

# ON TWO BATHYPELAGIC HOLOTHURIANS FROM THE SOUTH CHINA SEA

*Galatheathuria* n. g. *aspera* (Théel) and *Eynpniastes globosa* n. sp.

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The Echinoderms are almost all benthonic in their adult stage. The Comatulidae, or Feather-Stars, are able to swim up from their resting place by alternating up- and downwards movements of their arms, and also some Holothurians may swim freely over the bottom; but these animals all the same belong to the bottom fauna. Only one group of Echinoderms, the Pelagothuridae within the Holothurioidea, are known to live a pelagic life.

In the literature also two fossils have been recorded as pelagic Holothurians, but erroneously. The one, *Lorenzina*, SIMONELLI 1906, Bologna Mem. Acc. Sc. 1905 (6) 2, is a Medusa, the other, *Eldonia*, WALCOTT 1911, Smiths. Misc. Coll. 57, 3, is a Siphonophore (MADSEN, in press).

The bathypelagic Holothurians, comprising the two genera *Pelagothuria* and *Eynpniastes* (= *Planktothuria*), are gelatinous Medusa-like creatures without calcareous skeleton. *Pelagothuria* has a small body with a large swimming brim which almost surrounds its mouth and by means of which it floats in the deep-sea with the mouth upwards, now and then gently flapping the brim against the body. *Eynpniastes* (*Planktothuria*), on the other hand, is buoyant by means of a very thick gelatinous body-wall in which its papillae are almost concealed. These two forms may perhaps be ranged in the order of Elasipoda and are probably neotenic, but further investigations are needed for establishing with certainty their systematic position.

HÉROUARD noted in 1923 (Monaco Res. 66, p. 97) that the swimming brim of CHUN's *Pelagothuria*, contrary to CHUN's opinion, does not comprise the ventral radius, and HEDING stated in 1950 (Zool. Anz. 145) that also specimens of *Pelagothuria* from the type-locality of LUDWIG's *P. natatrix* had an open swimming brim. Examinations of fresh specimens onboard the Galathea enabled us to confirm that in *Pelagothuria* this brim really is a very enlarged laterodorsal veil, comparable to that found

in many bottom Elasipods, and that the hitherto published figures of *Pelagothuria* are artistic reconstructions.

A power of swimming freely over the bottom is known, as said above, for some other Holothurians. It was first observed by M. SARS in his *Stichopus natans* (*Bathyplores* n.) which is a rather solid Holothurian, in outer appearance much like a shallow water *Holothuria* s. str. SARS's description of the remarkable phenomenon was given in the Norwegian language and we think it worth while therefore to repeat it here in translation. SARS says (Vidensk. Selsk. Forhandl. 1867, p. 4): "The most remarkable feature of the present animal, by which it differs from all other hitherto known Holothurians, is its ability to rise from the bottom and perform swimming movements. These take place as in leeches and certain planarians by powerful and quick snake-like bends of the body, and this in up and down directions (no side-bends) almost in the shape of an S."

A note on swimming Holothurians is also found e. g. in GILCHRIST's paper of 1920 (Quart. J. Micr. Sc. 64). GILCHRIST says that "It has been observed . . . that some of the Holothurians procured in deep water off the South African coasts have the power of swimming about freely in the water by an undulatory movement of the body", and "Probably such deep-sea Holothurians do not bury themselves in the soft mud of the floor of the ocean, but flit more or less readily over its surface."

Probably a power of swimming, though often awkward, may be attributed to a considerable number of Holothurians of the family Psychropotidae within the order Elasipoda and of the genera *Bathyplores* and *Paelopatides* within the Synallactidae of the order Aspidochirota. These Holothurians have an elongate and flattened body with powerful longitudinal muscles, and the body is also often surrounded by a lateral brim, which may facilitate



Fig. 1. The content of the trawl from the pelagic haul made by the Galathea in the South China Sea at an estimated fishing depth of 3400-3800 m. *Eynpiastes globosa* n. sp. floats in the tub. *Galatheathuria aspera* (Théel) is lifted up with the oral side upwards.

swimming, though its primary function probably is to offer a larger surface for resting on the soft mud.

Most Psychropotids and species of *Paelopatides* are of a violet colour and often with the ventral side the darker. In a posthumous paper of 1938 by ÖSTERGREN (Studien über die Seewalzen, Göteborgs Vetensk. och Vitterh. Samh. Handl. (5) B. 8, p. 89) some remarks on this characteristic are found which we repeat here in translation, but do not comment on. ÖSTERGREN says: "In the depths where these animals live, no sunray penetrates. The bottom reflects more or less the light produced by the phosphorescent animals, but the water, on the contrary, does not. The dorsal side of the Holothurian must reflect the light just as much as does the bottom, if the animal should not be discerned from above, whereas, when the animal swims over the bottom, the ventral side must absorb the light as completely as possible if the animal should be concealed also from enemies coming from below."

With reference to these introductory remarks it can be understood that from an echinodermological point of view the pelagic haul made by the Galathea Expedition, July 1951, in the South China Sea with a triangular otter trawl of a spread of 13 m was a great success since it gave these two remarkable

animals: A record-sized Pelagothurid of about 25 cm in diameter, and a cushion-shaped animal unlike any pelagic animal hitherto known and only by a closer examination recognized as a Holothurian, of the species *Paelopatides aspera* Théel 1886 which we, however, consider to represent a new genus: *Galatheathuria*.

#### ***Galatheathuria* nov. gen.**

Large free-swimming Holothurian (Family Synalactidae within the order of Aspidochirota). Body broad oval, divided into a main body with a lateral brim (by undulations of which the animal is supposed to swim) and a head-like fore-end without a swimming brim. Mouth central on the ventral side of the fore-end. Tentacles rather dendritic and completely retractile. Anus dorsal posteriorly. Mid-ventral radius with a few pairs of pedicels posteriorly. Some very small papillae in each dorsal radius. Respiratory trees present. Calcareous bodies: Simple crosses with a high central projection. Genotype: *Paelopatides aspera* Théel 1886.

The new genus is most nearly related to *Paelopatides* in which the only known species, *G. aspera*, was also placed by THÉEL when it was first described. *Gala-*

*theathuria* is distinguished from *Paelopatides*, however, by the development of a distinct head-like fore-end and by the calcareous bodies which are crosses with a high central projection, as otherwise typical of the Psychropotidae within the Elaspoda. The sclerites of *Paelopatides*, if present at all, are usually rods or three-armed bodies; in a few species, however, four-armed bodies occur, but these are of the usual synallactid type with the ends of the arms enlarged and provided with a varying number of holes.

***Galatheathuria aspera* (Théel 1886)**

Pl. I, 1-3

*Pelopatides aspera* THÉEL 1886, p. 157, pl. X, 13.

The single specimen described here was collected at the Galathea st. 407 in the South China Sea, 12°10' N., 114°56' E., depth 4500 m. It was caught in a pelagic trawl with an estimated fishing depth of 3400-3800 m.

In addition four specimens of this species were taken by the Galathea in the Bay of Bengal at st. 314, 15°54' N., 90°17' E., depth 2580-2610 m. But since they were caught in a bottom trawl they are not as finely preserved as the specimen from the South China Sea. These specimens will be described later in the Galathea Reports.

The specimen from the South China Sea measures 22.5 cm in length and, inclusive of the lateral brim, 15 cm where broadest. It was about 6 cm high when caught, but in the present preserved state, with its turgor lost, it is completely flat. The ventral side was much more vaulted than the dorsal side. The length of the head-like fore-end is about 6 cm. The whole main body is provided with a 10-12 mm broad lateral brim continuing round the posterior end and reaching about 3 cm inwards over the fore-end. The lateral brim includes on either side 13 and 14 papillae respectively, which give the brim a slightly dented margin. The dorsal surface is of a uniform appearance, with 6 small and slender, very indistinct papillae, up to 4 mm long, evenly distributed along each of the dorsal ambulacra. The anus is indicated by a small hole in the dorsal midline about 1 cm from the posterior end. The head-like fore-end, which is somewhat broader than long, bears the mouth centrally on the ventral side. The fore-end has no swimming brim or lateral papillae, but along the edge there is a very narrow rim. On the ventral side of the head a 1.5 cm, or more, broad marginal zone with faint radiating

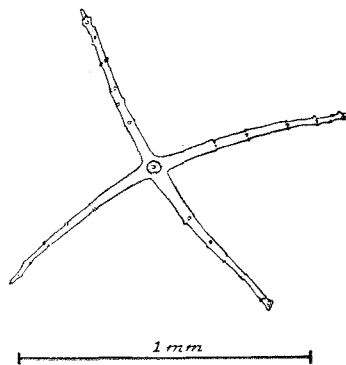


Fig. 2. *Galatheathuria aspera* (Théel).  
Sclerite from the bodywall.

furrows is marked off indistinctly from the rest of the oral surface. Most posteriorly on the main body there are 5 pairs of small midventral pedicels.

The tentacles were completely retracted and we have judged it inexpedient to dissect the unique animal in order to state their number, but one tentacle was extruded and found to be dendritic, not at all shield-shaped as is usual in the Aspidochirota and Elaspoda. Perhaps the dendritic shape is correlated with the free-swimming life of the animal; also *Pelagothuria* has tentacles which are not of the usual type, but more dendritic.

A cut in the posterior end of the animal made it possible to state that respiratory trees were present as in other Aspidochirota. The sclerites, as mentioned above, point, however, rather to the Elaspoda.

The body wall is densely provided with cross-shaped sclerites with long, slender, slightly inwardly bent arms and a central projection, which reaches into a small protuberance of the body wall. This gives the whole surface of the animal a curious shagreen-like character. The largest crosses have arms about 0.7 mm long and central projections about 0.3 mm high, but most sclerites are somewhat smaller. The arms and the spire are provided with some small spines, which are mostly placed in a few transverse rows. The sclerites are alike in the dorsal and ventral body wall, but are very small in the oral area. Sclerites with 5 arms occur scatteredly.

We have referred the present specimen to the species *aspera* erected by THÉEL 1886 (Challenger Rep. 14, pt. 39, p. 157) for a specimen collected by the Challenger in the Philippine Sea, 12°21' N., 122°15' E., depth 1320 m, a locality very near the Galathea st. 407. THÉEL's specimen was 12.5 cm long and 7.5 cm broad, thus half as long as the present

one; its colour in alcohol was a dark brownish-violet, and the present specimen is likewise dark violet in alcohol (darker in this state than when caught). When one reads THÉEL's description it is not immediately clear that he is describing the species to which the present specimen belongs. The anterior part of the body was surrounded by a broad brim, forming "a large transverse lobe", which was not continuous with the brim round the main body. This brim was formed by the "very thick sides of the body", the margin of it being much thinner, and this margin "may strictly be considered as the true brim". A comparison of the present specimen in the preserved state with the specimen described by THÉEL gives, however, the clue to his description. The margin of the head, corresponding to the marginal zone which is visible on the ventral side in the living animal, is now rather lobe-like after the collapse of the animal. The margin of the main body, on the contrary, is hardly to be discerned from the body itself. Obviously, the part of the brim which was formed by the thick sides of the body in THÉEL's specimen, and not the margin of it, was the true brim. There can be no doubt that he had before him the same species as we, since also his description of the sclerites agrees with those of the present specimen. Their characteristic feature, the small spines in transverse rows, seems, however, somewhat exaggerated in his figure (pl. X, 13). The enlarged ends of the arms in THÉEL's figure are probably due to a misinterpretation: The arms are in fact pointed, but the points are often broken off just distal to a ring of spines; thus the arms seem to terminate in a bunch of spines.

The colour of the present animal in a fresh state was a dark violet, indicating that it came from the abyssal part of the ocean. It is evident from the find, that the animal may swim up high over the bottom; but maybe it does so only more occasionally, otherwise resting on the bottom. The animal at least does not live entirely in the free water, since we found in the intestine some sand-incrusted foraminiferans of two types, some other bottom foraminiferans, sponge spicules, and various chitinous fragments, though also some remains of the pelagic *Coscinodiscus*, some radiolarians, and some *Globigerina*.

EKMAN (Zool. Jahrb. 47, 1925, p. 525) likewise found bottom material in the rectum of one of THÉEL's specimens of *Enypniastes eximia*, indicating that this species also is to some degree dependent on the bottom.

Though *Galatheathuria* may spend much time on the bottom, it nevertheless seems to be better suited for active swimming than any other described Holothurian: It also floated in the tub where it was put after the capture. The swimming of *Galatheathuria* no doubt takes place by undulations of the lateral brim, similar to the way of swimming of the cuttlefish *Sepia*. There is, indeed, much similarity in the general shape of these two quite unrelated animals.

#### ***Enypniastes globosa* n. sp.**

Pl. I, 4-5

The said pelagic haul in the South China Sea also yielded a very large Medusa-like Pelagothurid of the genus *Enypniastes*, about 25 cm in diameter, which is record size for such animals. The specimen was in a beautiful condition when caught, as illustrated by the photographs, and showed still some signs of life, the tentacles reacting by faint contractions when pinched. In the tub it floated with the mouth upwards.

It represents probably a new species which may be diagnosed as follows: Pelagic Holothurian of the genus *Enypniastes*, of large size and with an almost globular body, and with a tentacle crown covering almost the whole ventral side. Anus subdorsal. Anteriorly, a wreath of 12 large, dorsolateral papillae, and behind this wreath 3 pairs of small dorsal papillae. On the posterior half of the body 9 pairs of ventro-lateral papillae, of which the posterior 6 are distinctly smaller than the 3 anterior ones.

Type-locality: Galathea st. 407, South China Sea, 12°10' N., 114°56' E., depth 4500 m, estimated fishing depth 3400-3800 m. Since the animal was still alive some time after being taken, it was probably not caught at the estimated fishing depth of the trawl, but nearer the surface.

The type is preserved in the Zoological Museum of Copenhagen.

In a recent paper on the pelagi Holothurians HEDING (Zool. Anz. 145, 1950) discussed the synonymics of the species of *Enypniastces*, *Euriplastes*, and *Planktothuria*. He is undoubtedly right in regarding the two latter genera as synonyms of *Enypniastes*, but it seems rather improbable that he is right when he lumps all the described forms together into two species, *E. eximia* Théel and *E. ecalcareo* (Sluiter). Moreover, the two species, as defined by HEDING, apparently can not be distinguished; according to HEDING *eximia* should be distinguished by a larger number of dorsal papillae, but an exam-

ination of the literature shows that this is not true. Maybe, even more species than recognized in the literature ought to have been erected. The *eximia* of THÉEL (Chall. Rep. 4, pt. 13, 1882, pl. VIII, 6-7), of SLUITER (Siboga-Expeditie, 44, 1901, pl. II, 8-9), and of MITSUKURI (J. Coll. Sc. Tokyo Imp. Univ. 29, 1912, pl. VII, 59-60) are possibly three different species.

In regard to the large tentacle crown the present specimen most resembles *E. eximia* as portrayed by SLUITER, though in this species, which was taken by the Siboga at the Moluccas at a depth of 567 m, the tentacle crown extends to only half the ventral side. Another similarity is shown by the ventro-lateral papillae which also in SLUITER's specimens are of two types, the posterior 8 pairs being shorter than the anterior 5 pairs. But, apart from the different number, the papillae in *E. globosa* differ from those of SLUITER's specimens in being confined to the posterior half of the body, whereas they extend along the whole length of the body in SLUITER's specimens.

The present specimen had the oral side flattened, with the mouth almost central and surrounded by 19 tentacles of which the anterior 12 are subequal

and up to about 9 cm long, whereas the posterior 7, likewise subequal, are less than half as long. This segregation of the tentacles in long and short ones is perhaps a good distinguishing character of the species. The tentacles end in a fringed disc following a slender neck and are similar to those described and portrayed by MITSUKURI for *E. eximia*. The oral disc and the tentacles are light brownish with the head of the tentacles somewhat darker; otherwise the animal is light bluish, transparent. The 12 dorsolateral papillae of the anterior wreath are up to 7 cm in length, and the 3 pairs of dorsal papillae are about 1 cm long. Of the 9 pairs of ventro-lateral papillae the 6 posterior ones are subequal, conical, up to about 1.5 cm long, whereas the 3 anterior ones are stouter, cylindrical, up to about 5 cm long.

The globular shape of the animal, by which it differs from all the hitherto known species of the genus, is mostly due to the gelatinous tissue of the body wall, whereas the body itself is more oblong. In this gelatinous coat the papillae are almost completely imbedded; only 2-3 cm of the large dorso-lateral papillae and the tips of the long posterior papillae are free.

