

ANTIPATHARIA

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ABSTRACT

The material of antipatharians collected by the Galathea Expedition is not very large and numbers only 5 species. It is nevertheless of considerable interest as the antipatharians belong to a group of rare deep-sea invertebrates, new records of which provide valuable contributions to our knowledge of the composition and main pattern of the distribution of deep-sea benthos.

Two species are new to science; one of these belongs to the genus *Bathypathes*, which includes mainly deep-sea species, and the other is provisionally described as a new species of the genus *Parantipathes*. Numerous stems, without polyps, of *Stichopathes variabilis* were also present, but as will be shown below, these were evidently washed away from the off-shore shallow-water zone and are not to be referred to the deep-sea fauna of antipatharians.

Bathypathes Brook, 1889

Bathypathes Brook, 1889, p. 151.

Schizopathes Brook, 1889, p. 148.

Bathypathes (*Schizopathes*), Pesch 1914, p. 27.

Bathypathes (*Eubathypathes*), Pesch 1914, p. 29.

The genus *Bathypathes* contains antipatharians with pinnate or plumose colonies consisting of a straight or curved (in sagittal plane) main stem and numerous branches placed in two or more longitudinal rows and sometimes bearing pinnulae. The spines, which are wholly concealed in the soft tissues, are triangular, smooth and arranged in 3-10 longitudinal rows, in quincunx, spiral, or occasionally irregular distribution. There are three pairs of tentacles. Polyps have peristomial folds. Each ovum has its own mesogloal chamber. The study of new

materials confirmed the absence of taxonomical differences between the colonies of *B. patula* attached to the foreign bodies by a dilated base and *B. (Schizopathes) affinis*, whose base is free and hooked. Thus the taxonomic category *Schizopathes* has to be rejected.

Bathypathes patula Brook, 1889 (emend.)

(Fig. 1)

Schizopathes crassa Brook, 1889, p. 147.

Schizopathes affinis Brook, 1889, p. 148.

Bathypathes patula Brook, 1889, p. 151.

Bathypathes patula var. *plenispina* Brook, 1889, p. 152.

Bathypathes alternata Brook, 1889, p. 153.

Bathypathes erotema Schultze, 1902, p. 98.

Bathypathes (*Eubathypathes*) *patula*, Pesch 1914, p. 29.

Material:

St. 190, off S. E. Africa (29°42'S, 33°19'E), 2720 m, globigerina ooze, c. 2.4°C. - 5 specimens.

St. 217, Mozambique Channel (14°20'S, 45°09'E), 3390 m, globigerina ooze, 1.6°C. - 2 specimens + fragments.

St. 232, off East Africa (9°03'S, 49°22'E), 4930 m, c. 1.3°C. - 1 specimen.

St. 453, Makassar Strait (3°56'S, 118°26'E), 2000 m, greenish clay, 3.6°C. - 3 specimens, juv.

St. 574, Tasman Sea (39°45'S, 159°39'E), 4670 m, c. 1.1°C. - 48 specimens + fragments.

St. 664, Kermadec Trench (36°34'S, 178°57'W), 4540 m, brown sandy clay with pumice, 1.1°C. - 3 specimens.

St. 716, Central East Pacific (9°23'N, 89°32'W), 3570 m, dark, muddish clay, c. 1.9°C. - 7 specimens.

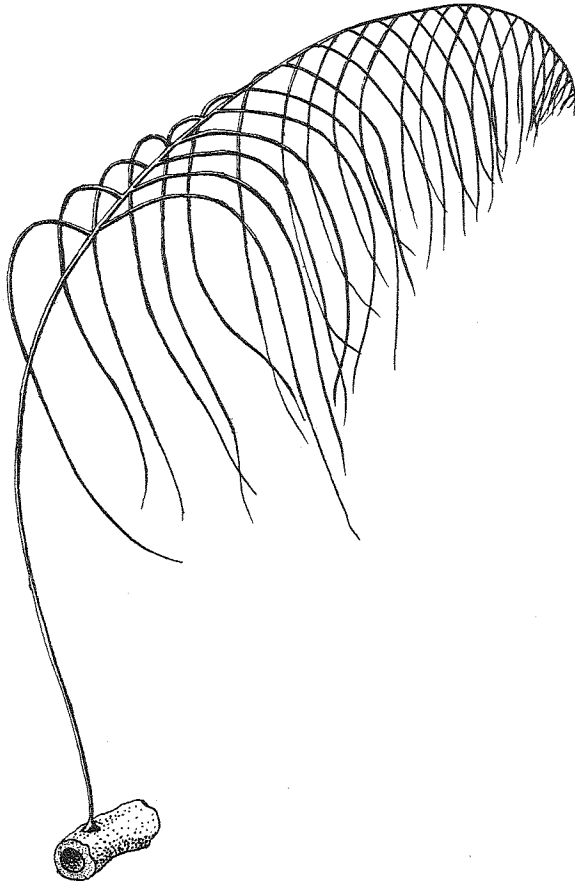


Fig. 1. *Bathypathes patula*; specimen from St. 716.

Remarks. This species is well known and has been thoroughly described previously (Pesch 1914; Pasternak 1958). With the exception of the colonies collected at St. 716, in the East Pacific, none of the "Galathea" specimens exceed the limits of intraspecific variability established on the basis of examination of numerous colonies from the Kurile-Kamchatka Trench and the northwestern Pacific (Pasternak 1958).

The straight adaxial portions of branches of the colonies from St. 716 intersect below the stem at an angle varying from 140° at the proximal to 60° at the distal parts of the colonies. Thus, the specimens from the East Pacific immediately become more unfolded than the typical ones. The branches then begin to curve downwards and somewhat upwards, towards the top of the colony, until the tips of the branches nearly touch each other at a distance of several mm below the dorsal surface of the main stem (Fig. 1). On the whole, these colonies resemble a kind of fish basket situated above the ground at a distance subequal to the length of the basal portion

of the stem. The colonies examined are thus much like those of *B. lyra* with the difference that the net of *B. lyra* is situated over the branched portion of the stem while the net of the East Pacific colonies of *B. patula* is under it.

Table 1 gives measurements of young colonies from Sts 190 and 453.

Table 1. Measurements (mm) of 4 young colonies of *Bathypathes patula*.

	St. 190		St. 453	
		I	II	III
Total length	136	104	115	106
Length of basal portion	48	80	89	76
Length of branched portion	88	24	26	30
Length of branches (max.)	92	346	41	42
Mutual distance between branches of one row	10.7	5	6	5
Diameter of stem (at the level of first pair of branches)	0.4	0.3	0.3	0.3
Number of branches of one row	9	5	5	6
Length of spines, μ (max.)	55	25	40	35

Ecology. Detailed morphological and histological examination of numerous adult colonies of *B. patula* from the northwestern Pacific revealed no differences of taxonomical value between the colonies fixed to the substrate in the normal manner, i.e., by the dilated basal disk, and those in which the basal portion of the stem is hooked and inserted in the soft sediments. Pesch (1914) regarded the difference in the attachment of the colonies as sufficient for subgeneric and specific separation. In my opinion, the development of a basal disk or hooked base is connected with the character of the substrate on which the planula of *B. patula* settles. If the planula attaches to a grain of sand or to a small foraminiferan shell, the young colony with growth and increase in weight would incline towards the bottom, turning round these insecure foundations. At the same time the stem might curve near the base to secure the vertical position of the colony. The process of synchronous inclination of the colony and curvature of its base have to continue, till the weight of the colony and the resistance of the sediment to the submersion of the curved base come to a balance. This assumption is supported by the configuration of the tip of the hooked base. Here a dome-shaped invagination, often surrounded by a circular thickening, more

seldom by a crown of rootlike projections, is recognizable. Among the "Galathea" colonies with hooked base these rootlike projections were not found, but the mentioned dome-shaped invagination was present on all specimens examined. It is also notable that one relatively young colony, 140 mm long, has only a slightly curved base not transformed to a hook, which quite corresponds to the third stage of the supposed development of a hooked base figured previously (Pasternak 1958, fig. 1).

Distribution. The Pacific: in the Kurile-Kamchatka and Aleutian Trenches and in the northern parts of the ocean at 3200-8600 m; in the S. W. Pacific at 4540-4670 m; in the East Pacific at 3050-4900 m; in the Indonesian waters at 490-4930 m. - The Indian Ocean: in the Arab Sea and Bay of Bengal at 692-4809 m; in the western part of the Indian Ocean at 3966-4480 m; in the vicinity of the Cocos Is. at 4809 m and in the region of the Java Trench at 2084-2675 m. - The Atlantic Ocean: along the western shores of Europe and Morocco at 412-2868 m; in the Caribbean at 3500-4960 m; near the mouth of the La Plata at 3477 m and at Birdwood Bank (Falkland Is.) at 100 m; in the Antarctic at 3766-4798 m. There are also underwater photographs of *B. patula* made in the Pacific sector of the Antarctic at 3766 and 4287 m and of a *Bathypathes* sp. in the eastern part on the Indian Ocean at 4483 m (Heezen & Hollister 1971, figs 4.11 L, 4.11 UL, and 2.19 UL).

Bathypathes lyra Brook, 1889.

Bathypathes lyra Brook, 1889, p. 154.

Material:

St. 279, east of the Seychelles (1°00'N, 76°17'E), 4320 m, globigerina ooze. - 1 specimen.

Remarks. The only specimen shows remarkable agreement with the short diagnosis of *B. lyra* (Brook 1889) and the detailed description of the colonies obtained by the "Vitiaz" in the Pacific and Indian Oceans (Pasternak 1958, 1964). The present colony is comparatively large. Its stem is 109 mm, of which 15 mm consists of the vertical basal portion and 94 mm of the branched portion, which latter is supported by the row of dorsal curved setae.

Branches of the first pair are 142 mm long and

not only reach the top of the colony, which according to Brook's diagnosis is one of the main characters of *B. lyra*, but being straight, appear much longer than the total length of the colony. The majority of colonies examined previously had the branches shorter than the branched portion of the stems (Pasternak 1964). Owing to the length of the basal part, the "fish basket" of the present colony was arranged higher than that of other specimens of *B. lyra*. This accounts for the size of the supporting dorsal setae, which are 15-25 mm long.

Distribution. The Pacific: in the region of the Hawaiian Ridge and in the northwestern and central parts of the ocean at 3640-5930 m, and in the central part of the Coral Sea at 4400 m. - The Indian Ocean: in the southern parts of the Arab Sea and the Bay of Bengal at 3512-4809 m; east and west of the Seychelles at 4320-4405 m, and in the northern and central parts of the Central Basin at 3960-4425 m. - The Atlantic Ocean: in the southern parts of the North African Basin at 5300 and 5440 m.

Bathypathes galathea n. sp.

(Fig. 2)

Material:

St. 724, Gulf of Panama (5°44'N, 79°20'W), 2950-3190 m, dark clay and stones, 2.0°C. - 2 specimens.

Both specimens have suffered rather badly during the dredging. One specimen lost the tip of the colony and the basal portion of the stem, fractured some mm below the first pair of branches. The second lost the basal disk (and the apical part of the stem).

Description (holotype). The colony consists of a main stem and numerous simple branches arranged in two lateral rows. The stem is robust but brittle, and compared with the colonies of *B. patula*, which the new species most closely approaches, seems to be more rough. The remaining branched portion of the stem is 265 mm long. The diameter of the stem varies from 1.2 mm at the proximal fracture to 1.5 mm at the level of the first pair of branches. The diameter of the stem of the branched portion does not change over the whole length except at the apical part of the colony, where the stem tapers gradually.

Branches are straight and robust. Fractures of

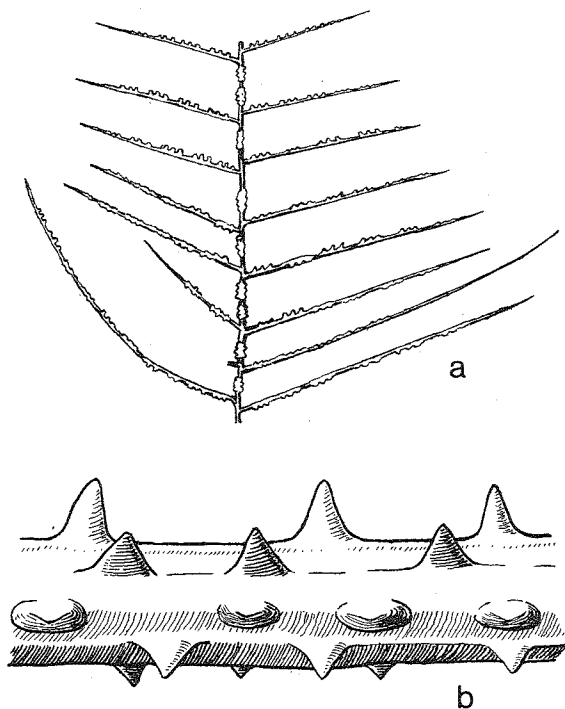


Fig. 2. *Bathypathes galathea* n.sp.; a, the distal portion of the colony; b, portion of a branch showing the arrangement of spines ($\times 50$).

the distal portions of branches are followed by regenerations. Depending on the thickness of the branches at the time of fracture, the decrease in diameter of the regenerated offshoots are more or less marked. The offshoots are thin, transparent and flexible. The only two unfractured old branches are 137 mm long at the proximal part of stem and 142 mm at the middle part. Apparently, the length of the branches varies little along the whole extent of the stem except at its apical part, where the length of the branches decreases rapidly. The diameter of the proximal part of the branches varies from 1-1.2 mm at the lower part of the colony to 0.4 mm at its top. Branches of right and left rows are nearly opposite. The mutual distance between the branches of one row does not change over the length of the colony except at its distal part, where the distance increases towards the top of the colony (Fig. 2). The proximal portions of the branches of both rows are arranged in one plane with the stem and ascend almost at right angles.

Spines are triangular, slightly compressed laterally, sharp and smooth. The longest spines are situated on the polyp-bearing surface and are 180-260 μ long. On the opposite surface they are 80-150 μ long. The spines are arranged in longitudinal rows,

6 of which can be seen on the old parts of branches from one aspect. This number decreases to 3-4 on the regenerated offshoots. The mutual distance between the spines of one row is extremely variable, from 400 to 1100 μ . This often leads to disturbance of the quincunx order in the arrangement of spines so that on a considerable part of the branches or stem the arrangement of spines becomes irregular.

Polyps are large, elongated in the direction of the axis of stem and branches, 4.5-7 mm long and about 1.5 mm wide, with a prominent oral cone. Tentacles are 1.5-2.5 mm long excluding the basal, bulbous parts. The distance between the polyps exceeds the distance between the pairs of tentacles.

The main features of the type specimen also apply to the other specimen, which has only lost the basal disk and several mm of the unbranched portion of the stem. The remaining part of the latter is 82 mm long and makes up more than one third of the total length of the colony.

Taking into consideration the above-mentioned peculiarities of the skeleton, the stem and branches of living colonies of *B. galathea* must have been only slightly curved, or even uncurved, and the curvature of the specimens examined, especially of the largest, may in part be due to the small size of the jar in which these specimens were preserved.

Remarks. *B. galathea* has certain affinities with *B. patula* Brook, 1889, and *B. platicaulis* Totton, 1923. The obvious difference between the new species and *B. patula* is that in the former the stem branches are robust and brittle and the general configuration of the colony, owing to the constant length of branches, is elongated oval, while in the latter species stem and branches are flexible and the configuration of the colony is triangular. From *B. platicaulis* the new species differs by the robust cylindrical stem and by the increase of the distance between the branches in the apical part of the colony. Finally, *B. galathea* differs from all other species of *Bathypathes* with simple branches in having extremely long and sharp spines, often arranged very irregularly.

Type locality: Gulf of Panama, 2950-3190 m.

Parantipathes Brook, 1889

This genus include antipatharians whose colonies are branched in bottle-brush form, with polyps without peristomial folds and elongated in the direc-

tion of the axis of the stem and branches. *Parantipathes* is not a well-defined genus. Pesch (1914) referred to this genus several species previously regarded as representatives of *Aphanipathes* and *Antipathes* on the grounds that their colonies are branched in many planes and appear to be more complicated than other species which are branched as a rule in only one plane. At the same time polyps of these species, e.g., *Parantipathes* (= *Aphanipathes*) *abietina* and *P.* (= *Aphanipathes*) *felix* are small, round, with short tentacles not combined in three pairs as in the typical species of *Parantipathes*. On the other hand, Pesch provisionally referred to the genus a new species, (?) *Parantipathes tristicha*, with two lateral rows of simple branches and only one row of branches bearing pinnulae. The polyps of the only colony of this species are unknown. There can be no doubt that a revision of *Parantipathes* is desirable.

Species of *Parantipathes* mainly belong to the shallow-water tropical bottom fauna. Nevertheless, some species also inhabit the bathyal zone.

? *Parantipathes wolffi* n. sp.
(Fig. 3)

Material:

St. 324, Strait of Malacca (6°38'N, 96°00'E), 1140 m, globigerina ooze. - 1 rather badly damaged colony.

Description. The mode of branching of the present colony fits well within the limits of the genus *Parantipathes*. The colony is fixed to the substrate in the normal manner by a dilated base. The nearly straight main stem, 1.3 mm wide, is fractured 17 mm above the base and bears two antero-lateral branches, one of which is also fractured near the stem, and several pinnulae. These branches, the diameter of which is a bit less than that of the stem, bear pinnulae and branches of the second order. The latter bear branches of the third order and so on. In total there are 5 series of branches; the largest branches of the II, III, IV and V orders are 155, 92, 45, 35 and 35 mm long respectively and 1.0-0.4 mm wide. The branches are inserted at nearly right angles in the proximal part of the colony and at an angle of 70-60° in the distal part. Branches of each following order have antero-lateral, dorso-lateral and nearly lateral positions, so that many planes can be brought through the colony.

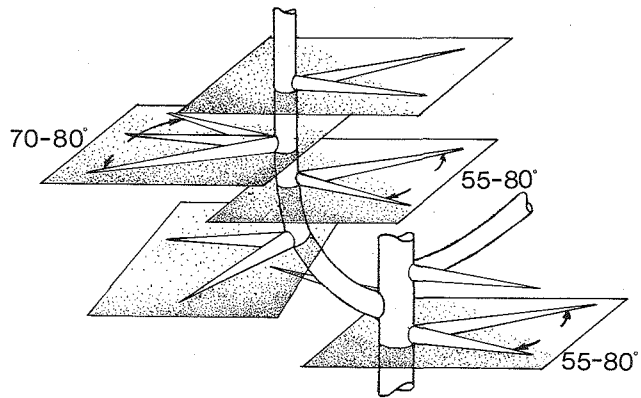


Fig. 3. ? *Parantipathes wolffi* n.sp.; diagrammatic projections of branches on the horizontal planes.

The pinnulae, 20-25 mm long in the proximal part of branches and 8-10 mm in the distal part, are arranged in two lateral longitudinal rows, in each of them grouped in pairs, seldom in triplets. Pinnulae in these groups are inserted at the same level, but sometimes a small hiatus, up to 0.4 mm occurs between them. Each pair of pinnulae lies in a plane perpendicular to the longitudinal axis of the branches. Within the limits of this plane the angle between pinnulae varies from 55° to 80°, mainly around 60° (Fig. 3). The distance between groups of pinnulae of one row is 1.5-3 mm (4 mm in the proximal part of the colony). Groups of pinnulae of the right and left rows alternate very regularly. The variation in the angles between pinnulae of each pair as well as the presence of triplets among the pairs give a bottle-brush shape to each branch of the colony.

The spines are triangular with a smooth surface, sometimes distally inclined, especially at the top. They are 35-70 μ high and 45-65 μ wide at the base, 200-450 μ apart. Spines are arranged in longitudinal rows, 5 of which can be seen on the stem and branches of the I and II orders and 4-3 on the other branches and pinnulae when viewed from one side. The rather regular quincunx in the arrangement of spines often disappears.

The polyps of the present colony are unknown.

Remarks. In some features, especially in the arrangement of spines, the new species is not far from *P. laricides* Pesch, 1914, from which it differs mainly in the more complex mode of branching and in the number of pinnulae in each group. Unfortunately, the description of *P. laricides* is also based on a single specimen damaged during the

dredging. It is possible that the simple and slightly curved stem of *P. laricides*, fractured above the base (Pesch 1914), is actually one of the branches of the colony. If so, the difference between the species is restricted to the number of pinnulae in each group and some less important features. To this may be added that the difference mentioned is not very clear, because *P. wolffi* may at times have a few groups of three rather than the usual two pinnulae, while *P. laricides* may occasionally have a few groups of only two rather than the usual three. Perhaps the examination of new material will show that this character is nonspecific. In favor of this assumption is the fact that both colonies were collected in the same biogeographical region (Arafura Sea and Strait of Malacca) and at the same depth.

Type locality: Strait of Malacca, 1140 m.

Stichopathes Brook, 1889

As the configuration and size of the polyps in *Cirripathes* where they are placed on all sides of the stem, and in *Stichopathes* where there is only one row, is too variable to be used for generic distinction, and as young colonies and the distal portions of ordinary colonies of *Cirripathes* sometimes have uniserial polyp distribution along the whole length, Pesch united *Cirripathes* and *Stichopathes* in the genus *Cirripathes*, but found it desirable to consider them as subgenera because of the principal difference in the distribution of polyps. Objections against such a revision are obvious. The arrangement of the polyps in one or several rows on the stems represents a stable morphological feature, and there is no doubt that the one row of polyps on the stem of young colonies of *Cirripathes* as well as on the top of adult ones will be multiplied during the growth of the colonies. Therefore the reestablishment of the genera *Cirripathes* and *Stichopathes* seems to be necessary.

The majority of *Stichopathes* species are distributed in the shallow-water zone of the tropics and only few have a wide range of geographical and vertical distribution.

Stichopathes variabilis (Pesch, 1914)

Cirripathes (Stichopathes) variabilis Pesch, 1914, p. 120.

Stichopathes filiformis Silberfeld, 1909, p. 15.
non *Stichopathes filiformis* of other authors.

Material:

St. 453, Makassar Strait (3°56'S, 118°26'E), 2000 m, greenish clay, 3.6°C. - Numerous dead fragments.

St. 465, Java Trench (10°20'S, 109°55'E), 6900-7000 m, 1.5°C. - Several dead fragments.

Remarks. Fragments of slender stems, curved or wound into a loose spiral, undoubtedly belong to *S. variabilis* owing to the presence of 4-7 rows of spines of extremely variable shape and dimension. On the proximal portion of the stems examined all kinds of spines described and figured by Pesch (1914) have been found, with the exception of distally curved and branched ones. The spines are of different lengths on the polyp-bearing and on the opposite side of the stem, the longest (450-650 μ) being arranged on the polyp-bearing side and the shortest (200-350 μ) on the opposite side. On the distal portion of the stems the spines are more uniform, triangular, sharp-tipped, smooth, 100-250 μ high. The distance between spines of one row is also very variable, 400-750 μ , more often about 600 μ . Thus, the present fragments agree perfectly with the description of *S. variabilis* var. *longispina* Pesch, 1914.

Distribution. Numerous living colonies of *S. variabilis* were found along the shores of Japan and the Indonesian Islands at depths of 9-567 m. Records from 2000-7000 m are very doubtful. It is possible that at St. 453 the Sigsbee trawl crossed a "cemetery" of dead stems of *Stichopathes* washed away from the shallow-water zone. As appears from the station list (Bruun 1958), triangular and rectangular dredges were fastened to this trawl. Subsequent attempts to obtain samples from bottom fauna at Sts 461 and 464 were unsuccessful - the gear was not on the bottom. At St. 465 several dead stems of *B. variabilis*, one of them macerated, were found only in the meshes of the dredges, the bag of the trawl being lost. There is no doubt that these fragments were left there from the preceding dredging.

Notes on the zoogeography of *B. patula* and *B. lyra*

Although the present collection of the deep-sea antipatharians *B. patula* and *B. lyra* is not very large, it makes a valuable contribution to the general picture of their horizontal and vertical distribution.

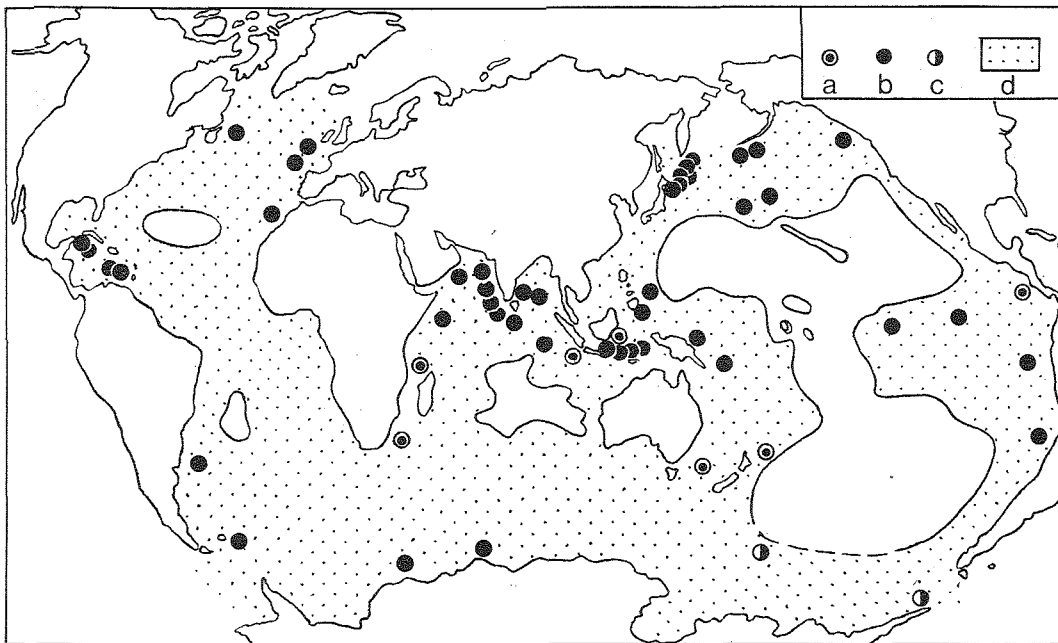


Fig. 4. Distribution of *Bathypathes patula*. a, "Galathea" records; b, other records; c, underwater photographs; d, eutrophic areas (after Sokolova 1972).

Previous data suggested that these species were pan-oceanic. However, new records of *B. patula* from the western and southwestern parts of the Indian Ocean, Tasman Sea and eastern part of the Pacific, and *B. lyra* from the northern part of the Central Basin of the Indian Ocean have filled many gaps in the wide ranges of these corals. Although our knowledge of the distribution of the deep-sea bottom fauna is far from adequate, it may be safely asserted that its distribution is most closely related to the accessibility of food. This thesis applies equally to both species.

Most often colonies of *B. patula* were found in the near-shore zone of the continents and islands bordering the ocean. But contrary to the majority of other deep-sea corals, whose ranges are much narrower than the eutrophic areas surrounding the continents (Pasternak 1973), *B. patula* inhabits also the peripheral parts of these areas. *B. patula* can therefore be regarded as an example of a deep-sea species whose distribution practically coincides with the eutrophic areas. The range of *B. patula* can be defined as wide circumoceanic eutrophic (Fig. 4).

B. lyra has a different pattern of distribution. Previous data had suggested that it mainly inhabits the abyssal region of the tropical zone, thus permitting Vinogradova (1969) to include *B. lyra* in the group of circumtropical abyssal bottom invertebrates erected by this author. However, the exis-

tence of abyssal bottom animals whose ranges are restricted to the tropical zone of the World Ocean seems to be very doubtful because of the water temperature, which is practically constant in the different parts of the abyss. The ranges of benthic invertebrates mentioned by Vinogradova can be regarded merely as a reflection of latitudinal zonation of the surface waters, and the term circumtropical is hardly suitable to them. In contrast to *B. patula*, numerous colonies of *B. lyra* were found in the transition between eutrophic and oligotrophic zones, and there are only few cases of identical occurrence of *B. patula* and *B. lyra*. Moreover, several specimens of *B. lyra* have recently been obtained by the "Vityaz" in the central parts of the Pacific which are characterized by true oligotrophic conditions. Thus, this deep-water species shows preference for areas where food conditions are far from optimal for the majority of other corals (Fig. 5). Selection of a term for the complicated and discontinuous range of *B. lyra* is rather difficult. It is only obvious that the term circumtropical does not fit this type of range. For want of a better term, the range of this species can be described as panoceanic subcentral.

The materials at hand confirm the previous picture of the bathymetrical distribution of *B. patula* and *B. lyra*. The former species, which occurs from 100 to 8600 m, must be regarded as mainly abyssal; its penetration into the sublittoral zone occurs only

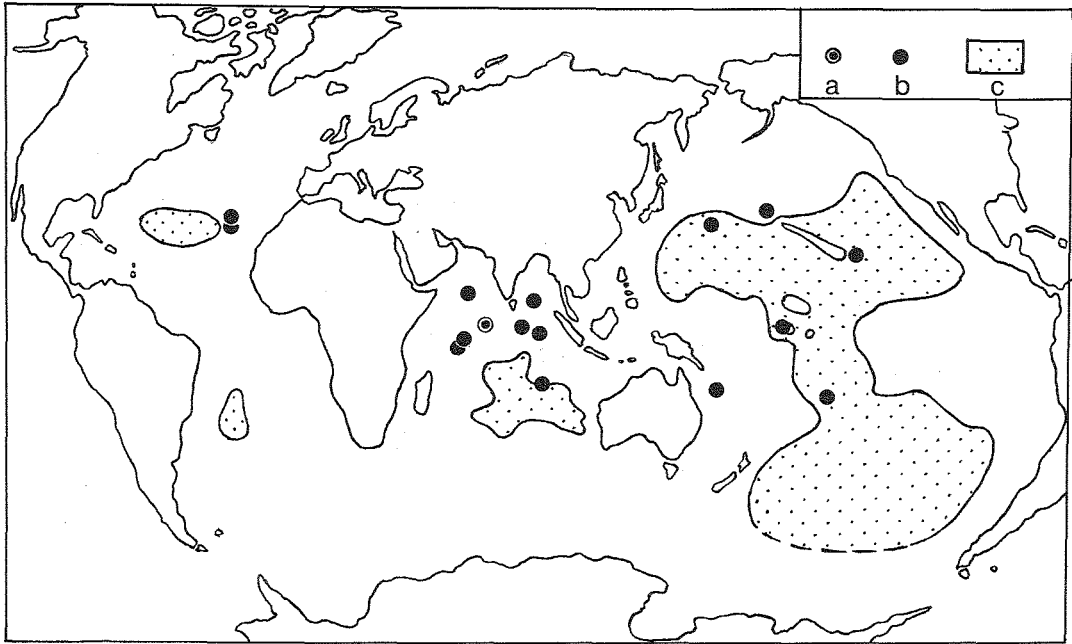


Fig. 5. Distribution of *Bathypathes lyra*. a, "Galathea" record; b, other records; c, oligotrophic areas (after Sokolova 1972).

in the cold, subpolar areas and into the bathyal zone only in regions where upwelling of cold deep-water masses takes place. The records of *B. patula* at hadal depths are few.

In contrast, *B. lyra* is a true abyssal inhabitant, occurring only at depths between 3500 and 6000 m.

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