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## FIRST RECORD OF A BATHYPELAGIC NEMERTEAN FROM THE CANARY ISLANDS

FÁTIMA HERNÁNDEZ MARTÍN<sup>1</sup> & RAY GIBSON<sup>2</sup>

Whith 2 figures, 1 plate & 1 table

**ABSTRACT** A juvenile specimen of *Pelagonemertes joubini* COE, 1926, collected from a depth of 1000 m close to the south coast of Fuerteventura, is the first bathypelagic nemertean found in waters of the Canary Islands. The specimen is the smallest example of this species yet found and only the third individual recorded from the North Atlantic.

**KEY WORDS:** North Atlantic, Canary Islands, bathypelagic nemerteans.

**RESUMEN** Un juvenil de *Pelagonemertes joubini* COE, 1926, colectado a una profundidad de 1000 m cerca de la costa sur de Fuerteventura, es el primer nemertino pelágico hallado en aguas de las Islas Canarias. El ejemplar es el más pequeño encontrado hasta ahora y el tercero citado para el Atlántico Norte.

**PALABRAS-CLAVE:** Atlántico Norte, Islas Canarias, nemertinos pelágicos.

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<sup>1</sup> Departamento de Biología Marina, Museo de Ciencias Naturales (OAN), Apto. Correos 853, Santa Cruz de Tenerife, Canarias, España.

<sup>2</sup> School of Biological and Earth Sciences, Liverpool John Moores University, Byrom Street, Liverpool L3 3AF, U.K.

*RESUMO* Um espécime juvenil de *Pelagonemertes joubini* COE, 1926, colhido à profundidade de 1000 m, próximo da costa Sul de Fuerteventura, é o primeiro nemertíneo pelágico encontrado em águas das Ilhas Canárias. O exemplar é o mais pequeno encontrado até agora e constitui a terceira referência para o Atlântico Norte.

*PALAVRAS-CHAVE:* Atlântico Norte, Ilhas Canárias, nemertíneos pelágicos.

## INTRODUCTION

The first description of a bathypelagic nemertean was MOSELEY's (1875) account of *Pelagonemertes rollestoni* MOSELEY, 1875, from the Indian Ocean, although LESSON (1830) had earlier reported finding large numbers of a pelagic 'mollusc', *Pterosoma plana*, LESSON, 1830, between the Moluccas and Papua New Guinea which may in fact have been a nemertean species (GIBSON, 1995). Since then pelagic nemerteans have been collected from all the oceans of the world, although many of the 97 species currently recognised (GIBSON, *in press*) are known only from single, or at most a few, specimens.

Several species appear to exhibit a wide zoogeographic distribution, for example, *Pelagonemertes rollestoni* has been reported from the North and South Atlantic and Pacific Oceans as well as the Indian Ocean. Other taxa, however, such as *Cuneonemertes gracilis* COE, 1926, from the South Pacific, or *Dinonemertes arctica* KOROTKEVICH, 1977, from the Arctic Ocean, seem to have a much more restricted distribution. Forty-six species (47%) of bathypelagic nemerteans have been found in North Atlantic waters, 29 of which are so far known only from this area, though it must be remembered that the North Atlantic has been investigated far more frequently than any other oceanic region.

COE (1945, 1946, 1954a, b) suggested that in consequence of the global circulation of deep oceanic currents, bathypelagic nemerteans might, over a long period of time, be expected to drift from one part of the world to another and thus show wide zoogeographic distributions. His suggestion, however, is contradicted by the work of VAN DER SPOEL & HEYMAN (1983), who showed that significant proportions of the bathypelagic fauna from any one oceanic region were apparently endemic. As noted by GIBSON (*in press*), the identification of conspecific nemerteans from widely separated geographic locations must be open to uncertainty, especially when the anatomical data on which their identification is primarily based is minimal for so many of the taxa. Even the precise depths from which individuals were collected are often unknown, since most specimens have been taken in nets hauled open to the surface, whilst accurate hydrographic data are even more restricted. VAN DER SPOEL (1985: 21) commented that bathypelagic nemerteans as a group have "an upper limit of distribution between 500 and 1000 m depth".

The finding of the present specimen in waters close to the south coast of Fuerteventura is thus of interest for several reasons. Except in the deep submarine canyon off Monterey Bay on the Californian coast, which has yielded many specimens of bathypelagic nemerteans, the vast majority of individuals, unlike the present example, have been collected far from land.

*Pelagonemertes joubini* COE, 1926, is also an uncommon species, with only nine previous specimens having been found (Table I), none of which was as small as the Fuerteventura example. It is also the first record of any bathypelagic nemertean from the waters of the Canary Islands.

**TABLE I** - Location and depth data for recorded specimens of the bathypelagic nemertean *Pelagonemertes joubini*.

Location	Depth	Number of Specimens	Reference
PACIFIC OCEAN			
6°30'S, 101°17'W Of the coast of Peru	0-554 m	1	COE, 1926
32°27'N, 117°30'W Coronado Trough, off southern California	874 m	1	COE, 1954b
Submarine canyon at entrance to Monterey Bay, California	0-690 m	1	COE, 1954b
Submarine canyon at entrance to Monterey Bay, California	0-1050 m	1	COE, 1954b
48°51'N, 157°35'W	0-4800 m	2	COE, 1954b
ATLANTIC OCEAN			
15°05'S, 9°26'E	0-1100 m	1	FRIEDRICH, 1969
50°57.8'N, 29°50.0'W	0-1005 m	1	VAN DER SPOEL, 1985
45°03.3'N, 29°59.1'W	1002-1752 m	1	VAN DER SPOEL, 1985
28°00'24''N, 14°21'45''W	1000 m	1	Present paper

## MATERIAL AND METHODS

The specimen was trawled from a depth of 1000 m on 6 September 1995 just south of the coast of Morrovable, Fuerteventura, Canary Islands (Fig. 1), in the region between Punta Jandia and Punta del Matorral (28°00'24"N, 14°21'45"W), by means of a triple WP-2 closing net of 200 µm mesh size, used during a survey of the pelagic marine fauna of the Canary Islands (Proyecto TFMCBM, Campaña TFMCBM/95). The specimen was preserved in 4% formalin and subsequently transferred to 70% alcohol.

After the external features were recorded the specimen was post-fixed in Bouin's fluid, embedded in 56° m.p. paraffin wax, sectioned transversely at 6 µm and stained by the Mallory trichrome method for histological examination. The slides of the specimen are deposited in the Museo de Ciencias Naturales de Tenerife, Santa Cruz, under registration number ZP/00038.

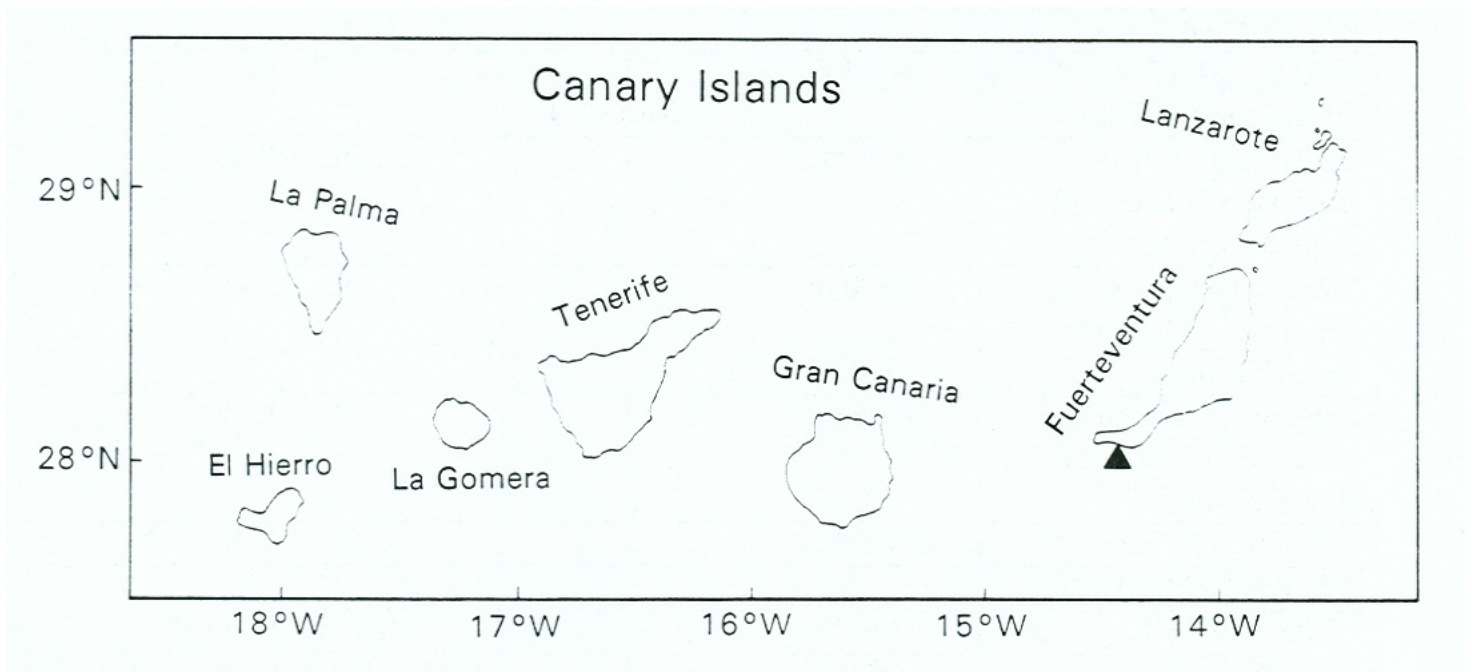


Fig. 1 - Map of Canary Islands, showing the location of the site just south of Fuerteventura.

## SYSTEMATICS

*Family Pelagonemertidae Moseley, 1875, emend. BRINKMANN, 1917*

Body usually broad and anteriorly flattened, posterior end often distinctly narrowed and in some genera bearing a broad caudal fin; mid-dorsal blood vessel ending in rhynchocoel close behind the brain; mouth and proboscis pore separate; intestinal diverticula usually with a ventral branch; lateral nerve cords containing myofibrillae; spermaries arranged in two groups behind, beside or in front of brain (GIBSON, *in press*).

*Genus Pelagonemertes* MOSELEY, 1875

Body flat, with an extensive gelatinous parenchyma between the body organs; body walls very thin, musculature primarily consisting of separate fibre bundles; 4-25 pairs of intestinal diverticula; mid-dorsal blood vessel rudimentary; testes in males anterior to brain.

*Pelagonemertes joubini* COE, 1926

External features

After fixation the specimen was 4.5 mm long and about 2.25 mm in maximum width. The body was anteriorly rounded, posteriorly tapering to end in a bluntly pointed tail with no caudal fin (Figs 2A, B, Plate I). The colour in life was not observed, but after preservation the individual was transparent, with the proboscis, rhynchocoel, alimentary canal and nervous system clearly distinguishable by their opaque white colouration. The proboscis was partly everted and approximately 0.75 mm in maximum diameter; its overall length was about 1.5 times that of the body.

The body wall musculature was visible in the intact specimen. The inner longitudinal muscles appeared as separate and very distinct fibre bundles, particularly on the dorsal and ventral margins, but the circular muscles were both less distinct and more weakly developed.

The rhynchocoel extended almost to the posterior end of the body (Fig. 2A). For most of its length it was spacious, but approximately 70-75% along its length narrowed sharply to end in a slender, tubular region. The proboscis was attached to the rhynchocoel wall at the point of narrowing.

The separation of the mouth and proboscis pore could not be distinguished in the intact specimen. The foregut was short, leading to a slender intestinal canal bearing 18 pairs of lateral diverticula. A short anterior caecum projected ventrally below the foregut. The anterior four pairs of intestinal diverticula were distinctly longer than the remainder, the diverticula becoming shorter and less regularly spaced farther back (Fig. 2B). With the exception of the first pair of diverticula, which were distally bilobed with a dorsal branch, none of the diverticula were subdivided, each forming a somewhat club-shaped tubular lateral extension of the gut curving dorsolaterally around the rhynchocoel and passing above the lateral nerve cords. Their degree of curvature was reduced posteriorly commensurate with their decreasing length.

Dorsal and ventral brain lobes were closely joined on each side. The lateral nerve cords extended almost to the posterior tip of the body, where they met by a sub-intestinal transverse connective (Fig. 2B).

Histological observations

The only histological study of the internal anatomy of *Pelagonemertes joubini* was that

made by COE (1926) when he established the species from a single specimen. Subsequent reports of the taxon have evidently relied on features visible in the intact individual for their identification.

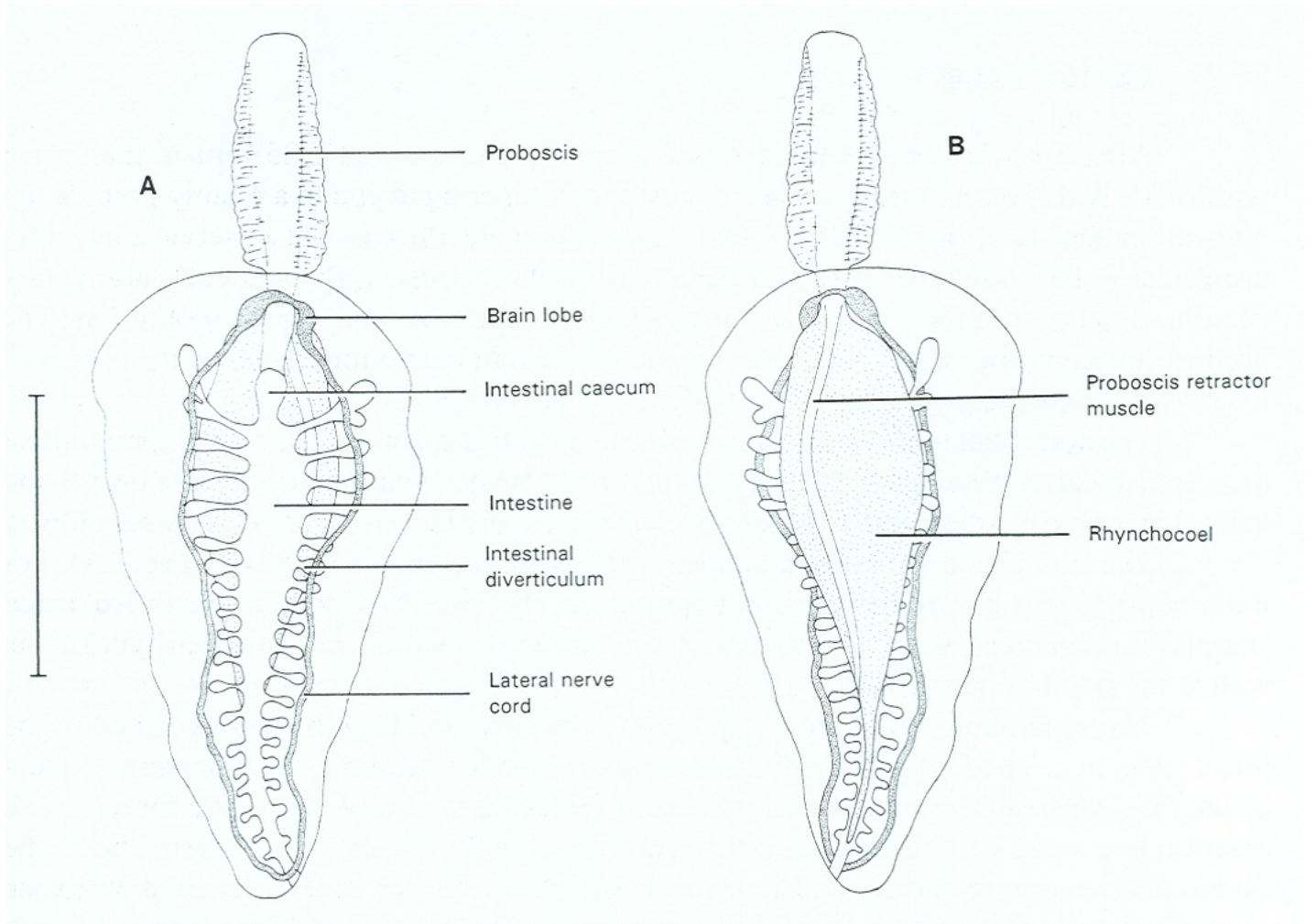


Fig. 2 - *Pelagonemertes joubini*. Camera lucida drawings of complete specimen, viewed from ventral (A) and dorsal (B) aspects and drawn to the same scale. Scale bar = 2 mm.

### Body wall, musculature and parenchyma

The organisation of the body wall, musculature and parenchyma of the present specimen broadly conform with that described by COE (1926), although some differences can be distinguished. Much of the epidermis of the Canary Islands example has sloughed off, but in the ventral cephalic region, close in front of the mouth, it is 15-25  $\mu\text{m}$  tall and packed with gland cells filled with strongly acidophilic secretory globules. These appear to correspond

with what COE (1926: 204-205) described as glands “with a coarsely granular, deeply staining secretion”; the second gland type described by him as filled with a clear, mucus-like secretion could not be found in those portions of the epidermis retained on the present specimen.

The epidermal basement layer is thin, as noted by COE, and although he did not describe it as externally developed into a basal-cup zone, typical of many hoplonemertean (NORENBURG, 1985), they are clearly visible in his pl. 25 fig. 155. In places the basal lamina extends between 5-10  $\mu\text{m}$  into the epidermis. Below the basement layer a distinct dermal zone, up to 15  $\mu\text{m}$  or more thick, separates it from the body wall musculature. COE (1926: pl. 25, fig. 156), although not mentioning a dermis in his description, depicts a comparable layer in his drawing through part of the cerebral portion of the body.

The body wall musculature is weakly developed. COE (1926: 205) emphasised the “interesting deviation” of the cephalic musculature in comparison with that of other known species of *Pelagonemertes*, in which there was only a “thin circular layer and a few scattered longitudinal fibers”, just as in the present example. In the brain region, however, the longitudinal muscles described and illustrated by COE are more strongly developed and arranged into “four bands of muscles (...) well separated from the circular muscles (...) by an irregular layer of parenchyma (...). Anteriorly these muscular bands fuse with the muscles of the proboscis-sheath at the point of attachment of the proboscis”. In the present specimen groups of muscle fibres radiating outwards from the proboscis insertion appear to be derived from the proboscis longitudinal muscle layer rather than that of the rhynchocoel wall, although it is difficult to determine at the insertion precisely where the rhynchocoel muscles cease and the proboscis muscles commence. The four bands of longitudinal muscle fibres are also nowhere near as well developed in the present individual, although their arrangement into discrete fibre bundles separated by parenchyma is just as originally described for the species.

### Proboscis apparatus

The general organisation of the rhynchocoel is very similar to that described by COE (1926: 206); he noted that the muscle layers of the rhynchocoel wall consisted of “an inner layer of longitudinal fibers, outside which are two incompletely separated layers of about equal thickness composed of oblique or spiral fibers”, whilst in the anterior region “the layers are almost reversed, there being an inner circular layer and an outer layer of longitudinal bundles”. Just behind the proboscis insertion in the present specimen the wall is about 30  $\mu\text{m}$  thick, and although extremely thin and incomplete, the inner layer of circular fibres can be distinguished. Farther back, however, the innermost muscles are longitudinal, whereas the outermost fibres have a more mixed arrangement, some appearing distinctly circular in orientation, others spirally disposed, although whether they indeed form two incompletely separated layers could not be determined.

The rhynchodaeal wall is extremely thin. It contains isolated longitudinal muscle fibres but no other musculature.

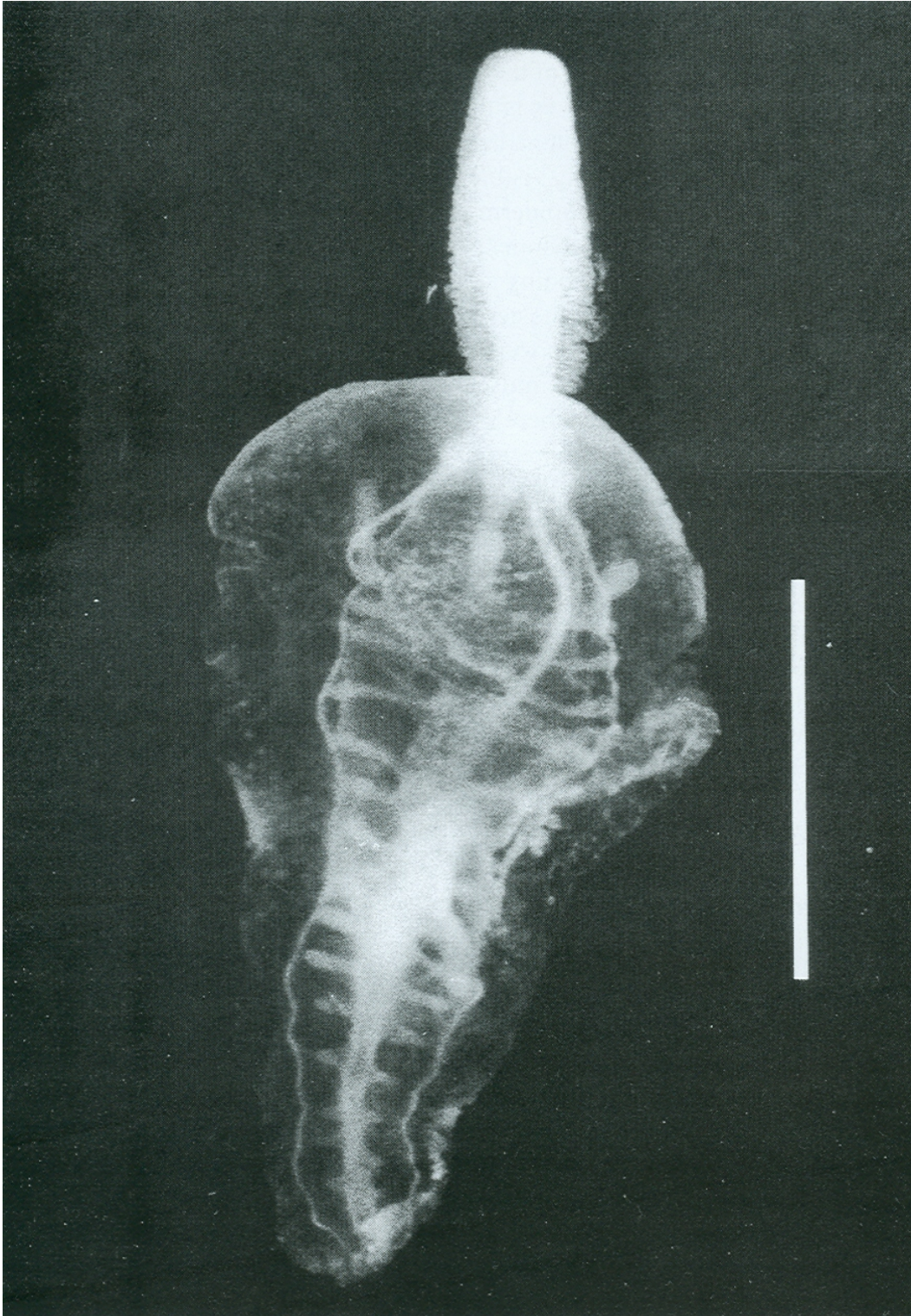


Plate I - *Pelagonemertes joubini*. Photograph of the complete specimen, after preservation, viewed from ventral aspect. Scale bar = 2 mm.



The anterior region of the proboscis possess a very similar organisation to that illustrated by COE (1926: pl. 4, fig. 32). The epithelium is arranged into wide, low papillae, whose glands contain strongly acidophilic contents. Below the epithelium the basement layer is 15-45  $\mu\text{m}$  or more thick; it is almost homogeneous in appearance but traversed by slender, radially-orientated, connective tissue fibrils which extend into the papillae. The muscle layers are in the same sequence as in COE's figure; the outer circular layer is about 10  $\mu\text{m}$  thick, the middle longitudinal zone 25  $\mu\text{m}$  across, and the inner circular coat, described by COE (1926: 207) as "very thin", has a maximum thickness of about 5-6  $\mu\text{m}$ . The longitudinal musculature is divided into two concentric 'layers' of similar thickness by the nerve ring, although COE (1926: 207) commented that the two regions were "unequal (...) the outer being somewhat the thinner of the two". COE noted that in the nerve ring there were 15 large nerves alternating with 15 smaller ones; in the present individual there is no clear distinction between major and minor nerves, although some are obviously larger than others, and only 28 nerves could be counted.

The stylet basis is broad and slightly curved, but the number of stylets on it could not be discerned. COE (1926: 206) stated that on the free border of the basis there were "about eight stylets (...) [each consisting] of a discoid base and blunt, conical tooth". He also commented that he was unable to find accessory stylets though he presumed these were present in life. In the Fuerteventura specimen there are two accessory stylet pouches, each containing 4-6 conical reserve stylets which have a thickened base some 8-9  $\mu\text{m}$  in diameter and are about 8  $\mu\text{m}$  tall; their shape is very similar to those illustrated by COE (1926: pl. 25, fig. 159).

The posterior chamber of the proboscis has the same construction as that described by COE.

### Alimentary canal

The gross anatomy of the alimentary canal, clearly visible in the whole animal (Plate I, Figs 2A, B), has been described earlier in the section on external features.

COE (1926: 207) reported that the mouth was "quite distinctly separated from the proboscis-opening", and the same condition is found in the present specimen; the mouth opens ventrally and pre-cerebrally, a short distance in front of the proboscis insertion. A short oesophageal region, about 100-120  $\mu\text{m}$  long, contains only acidophilic glands in its epithelium. Close in front of the brain the appearance of strongly basophilic gland cells marks the beginning of the stomach, which is similar in section to that illustrated by COE (1926: pl. 25, fig. 156).

### Nervous system

The brain lobes are well developed, the complete fusion between dorsal and ventral lobes noted by COE (1926) being evident in the present specimen. Dorsal and ventral cerebral commissures are of a similar thickness, 22-25  $\mu\text{m}$  across; the ventral commissure passes

between the foregut and rhynchocoel wall muscle layers, but the dorsal commissure, as described by COE (1926: 206), enters the rhynchocoel wall and crosses between its circular and longitudinal muscle layers.

Small nerves, at most only 3-4  $\mu\text{m}$  in diameter, are visible in the gelatinous parenchyma, and can also be found emerging from the lateral nerve cords close behind the brain, but none were traced. COE (1926: 208) commented that “The cephalic nerves, as well as the branches leaving the lateral nerves, are very conspicuous”.

COE (1926: text-fig. 6, pl. 25, fig. 161, 1927: fig. 7) discussed and illustrated the origin of the nerve cord musculature, showing it emerging from the rhynchocoel wall circular muscle layer. In the present specimen occasional fibres could be found leading towards one or the other lateral nerve from the rhynchocoel wall, but the complex arrangement described by COE could not be discerned.

### Blood system

The arrangement of the blood system is very similar to that described for *Pelagonemertes rollestoni* by BÜRGER (1909) and COE (1926). There are two main longitudinal vessels, transversely linked by three connectives. The anterior connective passes over the dorsal surface of the rhynchodaeum close in front of the proboscis insertion, the two vessels leading back to enter the cerebral ring between the rhynchocoel wall and brain lobes. A short distance behind the ventral cerebral commissure they are joined transversely by a connective which passes between the stomach and ventral rhynchocoel wall; it is from this connective that the short mid-dorsal blood vessel leads off, entering the rhynchocoel floor and extending posteriorly for about 200-220  $\mu\text{m}$  before ending blindly in a “broad, flattened sac” (COE, 1926: 208). The lateral blood vessels continue posteriorly close below the lateral nerve cords, to meet by a subintestinal connective. All the blood vessels have thin but distinct walls.

## SYSTEMATIC DISCUSSION

Ten species of *Pelagonemertes* are currently known (GIBSON, *in press*), with three (*P. joubini* (COE, 1926); *P. moseleyi* (BÜRGER, 1895); *P. rollestoni* (MOSELEY, 1875)) previously recorded from North Atlantic waters. The various species are distinguished by the number of pairs of intestinal diverticula and their organization, by the number of proboscis nerves, and whether or not the caudal extremity possesses a distinct fin. The number of intestinal diverticula (18 pairs) of the Fuerteventura specimen differs from *P. moseleyi*, which has only 4-5 pairs, but is within the range of the 12-20 or more pairs reported for *P. rollestoni*. In *P. rollestoni*, however, all the diverticula are deeply branched and lobed, irrespective of the size of the individual. COE's (1926: 207-208) original description of *P. joubini* records that the 18 diverticula on each side of the intestine “are not exactly paired (...). The most

anterior diverticulum on each side is much larger than any of the others. It is much lobed and extends forward as far as the brain-region. The remaining diverticula are relatively simple with only a few lobes and without trace of ventral branch. There is a gradual decrease in size and branching posteriorly until the condition of mere lobes is reached just anterior to the rectum". COE's original specimen, a female, was 20 mm long and 5 mm wide, much larger than the present individual. Differences between COE's account of the diverticula and that described for the Canary Island individual are thus most probably due to differences in the size and degree of sexual maturity of the two specimens. Histological studies of the present specimen reveal minor variations from the original description of the species, such as in the number of proboscis nerves or the clarity of the lateral nerve cord muscles. Such differences, however, are most likely to be due to the size or age of the Fuerteventura specimen, *i. e.*, intraspecific variation, rather than of systematic significance. In a subsequent paper, for example, COE (1954b) noted that the six then known individuals of the species were 10-24 mm long, with 18-24 pairs of intestinal diverticula, but all were sexually mature specimens. VAN DER SPOEL (1985: 21) commented of *P. joubini* that it "is distinct by its transparency, the widely separated intestinal diverticula, 18 in number, and its body shape". VAN DER SPOEL's two specimens, one female, one juvenile, were recorded as 20-25 mm in length; the Canary Island example is thus by far the smallest specimen of *P. joubini* so far collected.

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