

POGONOPHORA

Galathealinum bruuni n. gen. n. sp., a new representative of the class.

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INTRODUCTION

The class *Pogonophora* was erected by JOHANSSON in 1937 based upon a closer investigation on the species *Lamellisabella zachsi* USCHAKOV 1933. USCHAKOV described *L. zachsi* as a Polychaete belonging to a new subfamily of the family *Sabellidae*. By anatomical studies of USCHAKOV'S species JOHANSSON showed that it could not be a *Sabellid* and even not a Polychaete. In a later publication JOHANSSON (1939) regarded it as a representative of a new class of the Oligomera.

Lamellisabella zachsi was found in the Sea of Okhotsk at a depth of 3500 m. Later IVANOV (1949) described a new species of the same genera *L. gorbunovi* from the Polar Sea at 3700 m, and in 1951 the same author referred *Siboglinum weberi*, taken at depths from 462 to 2060 m by Siboga in the Malaya Archipelago and described by CAULLERY in 1914, to the same class.

Until then only very few specimens of the class were known, so the knowledge of the morphology and anatomy was very incomplete, but the recent Soviet expeditions to the northwestern part of the Pacific collected a very extensive material of *Pogonophora*, in one haul at 8840 m they obtained 2000 specimens of two new species, so after the description of the external morphology by IVANOV 1952, translated into English by PETRUNKEVITCH 1954, and the anatomy by IVANOV 1955a, we have now a complete picture of the structure of this interesting group.

The *Pogonophora* is a very homogenous group. All the species have a very long, cylindrical body (see PETRUNKEVITCH 1954 fig. 1). It consists of a short anterior section, in front of which there is a well-developed tentacle-apparatus, and a very long trunk.

The anterior section is drawn out into a cephalic lobe dorsal to the base of the tentacles. The tentacles are long and bear rows of small pinnules. On

the ventral surface of the anterior section there is always a pair of oblique cuticular ribs, called the bridle, they attenuate as they pass forward towards the lateral surface and then onto its dorsal surface. Between the anterior section of the body and the trunk is an external ringshaped constriction and an internal muscular diaphragma.

The trunk is divided into two main sections, the preannular and the postannular section, by two belts of chitinous platelets.

The preannular section has a wide ventral groove which gradually becomes obliterated towards the posterior end of the section. This groove is bordered by small folds with rows of adhesive papillae in which, except in *Siboglinum*, small chitinized platelets are situated. Anteriorly these organs of attachment are arranged in a secondary metamerism, but further back the adhesive papillae become scattered irregularly on the ventral side of the body. According to this we can distinguish a short metameric portion and a very long non-metameric portion in the preannular region. On the dorsal side of the metameric region there is a broad, ciliated band.

The postannular section of the trunk also bears small, adhesive papillae with chitinous platelets, again arranged metamericly in transverse ventral rows. No oral or anal openings are found in any specimen of *Pogonophora*. They live in tubes which consist of a chitin-like organic substance. These tubes never branch and have a lamellated structure. They are secreted by numerous glands in the body wall.

The anterior section of the body consists of two segments (see IVANOV 1955a fig. 1). The first segment is represented by an unpaired coelomic sac which opens laterally through a pair of coelomoducts. In the tentacles are coelomic canals which open in this anterior unpaired coelomic sac. The tentacle-apparatus is thus the first segment. To this segment belongs also the dorsal cephalic lobe. The

greater part of the anterior section of the body consists of the second segment. Its paired coelom sacs are without coelomoducts. In this part of the body are many multicellular glands. The trunk constitutes the third segment. It contains a pair of coelomic sacs in which the gonads are situated. The coelomoducts of this section are used as gonoducts.

The body is covered with a one-layer epithelium rich in unicellular glands and with a cuticle. The nervous system is very primitive, histologically resembling that of the *Enteropneusta*. It is situated in close connection with the epithelium. In the cephalic lobe there are many ganglion cells, and from this brain issues a longitudinal dorsal nerve-cord and lateral nerves to the tentacles.

The vascular system is represented by a ventral and a dorsal longitudinal vessel. In the ventral vessel the blood is running forward to the heart situated at the base of the tentacles. From here the blood is pumped into the tentacles from where it goes to the dorsal vessel where it runs backward to the posterior end of the body. In the females there are longitudinal vessels along the ovaries. There are several lateral connections between the dorsal and ventral vessels in the posterior part of the body. At the anterior end of the dorsal vessel are three blind-ending branches which convey blood to the brain. In one group of *Pogonophora* there is a pericardion lying dorsally to the heart.

The coelomoducts of the first segment are the excretory organs. They are ciliated and lying close to the blind-ending branches of the dorsal blood-vessel.

The *Pogonophora* have separate sex. There is only one pair of gonads situated in the trunk, separated from the coeloms by their own walls. In the males the testes fill up the whole posterior part of the trunk. The sperm ducts are very long canals which occupy a considerable portion of the preannular region; they are usually filled up with characteristic spermatophores. They open on the border between the anterior section of the body and the trunk upon a pair of genital papillae. The ovaries occupy the anterior part of the trunk and have very short oviducts which open in the middle of the trunk. The eggs are very big with much yolk. The larval development is unknown.

There is no digestive canal and no anal or oral opening.

The *Pogonophora* live a sedentary life at very great depths. The finds are from 462 m in the Malaya Archipelago and down to about 10.000 m in

the Kurile-Kamtschatka Trench. They live in a cylindrical tube which sticks out of the bottom with its open end upward and they never leave the tube. In some places they are extremely numerous. They seem to have an extra oral digestion. IVANOV (1955b) showed that the structure of the tentacle-apparatus reminds of a digestive canal. The animals always keep the tentacles close together, forming a cylinder with an opening at the upper end and openings between the bases of the tentacles. At the edge of the tentacles are cilia which form longitudinal ciliated bands. By means of the ciliated bands the water streams through the tentacle-cylinder and brings with it the plankton or détritius. When the tentacles are filled up with food the animals may withdraw to their tubes and begin to digest. Several glands at the edge of the tentacles seem to function as digestive glands and the long bloodfilled pinnules remind so much of the villi in a mammalian intestine that it may have the same function. Besides, the tentacle-apparatus undoubtedly performs a respiratory function. The need of food must be great since the *Pogonophora* have a big production of sperm and eggs and the eggs are very rich in yolk. According to IVANOV (1955b) the growth continues even in the adult animals.

In the latest publication by IVANOV (1955c) he is of the opinion that the class *Pogonophora* should be placed in the neighbourhood of the *Enteropneusta*. Several characters are common. Nevertheless there are other characters which separate the *Pogonophora* from the Hemichorda, so IVANOV prefers to regard the group as a special type of Deuterostomia and erect a new phylum *Brachiata*. The phylum *Brachiata* has one class *Pogonophora* JOHANSSON 1937.

The class *Pogonophora* can be separated into two orders:

1. *Athecanephria* IVANOV 1955: First coelom formed as a sac. The coelomoducts of the first segment are placed far from each other and lying close to the *lateral* blind-ending branches of the anterior part of the dorsal blood-vessel. The heart with a pericardion. 1 family: *Siboglinidae*.

2. *Thecanephria* IVANOV 1955: First coelom formed as a horse-shoe. The coelomoducts of the first segment are closer together medially and lying close to the *medial* blind-ending branch of the anterior part of the dorsal blood-vessel. No pericardion.

- 3 families: *Polybrachiidae*, *Lamellisabellidae*, *Spirobrachiidae*.

As to the definition of the families and the previously described species see PETRUNKEVITCH 1954.

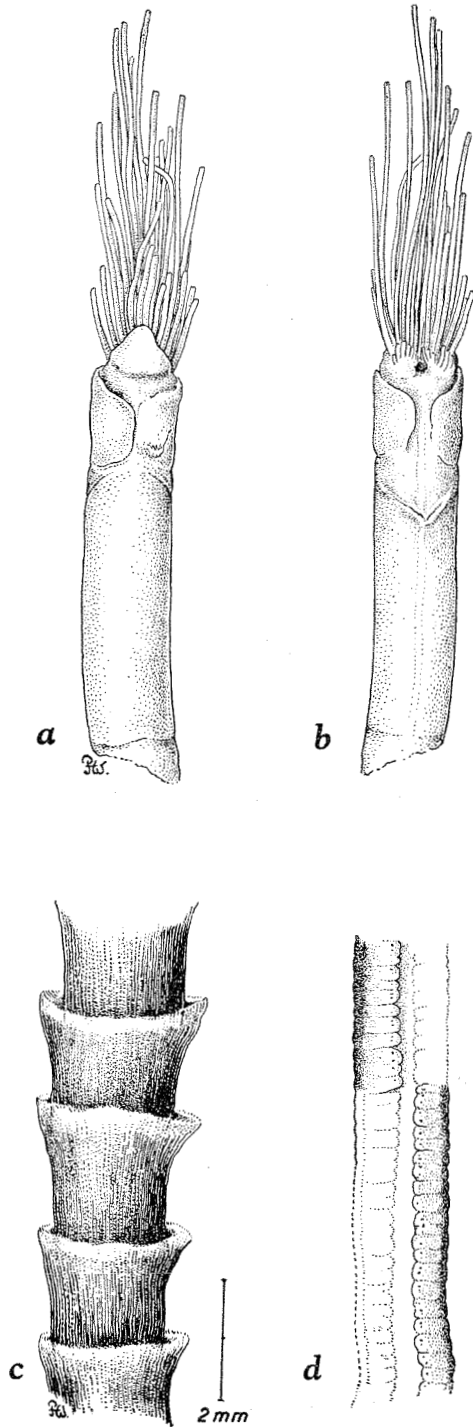


Fig. 1. a-b. Anterior section of *Galathealinum bruuni* n. gen. n. sp. a. Dorsal view. b. Ventral view. c. Part of tube. d. Part of trunk, ventral view.



Fig. 2. Tube of *Galathealinum bruuni* n. gen. n. sp.

So far 8 species have been described, but IVANOV writes in one of his latest publications (1955a) that the material from the great Soviet Expedition in the northwestern part of the Pacific includes 12 species belonging to 8 genera and 4 families.

The material from the »Galathea«-Expedition contains one species of *Pogonophora*, which is different from any of the described species and genera.

The figures in this publication were made by Poul H. Winther, the scientific drawer, and the English text was corrected by Mrs. A. Volsøe to both of whom I express my best thanks.

Description of the material

FAM. POLYBRACHIIDAE Ivanov 1952

Pogonophora with numerous free tentacles arranged in a circle or on a horseshoe-shaped base.

Galathealinum bruuni n. gen. n. sp.

Figs. 1 and 2.

Material:

Celebes Sea: St. 450. 1°50'N 119°30'E. 5090-5110 m. 1 specimen, anterior section with a piece of the anterior part of the trunk. Most of the tentacles lost. Anterior section: 7×1 mm. (Type). 1 tentacle-crown. 9 tubes, largest one 370 mm long, possibly broken. (Type in the Zoological Museum of the University, Copenhagen).

Numerous long, free tentacles. On the free tentacle-crown I can count 105 tentacles, but some were possibly lost. The tentacles are attached to a horseshoe-shaped base. Anterior section of the body in front of the bridle with a deep dorsal transverse groove which separates the cephalic lobe from the body. On the ventral side, anteriorly to the bridle, are two wings or folds, separated ventrally, which continue laterally where the edge is parallel to the bridle. They are fused dorsally. The combs of the bridle do not merge ventrally. Adhesive platelets on the anterior part of the trunk oval, the longest diameter 40 μ . A sickle-shaped thickening of their anterior edge.

The tubes are thin and massive at the base, 0.8 mm in diameter, but become longer and cylindrical in the upper part where they have a diameter of 2 mm. They remind of the tubes of *Polybrachia annulata*, but the distance between the collars are shorter.

The only specimen at hand is in a poor condition, because it was preserved in the tube. The *Pogonophora* have a very strong longitudinal musculature which makes the animals contract strongly during fixation. This makes it very difficult to extract the animals from the stiff and hard tube. Nevertheless, the most important characters are visible, and they show that the specimens represent a new genus. The numerous free tentacles arranged on a horseshoe-shaped base place the species in the family *Polybrachiidae*. It reminds of the genus *Polybrachia*, but it has no rings in front of the bridle. Instead of this there is a deep fold starting with two wings on the ventral side of the body. This character is not present in the earlier described species and refers it to a new genus.

Distribution: Celebes Sea 5090-5110 m.

Zoogeographical Remarks

Species of the class *Pogonophora* are known only from the Malaya Archipelago, the north western Pacific, and one single find in the Polar Sea. Apart from *Siboglinum weberi*, which was taken at 462 m, all the other species are from depths greater than 3000 m. So they seem to live at great depths only and this may be the reason why they have only been found in so few places. They may have a wider distribution, but may have been overlooked. On the other hand, the tubes are long and very characteristic, and in places where the *Pogonophora* live they are extremely numerous. At least it seems almost incredible that they should have been overlooked in the Atlantic which is so well explored even at great depths.

IVANOV (1955b) writes that the food requirements of these animals must be very great, since the production of sperm and eggs is so considerable and the growth continues throughout their life time. We know now that the supply of organic matter is great in the north western part of the Pacific and the Malaya Archipelago, so it seems reasonable to me that *Pogonophora* is restricted to areas where the organic production is high. The ability to spread to other areas rich in food seems to be rather limited. They are exclusively sedentary, they never leave the tube, and the big eggs rich in yolk are indicative of a non-pelagic or at least a very short pelagic larval life.

According to this the *Pogonophora* seem to be a very specialized deep-sea group from areas in the western Pacific with a great supply of organic matter.

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