revision, the Elasipoda comprised 171 species. Of these, 165 belonged to the benthic families Deimatidae, Laetmogonidae, Psychropotidae, and Elpidiidae, while the remaining six belonged to the pelagic family Pelagothuriidae. The present investigation deals with the four benthic families only. Eleven species are erected, while 18 previously described species are left out, being insufficiently described. The total number of recognized benthic species is reduced from 165 to 106.

In addition to the material brought home by the Galathea Expedition (1950–1952), the investigation also includes the Elasipoda taken during three collecting voyages of the late Dr. Th. Mortensen during the years 1913–1930.

The working up of this global material made necessary a comparison with the described materials from earlier deep-sea expeditions. With this purpose visits were paid to the museums of London, Amsterdam, Paris, Monaco, Washington, and Cambridge (Mass.).

The present work discusses all the 106 known species of benthic Elasipoda, 75 of which have been examined.

Among the many people who have contributed with aid and advice to the present work I owe a particular debt to the late Dr. Anton Fr. Bruun, the inspiring scientific leader of the Galathea Expedition, who gave me the opportunity to participate in the expedition and afterwards placed at my disposal the rich material of holothurians.

I am indebted to all my deep-sea colleagues in the Zoological Museum, of whom I may mention Dr. F. J. Madsen, curator of echinoderms, and Dr. T. Wolff, editor of the Galathea Report.

A number of echinoderm specialists have shown me a great helpfulness during my visits to foreign museums: Dr. G. Cherbonnier (Paris), Dr. Ailsa M. Clark (London), Professor H. Engel (Amsterdam), Professor H. B. Fell and Dr. Elisabeth Deichmann (Harvard), and Dr. D. L. Pawson (Washington). Dr. Johanne Kjennerud (Bergen) kindly sent specimens for re-examination.

The photographs in Pls. I–XII were made by Mr. G. Brovad.

The histological sections of the gonads shown in Pls. XIII and XIV were kindly prepared and photographed by Dr. J. Lützen and Mr. Kjeld Hansen, Institute of Comparative Anatomy, University of Copenhagen.

Most of the drawings, apart from the simple line drawings, were made by the late Poul H. Winther (PHW), while a few are due to Mrs. Lise Jersing (LJ) and Mrs. Julie Tesch (JT). The diagrams in Figs. 99–103 were made by Mr. E. Leenders.

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History of exploration

Descriptions of deep-sea holothurians are almost exclusively found in the reports from the various deep-sea expeditions. A review of these expeditions and of the work dealing with their collections of holothurians, therefore, is at the same time a history of exploration of this group.

The Challenger Expedition 1872–1876 founded the knowledge of the deep-sea holothurians, as well as that of most other deep-sea animal groups. The holothurians from this famous expedition were treated by Théel (1882, 1886 a) who erected the order Elasipoda, comprising 52 species. Only one of the species, *Elpidia glacialis,* was known before, described by the same author in an earlier paper (Théel 1876).

While the *Challenger* brought home material from the three main oceans, the subsequent deep-sea expeditions explored restricted regions.

The Norwegian North-Atlantic Expedition 1876–1878, with the research vessel *Vöringen,* explored the Norwegian Sea and the adjacent regions of the North Atlantic (Danielssen & Koren 1882). The genera *Irpa* and *Kolga* were erected on this material.

The *Ingolf* 1895–1896 explored the northernmost part of the North Atlantic and the southwestern part of the Norwegian Sea (Heding 1935, 1942). The *Godthaab* 1928 explored the West Greenland seas (Mortensen 1932).

The area investigated by the *Ingolf* is bordered to the south by a large unexplored area. Farther south, the North Atlantic has been explored by a number of expeditions. The eastern and central parts were explored by the *Travailleur* and the *Talisman* 1880–1883 (R. Perrier 1902) and by the expeditions of Prince Albert I of Monaco with the *Princesse Alice* and the *Hirondelle II* (von Marenzeller 1893a, Hérouard 1902, 1923). The Bay of Biscay by the *Caudan* 1895 (Koehler 1896). The western North Atlantic was covered by the *Albatross* 1893 (Verrill 1885), the *Blake* 1877–1880 (Théel 1886 b), and the *Atlantis* 1938–1939 (Deichmann 1940). The *Michael Sars* crossed the North Atlantic (Grieg 1921). The Swedish Deep-Sea Expedition 1947–1948 made a few deep-sea trawlings in the mid-Atlantic, including one at hadal depth (7625–7900 m) in the Puerto Rico Trench (Madsen 1953).

The German Deep-Sea Expedition 1898–1899 with the *Valdivia* explored the eastern South Atlantic, the Antarctic Ocean, and the Indian Ocean (Ludwig & Heding 1935, Heding 1940).

The *Investigator* 1887–1901 explored the Bay of Bengal and the Arabian Sea (Koehler & Vaney 1905). The *Siboga* 1899–1900 explored the Indonesian Seas (Sluiter 1901 b).

A number of expeditions with the *Albatross* explored regions of the Pacific Ocean; most of them were working close to the coasts: West coast of Central America 1891 (Ludwig 1894);

Hawaiian Islands 1902 (Fisher 1907); North Pacific coast of North America 1903 (Edwards 1907); Japan 1906 (Ohshima 1915, 1916–1919), and Baja California 1911 (Clark 1913, 1923 a). Only the expeditions 1899–1900 and 1903–1905 to the eastern Tropical Pacific had a number of stations far from the coast. The holothurians from the two last-mentioned expeditions were treated by H. L. Clark (1920).

The Antarctic Ocean was investigated, besides by the *Challenger* and the *Valdivia,* by the French Antarctic Expeditions 1903–1905 and 1908–1910 (Vaney 1906, 1914); the *Belgica* 1897–1899 (Hérouard 1906); the *Scotia* 1902–1904 (Vaney 1908); the Swedish Antarctic Expedition 1901–1903 (Ekman 1925); the German Antarctic Expedition 1901–1903 (Ekman 1927), and the *Eltanin* 1962–1964 (Agatep 1967 a, b).

Since 1949, Russian expeditions, in particular with the *Vitiaz,* have explored various parts of the world ocean. The holothurian genera *Myriotrochus* and *Elpidia* have so far been worked up (Belyaev 1970, 1971).

The degree of exploration of the different geographic regions (Figs. 107–108) is further considered in connection with the discussion of the geographic distribution of the species (p. 219).

The Galathea collections

The *Galathea,* like the *Challenger,* undertook a circumnavigation of the world. A special object was to explore the fauna of the deep-sea trenches – the fauna which Bruun (1956) termed the hadal fauna. Prior to the Galathea Expedition, this fauna was known only from one haul made by the Swedish Deep-Sea Expedition at 7625–7900 m in the Puerto Rico Trench.

The *Galathea* brought up benthic animals from 98 trawling and dredging stations at depths greater than 400 m, 83 of them exceeding 1000 m.

While holothurians were taken at only 7 of the 15 stations at depths of 400–1000 m, they were present at 79 of the 83 stations at depths greater than 1000 m. Three of the stations which did not yield holothurians were from hard bottom in the Indian Ocean off South Africa (depth: 4390–5340 m). The hauls made at two of the stations (175 and 178) failed almost totally, yielding very little benthic material. The third one (St. 182) brought up blocks of lava and a typical epifauna, especially of Bryozoa.

Only one soft-bottom trawling-station at depths exceeding 1000 m failed to bring up holothurians: St. 302 in the Bay of Bengal (depth: 1190 m, bottom: clay). The station yielded 51 bivalves and some other benthic invertebrates.

In addition to the exploration of the trenches, the *Galathea* concentrated on the exploration of the abyssal fauna, while the bathyal fauna was investigated to a more limited extent.

The equipment of the *Galathea* made possible the use of large fishing gear. Shrimp Otter Trawl (SOT) and Herring Otter Trawl (HOT) of the types used by Danish fishermen were used at great depths – the HOT at a depth down to 7160 m in the Sunda Trench. A 6 m wide Sledge Trawl (ST 600) was used down to 8210–8300 m in the Kermadec Trench, and a 3 m wide Sledge Trawl (ST 300) down to 10200 m in the Philippine Trench.

The *Galathea* collections, including the type specimens, are kept in the Zoological Museum of Copenhagen.

The advantage of large gear in catching holothurians

The large gear used by the *Galathea* brought up rich catches of the larger animals of the sea floor. But the wide meshes of the nets did not permit an effective collecting of the smaller ones. Groups of small-sized animals (e. g. Crustacea) are not represented in such proportions as to give a correct impression of their density on the sea floor.

Trawls with a large opening have a particular advantage in catching holothurians. Bathyscaphe observations have shown that many deep-sea holothurians are so buoyant that they may be swept off the bottom by the water movements caused by the sampling gear. Barham *et al.* (1967) relate, from a depth of 1060–1243 m in the San Diego Trough, that "the motion of the passing bathyscaphe sweeps *Scotoplanes* sp. off their feet and tumbles them around". They pointed to the remarkable fact that extensive grab-sample explorations in the same area (Hartman 1963, Hartman & Barnard 1958–1960) failed to bring up a single specimen of *Scotoplanes.* Apparently, *Scotoplanes* is so buoyant that it escapes the bottom grab.

Wolff (1971), during dives of the bathyscaphe *Archimède* to 4160 m off Madeira, observed a sausage-shaped holothurian (agreeing in shape

with *Benthodytes* and with some genera of the Aspidochirota) which, at the approach of the grab of the bathyscaphe, changed rapidly into a loaf-shape and, due to its buoyancy, escaped the grab.

The unfitness of small nets for catching these highly buoyant animals is illustrated by the fact that the haul made with the Herring Otter Trawl at the *Galathea* St. 716 (3570 m depth off Costa Rica showed a much greater dominance of holothurians than did the hauls with the small dredge (100 cm wide and 10 cm high) used by the *Vema* in the same area (Wolff 1961).

The poor representation of juvenile stages of holothurians (p. 182) may be due not only to the large mesh size of the gear used by the *Galathea*. Possibly, the holothurians of the deep sea are long-lived and spend a comparatively short period of their life as juveniles. In addition, the juveniles may be even more buoyant than the adult individuals, or they lead a semipelagic life. It is noteworthy that the smallest specimens taken belong to the genera *Elpidia,* of which the hadal forms, in particular, are heavily armoured, and to *Myriotrochus* which, in contrast to the Elasipoda, live buried in the substratum.

List by station of the Elasipoda collected by the Galathea

Abbreviations of gear: HOT: Herring Otter Trawl. SOT: Shrimp Otter Trawl. SBT: Shrimp Beam Trawl. ST 200, ST 300 and ST 600: Sledge (Agassiz, Sigsbee) Trawl, 2 m, 3 m, and 6 m wide.

Temperature records preceded by "c." are from closely situated stations.

For further information of the stations, see Bruun (1958) and Kiilerich (1964).

32. Monrovia–Takoradi (4°05'N, 2°13'W), 2100 m, 20.XI.1950, SBT
    Benthodytes lingua Perrier, 4
    Psychropotes depressa (Théel), 13
    Scotoplanes globosa Théel, 37
52. San Tomé–Cameroon (1°42'N, 7°51'E), 2550 m, muddy clay, c. 3.0° C., 30.XI.1950, SOT
    Psychropotes depressa (Théel), 5
    Peniagone diaphana (Théel), 3
63. Off Gabon (2°00'N, 9°14'E), 1520 m, blue clay, c. 3.8° C., 2.XII.1950, SOT
    Peniagone diaphana (Théel), 1
65. Off Gabon (2°17'S, 8°10'E), 2770 m, bluish clay, 3.0° C., 4.XII.1950, ST 300
    Psychropotes depressa (Théel), 2
186. Cape Town–Durban (32°33'S, 32°01'E), 3620 m, Globigerina ooze, 1.2° C., 31.I.1951, SOT
    Benthodytes plana n. sp., 1
    Benthodytes typica Théel, 4
190. Off Durban (29°42'S, 33°19'E), 2720 m, Globigerina ooze, 3.II.1951, ST 300
    Deima validum validum Théel, 2
    Benthodytes typica Théel, 2
192. Off Durban (32°00'S, 32°41'E), 3430 m (ST 300) and 3530 m (SOT), Globigerina ooze, 1.2° C., 5.II.1951
    Oneirophanta mutabilis mutabilis Théel, 3
    Benthodytes typica Théel, 5
    Psychropotes verrucosa (Ludwig), 1
193. Off Durban (32°34'S, 31°52'E), 3680 m, Globigerina ooze, 1.1° C., 6.II.1951, SOT
    Deima validum validum Théel, 5
217. Mozambique Channel (14°20'S, 45°09'E), 3390 m, Globigerina ooze, 1.6° C., 27.II.1951, HOT
    Deima validum validum Théel, 1
    Oneirophanta mutabilis mutabilis Théel, 1
    Benthodytes typica Théel, 24
    Psychropotes sp., 1
231. Madagascar–Mombasa (8°52'S, 49°25'E), 5020 m, 7.III.1951, ST 300
    Psychropotes belyaevi n. sp., 2
    Ellipinion solidum n. sp., 1
    Peniagone sp., 1
232. Madagascar–Mombasa (9°03'S, 49°22'E), 4930 m, c. 1.3° C., 8.III.1951, HOT
    Psychropotes belyaevi n. sp., 1
    Ellipinion solidum n. sp., 1
    Peniagone sp., 3
234. Madagascar–Mombasa (5°25'S, 47°09'E), 4820 m, Globigerina ooze, 10.III.1951, HOT
    Deima validum validum Théel, 7
    Psycheotrephes magna n. sp., 4
    Psychropotes belyaevi n. sp., 3
    Psychropotes verrucosa (Ludwig), 2
    Psychropotes longicauda Théel, 6
    Peniagone convexa n. sp., 1
235. Madagascar–Mombasa (4°47'S, 46°19'E), 4810 m, Globigerina ooze, c. 1.7° C., 11.III. 1951, HOT
    Deima validum validum Théel, 1
    Psychropotes belyaevi n. sp., 19

Psychropotes semperiana Théel, 4
Psychropotes longicauda Théel, 5

241. Off Kenya (4°00'S, 41°27'E), 1510 m, pure Globigerina, c. 4.3° C., 15.III.1951, HOT
Benthogone rosea Koehler, 1

279. Seychelles–Ceylon (1°00'N, 76°17'E), 4320 m, Globigerina ooze, 8.IV.1951, ST 300
Deima validum validum Théel, 2
Psychropotes semperiana Théel, 1

281. Seychelles–Ceylon (3°38'N, 78°15'E), 3310 m, Globigerina ooze, 10.IV.1951, ST 300
Deima validum validum Théel, 1
Benthodytes plana n. sp., 1
Benthodytes typica Théel, 1

282. Seychelles–Ceylon (5°32'N, 78°41'E), 4040 m, blackish mud, c. 1.4° C., 11.IV.1951, HOT
Benthodytes typica Théel, 1
Peniagone convexa n. sp., 1
Peniagone rigida (Théel), 1

299. Bay of Bengal (17°10'N, 84°30'E), 2820 m, mud, 24.IV.1951, HOT
Benthodytes typica Théel, 26
Psychropotes mirabilis n. sp., 1

314. Bay of Bengal (15°54'N, 90°17'E), 2600 m, brownish ooze, 3.V.1951, HOT
Benthodytes typica Théel, 1

324. Strait of Malacca (6°38'N, 96°00'E), 1140 m, brownish Globigerina ooze, 9.V.1951, ST 300
Benthogone fragilis (Koehler & Vaney), 1

435. Philippine Trench (10°20'N, 126°41'E), 9820–10000 m, very stiff clay, 2.6° C., 7.VIII. 1951, ST 300
Ellipinion galatheae (Hansen), 1

465. Sunda Trench (10°20'S, 109°55'E), 6900–7000 m, 1.5° C., 5.IX.1951, ST 300
Elpidia glacialis sundensis Hansen, 7

466. Sunda Trench (10°21'S, 110°12'E), 7160 m, bluish clay, c. 1.5° C., 6.IX.1951, HOT
Peniagone sp., 8
Amperima naresi (Théel), 114
Elpidia glacialis sundensis Hansen, c. 3000

474. Sunda Trench (9°49'S, 114°13'E), 3810–3840 m, 1.2° C., 11.IX.1951, ST 300
Benthodytes sp., 1

490. Bali Sea (5°25'S, 117°03'E), 545–570 m, sand and clay, c. 6.5° C., 14.IX.1951, ST 300
Orphnurgus glaber Walsh, 5

495. Banda Trench (5°26'S, 130°58'E), 7250–7290 m, clay, 3.6° C., 22.IX.1951, HOT
Benthodytes sanguinolenta Théel, 5
Psychropotes verrucosa (Ludwig), 3
Peniagone sp., 1

497. Banda Trench (5°18'S, 131°18'E), 6490–6650 m, soft clay, 23.IX.1951, HOT
Benthodytes sanguinolenta Théel, 3
Psychropotes verrucosa (Ludwig), 1

517. New Britain Trench (6°31'S, 153°58'E), 8940 m, clay, 13.X.1951, ST 300
Elpidia glacialis solomonensis Hansen, 14

521. New Britain Trench (5°59'S, 153°28'E), 8780–8830 m, clay, 16.X.1951, ST 200
Elpidia glacialis solomonensis Hansen, 63

550. Tasman Sea (31°27'S, 153°33'E), 4530 m, very stiff clay, c. 1.0° C., 12.XI.1951, ST 200
Deima validum validum Théel, 1

574. Tasman Sea (39°45'S, 159°39'E), 4670 m, 18.XII.1951, ST 600
Deima validum validum Théel, 1
Psychropotes verrucosa (Ludwig), 1
Peniagone diaphana (Théel), 2

575. Tasman Sea (40°11'S, 163°35'E), 3710 m, pteropod ooze, c. 1.1° C., 19.XII.1951, SOT
Benthodytes typica Théel, 21
Psychropotes verrucosa (Ludwig), 3

601. Tasman Sea (45°51'S, 164°32'E), 4400 m, Globigerina ooze, c. 1.1° C., 14.I.1952, HOT
Psychropotes longicauda Théel, 5

602. Tasman Sea (43°58'S, 165°24'E), 4510 m, bluish clay, c. 1.1° C., 15.I.1952, ST 300
Elpidia theeli Hansen, 14
Psychropotes verrucosa (Ludwig), 1

607. Tasman Sea (44°18'S, 166°46'E), 3580 m, clay, c. 1.3° C., 17.I.1952, HOT
Benthodytes sanguinolenta Théel, 2

626. Tasman Sea (42°10'S, 170°10'E), 610 m, Globigerina ooze, 20.I.1952, ST 300
Peniagone sp., 4 juveniles

649. Kermadec Trench (35°16'S, 178°40'W), 8210–8300 m, grey clay with pumice, 1.5° C., 14.II.1952, ST 600
Peniagone azorica von Marenzeller, 160
Elpidia glacialis kermadecensis Hansen, c. 1800

650. Kermadec Trench (32°20'S, 176°54'W), 6620–6730 m, brown clay with pumice, 1.3° C., 15.II.1952, ST 600
Apodogaster sp., c. 10
Peniagone azorica von Marenzeller, 260
Scotoplanes globosa Théel, 31
Elpidia glacialis kermadecensis Hansen, 1
Psychropotes verrucosa (Ludwig), 1

651. Kermadec Trench (32°10'S, 177°14'W), 6960–7000 m, brown clay with pumice, 1.3° C., 16.II.1952, HOT
Peniagone azorica von Marenzeller, 6

653. Kermadec Trench (32°09'S, 176°35'W), 6180 m, brown clay with pumice, 17.II.1952, HOT
Peniagone azorica von Marenzeller, 1
Scotoplanes globosa Théel, 1

654. Kermadec Trench (32°10'S, 175°54'W), 5850–5900 m, brown clay with pumice, 1.2° C., 18.II.1952, HOT
Oneirophanta mutabilis mutabilis Théel, 14
Apodogaster sp., 3
Peniagone azorica von Marenzeller, 11
Scotoplanes globosa Théel, 16

658. Kermadec Trench (35°51'S, 178°31'W), 6660–6770 m, brown sand with clay and stones, 1.3° C., 20.II.1952, ST 600
Peniagone azorica von Marenzeller, c. 600
Peniagone sp., 1
Scotoplanes globosa Théel, 17

661. Kermadec Trench (36°07'S, 178°32'W), 5230–5340 m, pumice in abundance, 1.1° C., 23.II.1952, ST 600
Peniagone azorica von Marenzeller, 60
Ellipinion sp., 3

663. Kermadec Trench (36°31'S, 178°38'W), 4410 m, brown sandy clay with pumice, 1.2° C., 24.II.1952, HOT
Oneirophanta mutabilis mutabilis Théel, 1
Apodogaster sp., 6
Laetmogone wyvillethomsoni Théel, 1
Benthodytes sanguinolenta Théel, 1
Psycheotrephes magna n. sp., 3
Psychropotes longicauda Théel, 14
Psychropotes loveni Théel, 1
Peniagone humilis n. sp., 1
Peniagone azorica von Marenzeller, 267
Achlyonice ecalcarea Théel, 1
Ellipinion bucephalum n. sp., 1
Scotoplanes globosa Théel, 5

664. Kermadec Trench (36°34'S, 178°57'W), 4540 m, brown sandy clay with pumice, 1.1° C., 24.II.1952, HOT
Oneirophanta mutabilis mutabilis Théel, 5
Oneirophanta setigera (Ludwig), 1
Apodogaster sp., 1
Benthodytes sp., 1
Psychropotes longicauda Théel, 33
Peniagone azorica von Marenzeller, 179

665. Kermadec Trench (36°38'S, 178°21'E), 2470 m, grey clay, 2.1° C., 25.II.1952, HOT
Benthodytes sp., 1
Scotoplanes globosa Théel, 1

668. Kermadec Trench (36°23'S, 177°41'E), 2640 m, clay, 2.0° C., 29.II.1952, HOT
Deima validum validum Théel, 1
Benthodytes typica Théel, 1
Psychropotes loveni Théel, 2
Peniagone azorica von Marenzeller, 5
Amperima robusta (Théel), 1
Scotoplanes globosa Théel, 66

716. Acapulco–Panama (9°23'N, 89°32'W), 3570 m, dark muddish clay, c. 1.9° C., 6.V. 1952, HOT
Oneirophanta mutabilis affinis Ludwig, 30
Benthodytes incerta Ludwig, 16
Benthodytes sanguinolenta Théel, 1
Psychropotes longicauda Théel, 5
Peniagone papillata n. sp., 41
Peniagone vitrea Théel, 1
Scotoplanes clarki n. sp., c. 100

724. Gulf of Panama (5°44'N, 79°20'W), 2950–3190 m, dark clay and stones, c. 2.0° C., 12. V.1952, ST 600
Apodogaster sp., 1

726. Gulf of Panama (5°49'N, 78°52'W), 3270–3670 m, clay, c. 2.0° C., 13.V.1952, HOT
Oneirophanta mutabilis affinis Ludwig, 1
Oneirophanta setigera (Ludwig), 1
Benthodytes typica Théel, 1

739. Gulf of Panama (7°22'N, 79°32'W), 915–975 m, green clay, c. 5° C., 15.V.1952, HOT
Pannychia moseleyi Théel, 13

758. Puerto Rico Trench (18°45'N, 66°27'W), 2840 m, c. 3–4° C., 30.V.1952, ST 600
Benthodytes typica Théel, 3

List by station of the Elasipoda collected by Dr. Th. Mortensen

The Pacific Expedition 1913–1916

27.III.1914. 15 miles W. 1/2 S. of Jolo (Philippines), 458 m, soft bottom
Orphnurgus glaber Walsh, 3

10.VI.1914. Sagami Bay (Japan), 450 m
Laetmogone fimbriata (Sluiter), 5

2.VII.1914. Sagami Bay (Japan), 732 m
Laetmogone maculata (Théel), 1
Laetmogone fimbriata (Sluiter), 2

15.IX.1914. N.E. of Tasmania (39°10'S, 149°55'E), 366–458 m, soft bottom
Laetmogone maculata (Théel), 9
16.IX.1914. N.E. of Tasmania (38°12'S, 149°40'E), 183–293 m
Laetmogone maculata (Théel), 1

The Danish Expedition to the Kei Islands 1922 (cf. Mortensen 1923)

St. 41. Kei Islands (5°29'S, 132°28'E), 245 m, mud
Orphnurgus glaber Walsh, 1
Laetmogone maculata (Théel), 1
Laetmogone fimbriata (Sluiter), 1
St. 42. Kei Islands (5°35'S, 132°29'E), 225 m
Laetmogone maculata (Théel), 1
St. 51. Kei Islands (5°46'S, 132°51'E), 348 m, mud
Orphnurgus glaber Walsh, 1
St. 52. Kei Islands (5°46'S, 132°50'E), 352 m
Orphnurgus glaber Walsh, 1
St. 56. Kei Islands (5°31'S, 132°51'E), 345 m
Orphnurgus glaber Walsh, 1

The Java – South Africa Expedition 1929–1930

St. 25. Off Durban (29°56'S, 31°19'E), 412 m, sandy mud
Laetmogone fimbriata (Sluiter), 10
St. 78. Off St. Helena (8 miles W. by N. of Sugarloaf), 2400–2780 m (collected by the *Dana*)
Achlyonice ecalcarea Théel, 1

In addition, seven specimens of *Benthodytes lingua* R.Perrier from South Africa, probably originating from The Java–South Africa Expedition, are described in the present work.

Re-examined material

A re-examination was made of the collections in the following museums:

The British Museum (Natural History). The greater part of the *Challenger* collections are kept here, although a number of specimens from this expedition were distributed to other museums (Amsterdam, Copenhagen, Paris).

The Zoological Museum, Amsterdam. The *Siboga* holothurians are kept here, in a fine state of preservation.

The Muséum National d'Histoire Naturelle, Paris, keeps the complete collections of the *Travailleur* and the *Talisman*. Unfortunately, the specimens are in a rather poor state as regards their external morphology. The deposits, however, are well preserved in most of them.

The Musée Océanographique de Monaco keeps the collections made by the *Princesse Alice* and the *Hirondelle II*.

The Zoological Museum, University of Copenhagen. In addition to the collections from the *Galathea* and from Dr. Mortensen's expeditions this museum keeps the collections made by the *Ingolf* and the *Godthaab*. The holothurians of the German Deep-Sea Expedition *(Valdivia)* are also at the present time kept in Copenhagen.

The Museum of Comparative Zoology, Cambridge (Massachusetts), keeps the *Blake* and a smaller part of the *Albatross* collections.

The United States National Museum, Washington, keeps the greater part of the collections from the various expeditions of the *Albatross*. However, the holothurians obtained during the Japanese cruise (Ohshima 1915, 1916–1919) seem to be almost entirely lost.

In the above-mentioned seven museums are stored the greater part of the previously described material of deep-sea holothurians.

The re-examination of the specimens in the museums mentioned concerned the external morphology, while skin samples had to be taken to the Zoological Museum of Copenhagen for an examination of the deposits. For this reason the revision of the materials did not include the selection of lectotypes, despite the fact that type specimens were usually not selected by the original authors. Whenever a specimen was found to be labelled "Type", it has been stated here.

Abbreviations of museum names

BM: British Museum (Natural History), London
MCZ: Museum of Comparative Zoology, Cambridge, Massachusetts
MNHN: Muséum National d'Histoire Naturelle, Paris
MOM: Musée Océanographique, Monaco
USNM: United States National Museum, Washington, D.C.
ZMA: Zoological Museum, Amsterdam
ZMUC: Zoological Museum, University of Copenhagen

Methods of examination

In order to state the variation of the taxonomic characters all available specimens of each species were as a rule examined. The taxonomically important calcareous deposits (p. 182) were examined in about 1200 specimens, representing 75 species and originating from the *Galathea* as well as from previous expeditions. The examination was made by means of slide preparations of the dorsal and ventral skin, and usually also of a tentacle, a tubefoot, and a papilla. The deposits of the internal organs are less important taxonomically, and were not examined in all species. The preparations were made by dehydrating a piece of skin in absolute alcohol, with subsequent clearing in xylene and mounting in Canada balsam. The preparations are all kept in the Zoological Museum of Copenhagen.

Permanent mounts for deposit studies are of the greatest importance, when the variation of the deposits and the synonymy of the species are investigated.

The *Galathea* specimens were preserved on board in 4 % formalin neutralized with borax, or in 70 % alcohol. The former specimens were transferred to 70 % alcohol after the return of the expedition. The calcareous deposits are well preserved in practically all the specimens. Unneutralized formalin dissolves the deposits and should never be used for specimens to be studied taxonomically. When specimens are fixed for histological investigations, the borax should be replaced by $CaCO_3$ to avoid maceration of the tissues.

Specimens first kept in formalin in some instances proved to have retained their natural shape better than specimens transferred directly to alcohol. Thus, in *Scotoplanes globosa* the marginal lobes on the tentacle discs were visible only in specimens which had been through formalin.

II. SYSTEMATIC PART

Order Elasipoda Théel, 1882

Diagnosis: Mesentery with dorsal attachment throughout its length. Respiratory trees absent.
Remarks: The taxonomy and relationship of the Elasipoda, including the basis of the proposed division of the order into two suborders, are discussed in the General Part (pp. 206–207).

Key to the suborders

1. Deposits perforated plates, spatulated crosses, rods, or wheels ..... Deimatina (p. 14)
1. Deposits, when present, primary crosses (or primary cross derivatives) with arrested development of dichotomous divisions ..... Psychropotina (p. 75)

Suborder Deimatina nov. subordo

Diagnosis: Deposits perforated plates (or derivatives from these) or wheels; no primary crosses with arrested development of dichotomous divisions. Papillae usually numerous and large.

Key to the families

1. Deposits perforated plates, spatulated crosses, and spatulated rods, or transformed into spindle-shaped, rounded, or amorphous bodies. Wheels absent. Each gonad composed of a single cluster of unbranched sacs ..... Deimatidae (p. 15)
1. Deposits wheels. In addition only scattered rods, or (in *Laetmogone violacea)* spinous crosses occur. Each gonad composed of numerous branched ducts and tubules ..... Laetmogonidae (p. 47)