

## Presence of *Micronereis* in Antarctic waters and description of a new species, *M. antarctica* (Polychaeta: Nereididae: Notophycinae)

Nicolás Rozbaczylo, Elba Canahuire, and F. Patricio Ojeda

(NR, FPO) Departamento de Ecología, Facultad de Ciencias Biológicas, P. Universidad Católica de Chile, Casilla 114-D, Santiago, Chile; (EC) Facultad de Ciencias Biológicas, Universidad Nacional Mayor de San Marcos, Apartado 140434, Lima 100, Perú

**Abstract.**—A new species of Nereididae, *Micronereis antarctica* from Antarctic waters (South Shetland Islands and the Palmer Archipelago), is described. The species was collected on the sea-bed from the intertidal zone to 30 m deep. This represents the first record of the genus in Antarctic waters. Of the eight known species in this genus, *M. antarctica* is most similar to *M. nanaimoensis* Berkeley & Berkeley, 1953 distributed along the western coast of North America; the two species can be distinguished by morphological differences of the peristomium and mouth, the parapodia and setae, and coloration of integument and eggs.

The systematics of *Micronereis* Claparède, 1863 was reviewed recently by Paxton (1983). *Micronereis* is the only genus in the Notophycinae, one of the four subfamilies in the Nereididae. The Notophycinae show the greatest divergence from the basic nereidid plan by the absence of antennae, presence of small palps lacking palpostyles, a very short peristomium, a proboscis that is not fully eversible, two types of very slightly sclerotized paragnaths, parapodia without dorsal cirri on the first two setigers, and biramous parapodia with widely separated notopodia and neuropodia (Banse 1977, Paxton 1983). The taxonomic status of the genus has been reviewed by Reish (1961), Banse (1977), Buzhinskaya (1981) and Paxton (1983); reproduction and development of some of its species have been studied by Racovitza (1893, 1894), Berkeley & Berkeley (1953) and Rullier (1954).

With eight species described, *Micronereis* has a wide geographical distribution. Its species have been found on the coasts of Europe (*M. variegata* Claparède, 1863), the Pacific coast of North America (*M. nanaimoensis* Berkeley & Berkeley, 1953), the Atlantic coast of North America (*M. pic-*

*cola* Paxton, 1983), the Kurile Islands, Sea of Okhotsk (*M. ochotensis* Buzhinskaya, 1981), the Marshall Islands, Western Pacific (*M. eniwetokensis* Reish, 1961), Australia (*M. halei* Hartman, 1954), Australia and Suez Canal, Egypt (*M. bansei* (Hartmann-Schröder, 1979)), and Snares Island, New Zealand (*M. minuta* (Knox & Cameron, 1970)). Villalba & Viéitez (1988) have reported the presence of *Micronereis* in NW of Spain through a specimen from the intertidal zone of an area in the ría Pontevedra, which could represent a new species. Until now no species of *Micronereis* has been found south of the Antarctic Convergence. In studies undertaken in the intertidal and subtidal zones of Robert Island, South Shetland Islands and Doumer Island, Palmer Archipelago as part of the "Antarctic intertidal ecology" and "Herbivorous fish of the Antarctic rocky sublittoral" projects, numerous *Micronereis* specimens were found. These differed from the other known species reported for the genus and consequently are described as a new species.

Type specimens of the new species are deposited in the National Museum of Nat-

ural History, Smithsonian Institute, Washington D.C. (USNM); Sala de Sistemática, Departamento de Ecología, Pontificia Universidad Católica de Chile (SSUC); and Museo de Zoología, Universidad de Concepción (UCCC).

#### Materials and Methods

Specimens were collected at Robert Island, South Shetland Islands (62°24'S, 59°30'W), in January 1978 and 1979, and in South Bay, Doumer Island, Palmer Archipelago (64°52'S, 63°36'W), in January 1993 and 1995. In Robert Island, samples were taken from a rocky shore ("Roquerío Gaviota") overlooking the Estrecho Inglés, about mid-way between Cabo Morris and Caleta Copper Mine; samples were taken during low tide, in the lower intertidal fringe, from among the alga *Gigartina skottsbergii* Setchell & Gardner, 1936. In South Bay, samples were taken from the subtidal seabed by diving; samples were collected from 1 m<sup>2</sup> areas along a bathymetric transect at six depths (3, 7, 12, 20, 30 and 40 m) with four replicate samples taken at each depth. Polychaetes were fixed in 10% formalin and preserved in 70% ethanol. Small specimens, oocytes and eggs were measured by microscopic observation and the use of a calibrated micrometer eyepiece in the stereoscopic and compound microscopes. To examine paragnaths and jaws, it was often necessary to make a ventrolateral incision and dissect out the complete pharynx and buccal tube, which were opened by cutting laterally. Figures were prepared with a drawing tube on a Wild M-5 stereoscopic microscope and a Leitz compound microscope. For scanning electron microscopic observations (SEM), specimens were treated with ultrasound in an aqueous medium to detach particles adhering to the setae and body surface, dehy-

drated in acetone, critical point dried in CO<sub>2</sub>, mounted on bronze stubs with double-coated tape, sputter-coated with gold-palladium (≈40 Å) and examined and photographed with a JEOL JSM-25SII microscope using an accelerating voltage of 30 kV.

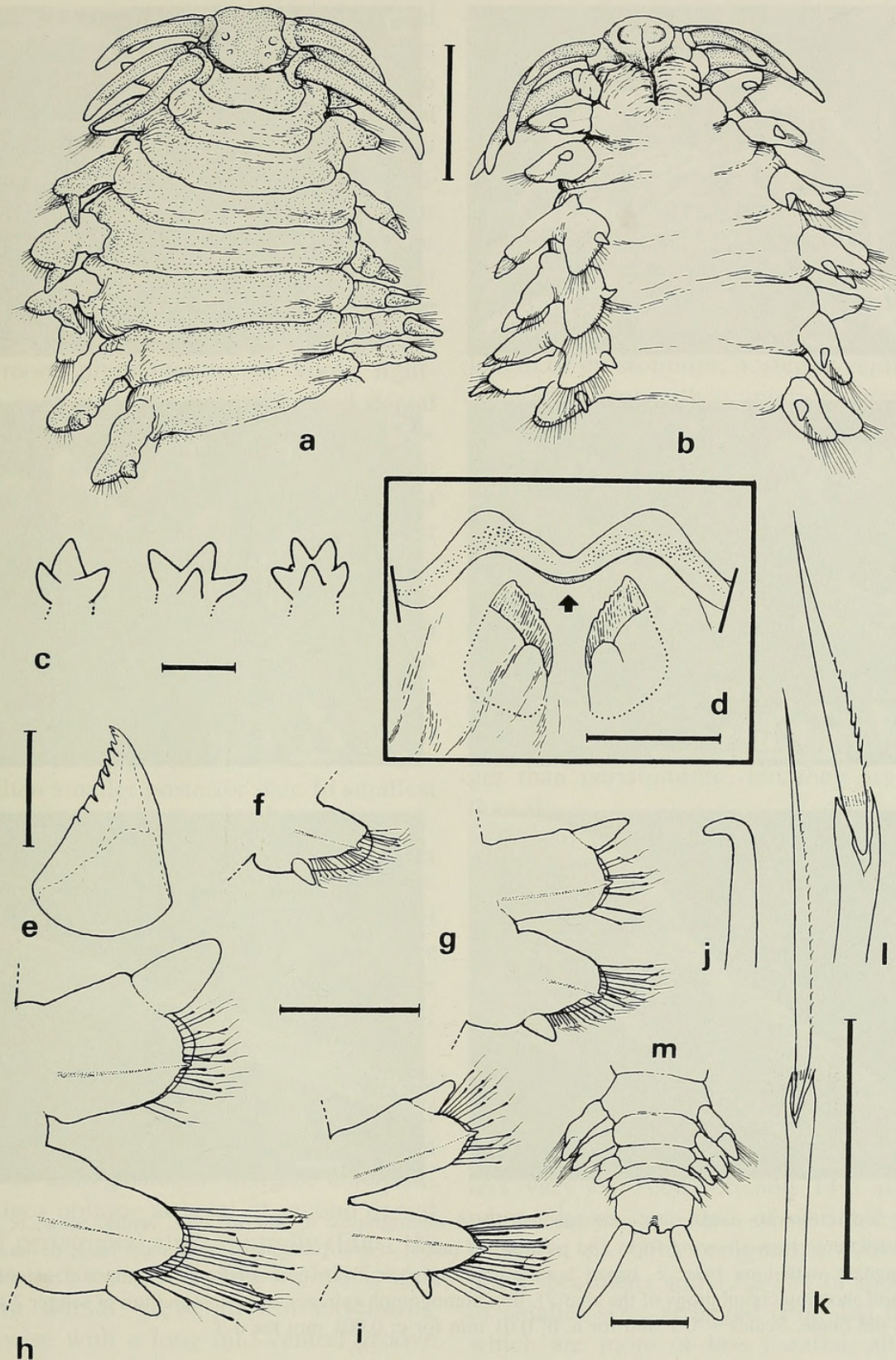
#### *Micronereis antarctica*, new species

Figs. 1, 2

*Material examined*.—Antarctica: Palmer Archipelago, Doumer Island, South Bay, 64°52'S, 63°36'W, J. M. Fariña & A. Palma, coll., 26 Jan 1993, female holotype (USNM 174067, 12 m; 4 sex indeterminate paratypes (USNM 174068, 7–20 m; 11 sex-indeterminate paratypes (USNM 174069), 12–20 m; 3 female paratypes (USNM 174070, 1 small female paratype (USNM 174071); 2 small sex-indeterminate paratypes (USNM 174072), 14 Jan 1995, 12 m, J. M. Fariña & B. Broitman, coll.; 1 female paratype (SSUC 6791) and 10 sex-indeterminate paratypes (SSUC 6792), 26 Jan 1993, 12–20 m, J. M. Fariña & A. Palma, coll.; 1 female paratype (SSUC 6793), 14 Jan 1995, 12 m; 3 female and 1 sex-indeterminate paratypes (UCCC 24038–24041), 14 Jan 1995, 12 m, J. M. Fariña & B. Broitman, coll. South Shetland Islands, Robert Island, Copper Mine Peninsula, 62°24'S, 59°30'W, N. Rozbaczylo, coll., 12 Jan 1978, intertidal, 2 small sex-indeterminate paratypes (USNM 174073).

*Diagnosis*.—Prostomium rounded to subquadrangular. Peristomium well developed, approximately half the length of prostomium. Peristomial cirri subulate. Mouth with long mid-ventral fissure. Oral paragnaths with 3–5 conical cusps circularly disposed. One median maxillary paragnath bar-shaped. Jaws of adults of shortened type. Compound homogomph spinigers with serrated blades, shaft without internal

Fig. 1. *Micronereis antarctica*, new species, holotype; a, anterior end, dorsal view; b, anterior end, ventral view; c, oral paragnaths showing different numbers of cusps, side view; d, scheme of buccal tube and pharynx



dissected ventrally showing the two groups of oral paragnaths, the maxillary paragnath (indicated by the arrow) and the jaws; e, jaw from a specimen 4.9 mm in length; f, parapodium from setiger 1, posterior view; g, parapodium from setiger 3, posterior view; h, parapodium from setiger 13, posterior view; i, parapodium from setiger 26, posterior view; j, tip of a notopodial acicula from setiger 26; k, thin homogomph spiniger from notopodium of setiger 12; l, broad homogomph spiniger from notopodium of setiger 12; m, posterior end. Scales = 1 mm for a, b; 0.5 mm for d-i, m; 0.05 mm for k, l; 0.01 mm for c, j.

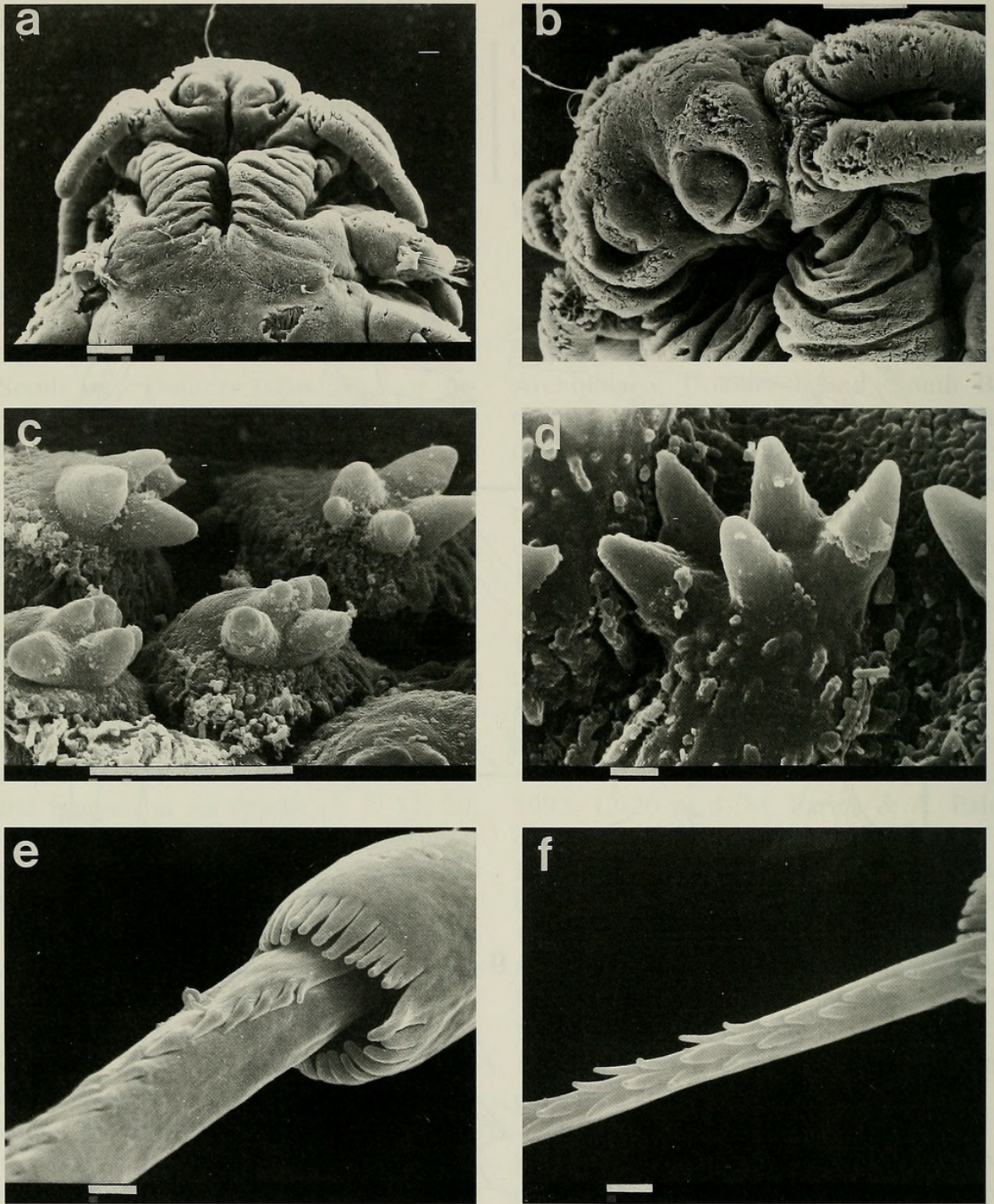


Fig. 2. *Microneis antarctica*, new species, SEM micrographs: a, anterior end, ventral view; b, anterior end, ventrolateral view showing form and position of palps; c, oral paragnaths with short base; d, detail of an oral paragnath with long base; e, broad homogomph spiniger from neuropodium of setiger 5, detail of the articulation showing crenulations of the shaft; f, thin homogomph spiniger from notopodium of setiger 7 showing detail of the blade. Scales = 0.1 mm for a, b; 0.01 mm for c; 0.001 mm for d-f.

transversal septa, with crenulated distal end. Notopodial and neuropodial aciculae with bent tips. Parapodia without ciliation. Accessory parapodial cirri absent.

*Description*.—Holotype female, com-

plete with 40 setigers, measuring 14.5 mm long, 1.9 mm wide without and 2.7 mm with parapodia. Smallest specimens (Paratypes USNM 174071 and USNM 174072 and 174073) 2.5–4.2 mm long for 14–17

setigers; width 0.3–0.8 mm without and 0.7–1.2 mm with parapodia, without setae. Largest specimen (Paratype SSUC 6793) 36 mm long for 46 setigers, width 2.4 mm without parapodia at setigers 4–5 and 3.9 mm with parapodia, without setae. In specimens conserved in alcohol body colour varying from light to dark brown more or less uniform; distal ends of peristomial cirri with little or no pigmentation; in some specimens the prostomium and first setigers have more pigmentation; in some light-brown specimens the notopodia and dorsal parapodial cirri are dark brown; in a few specimens the body has darkish brown transversal stripes of different lengths that cover the full width of the segment against a light-brown background.

Prostomium (Fig. 1a) rounded to subquadrangular, slightly wider than long, with weakly bilobed anterior margin; rounded in the smallest specimens. Two pairs fuchsia-coloured eyes with lenses, in trapezoidal arrangement; anterior pair larger and further apart than smaller posterior pair. In smallest specimens eyes in a nearly transverse row. A pair of small, rounded, ventral palps (Figs. 1b, 2a, b), with external lateral margins delimited by a slight half-moon shaped depression and separated from each other by a more or less narrow gap; tips of palps slightly bent towards middle ventral line of body, with brown-coloured spots.

Peristomium (Fig. 1a), seen dorsally, a clearly visible segment approximately half the length of prostomium; anterior margin narrower than posterior margin; anterolateral edges oblique at level of second dorsal pair of peristomial cirri; ventrally (Figs. 1b, 2a), the peristomium is only slightly longer than in dorsal view; mouth extending lengthwise with a long mid-ventral groove extending almost the entire length of peristomium and reaching nearly the anterior border of the first setiger; 2 to 10 furrows on either side of the groove around mouth; in smallest specimens there is no groove so that anterior margin of peristomium is en-

tire with few furrows and U- or V-shaped or slightly concave.

Four pairs long, subulated tentacular cirri of different lengths; the anterior two pairs, arising slightly in front of the first pair of eyes and the posterior two pairs at level of second pair of eyes or slightly posterior; the anterior ventral pair is the shortest, approximately 1.5 to 2 times the length of prostomium; anterior dorsal pair longer than anterior ventral pair, measuring over twice the length of prostomium; posterior ventral pair somewhat longer than anterior dorsal pair; posterior dorsal pair longest, measuring approximately three times length of prostomium and in most of the larger specimens, when extended backwards, reaching near to the posterior border of setiger 3 and in few cases anterior margin of setiger 5. In most smaller specimens posterior ventral pair of peristomial cirri is the shortest; posterior dorsal pair, extended backwards, reaching setigers 2–3. Dorsally both the first and second setigers segments are only slightly longer than peristomium, but they are wider than it.

Buccal tube with up to 180 oral paragnaths and with one mid-dorsal maxillary paragnath. Oral paragnaths (Figs. 1c, 2c, d) caramel-coloured, with 3 to 5 conical cusps of varying sizes, arranged circularly with tips facing outwards; cusps simple or bifid. In general, paragnaths with four cusps in the form of a cross are most common. In both large (over 13.5 mm) and smaller specimens (4.9–5.7 mm) there are small and large paragnaths, whose distal diameters vary between 4.6 and 11.5  $\mu\text{m}$  and whose bases are also of variable length (Fig. 2c, d). Oral paragnaths, 176–180 in large specimens and 132–154 in specimens of smaller size, arranged (Fig. 1d) in rows which are more or less parallel, alternate, distributed in two fusiform bands which surround almost the entirety of the buccal tube, with the wider central parts in lateral position and the narrow ends in dorsal and ventral position; the dorsal and ventral ends of both bands approximate towards the

middle line of the buccal tube taking up a V shape; in the widest parts there are 3–4 rows of predominately large paragnaths (with greater diameter and long base); towards the narrow ends the number of rows diminishes from 2 to 1, being continuous only between the ventral ends of both areas (so constituting the vertex of a V). The rows are discontinuous dorsally; here the paragnaths tend to be small (with smaller diameter and short base). Maxillary paragnath located in mid-dorsal region of buccal tube (Fig. 1d), shaped like a thick bar, with anterior margin slightly concave; light caramel-coloured in large specimens and unpigmented in small specimens. Pharynx with two jaws (Fig. 1d, e), caramel-coloured; of prolonged type in small specimens, in large of shortened type; with 10 teeth on cutting edge distributed as follows: 2–3 incipient teeth in the basal part, then 4–6 prominent teeth and distally one to two small teeth close to the apex. Posterior edge of invaginated pharynx generally reaching back to setiger 4–5 in larger specimens and setiger 2–3 in smaller ones.

First and second pair of parapodia uniramous (Fig. 1f); first pair shortest, directed anteriorly or laterally; presetal lobe longer than postsetal; ventral cirri conical, slightly smaller than those of following parapodia, and located closer to base of parapodia. Setae are homogomph spinigers; shaft without internal transversal septa, distal ends weakly crenulated; blades finely serrated but serration not always visible under 40× magnification; usually setae becoming slightly wider towards acicula; first of supra-acicular dorsal setae thinnest and longest.

From setiger 3 onwards parapodia biramous with conical dorsal cirrus larger than ventral cirrus; presetal lobe longer than postsetal in both rami; notopodial and neuropodial aciculae with bent tips (Fig. 1j) extending slightly beyond the distal margin of the presetal lobe, covered by epidermis; aciculae dark brown with colourless tips. In anterior biramous parapodia (Fig. 1g) notopodial ramus similar in length and width

to neuropodial ramus; towards middle of body notopodia becoming slightly wider (Fig. 1h), diminishing again and similar to neuropodia in posterior setigers (Fig. 1i). Setae homogomph spinigers, similar to those in anterior uniramous parapodia (Fig. 2e, f), of two types: one, with blades gradually tapering towards tip, with fine serrations uniformly distributed along almost entire length of blade (Fig. 1k); and, two, with blades widened at base, with more conspicuous, wider based serrations ending in fine extensions (Fig. 1l). Narrower setae located in dorsal- and ventralmost positions of each fascicle, wider ones in middle of each fascicle, next to aciculae; under SEM 2–3 longitudinal rows of spines can be observed as more or less fingerlike extensions bent slightly outwards (Fig. 2f), or bent towards the central axis (Fig. 2e). Pygidium short, with terminal anus, without accessory lobes (Fig. 1m), with pair of subulate cirri approximately 1.5–3 times as long as pygidium.

*Geographical distribution.*—South Shetland Islands, Robert Island, intertidal to 6 m deep and Palmer Archipelago, Doumer Island, 3–30 m.

*Remarks.*—None of the specimens examined presented the characteristics in the male described for other species of *Micronereis* (setiger 3 with neuropodial copulatory hooks, accessory parapodial cirri, pygidium with a pair of lateral lobes between the cirri and the anus, additional simple setae or spinigers) or clearly recognizable male gametes. Specimens having eggs or containing oocytes were determined to be female. In the light of the uncertainty present in identifying male specimens, it was decided to consider those specimens in which oocytes were not observed, to be of indeterminate sex. Oocytes are located in the coelomic cavity and in various cases also in the region adjacent to the parapodial rami. In a specimen of 4 mm in length and 16 setigers the oocytes measured 54  $\mu\text{m}$  in diameter and in larger specimens (14.5–26 mm in length, 40 and 38 setigers respec-

tively) measured 194 and 266  $\mu\text{m}$  in diameter; the larger oocytes are light brown. Jaws of females are of shortened type; jaws of a small specimen (4 mm long) are of prolonged type with distal prolongation and 5 proximal teeth. Accessory parapodial cirri absent. In general in the larger female the body is of uniform dark brown colour, of inflated appearance, with bulbous lobe at base of dorsal cirri. In many specimens the parapodia of middle region of the body have openings on the dorsal surface of the base of the notopodial lobes through which a hyaline mucous substance can be seen to have passed; apparently this would serve to keep the oocytes attached to the body of the female. Some specimens also present openings in the neuropodia. In specimens having few openings in parapodia, up to two circular areas, one proximal and the other distal, with thin more or less translucent walls, can be seen in the dorsal region of intact notopodia. A female, 21 mm in length, with 41 setigers, was collected with its mucous egg cocoon in the lower intertidal fringe of Robert Island attached by mucous to the algae *Gigartina skottsbergii*; the mucous egg cocoon preserved in alcohol measures 3 mm in diameter and contains at least two layers of eggs; 143 dark brown eggs, 261–360  $\mu\text{m}$  in diameter, were counted in the outer layer.

*Taxonomical remarks.*—The new species *Micronereis antarctica* is most similar to *M. nanaimoensis* Berkeley & Berkeley, 1953 distributed along the west coast of North America; in both species individuals reach large sizes (over 10 mm); they are similar in the form of prostomium (anteriorly rounded and slightly bilobed), the form of peristomial cirri (subulate), absence of accessory parapodial cirri, and distally bent tips of noto- and neuropodial aciculae. *M. antarctica* is distinguished from *M. nanaimoensis* by the following characteristics present in the latter species: peristomial segment shortened, mouth with conical lateral lips, parapodia strongly ciliated with dorsal and ventral subulate cirri, setae with

internal transversal septa in the shaft, tips of aciculae only slightly bent, different body colour pattern for females (a closely set of fine, transverse, dark red or red-brown lines on a cream ground), and differences in egg size and colour (green and 200  $\mu\text{m}$  for *M. nanaimoensis* and brown and 360  $\mu\text{m}$  for *M. antarctica*). It also resembles *M. variegata* Claparède, 1863 in the form of prostomium (rounded with anterior edge slightly bilobed), form of peristomial cirri (subulate), absence of accessory parapodial cirri, and absence of internal transversal septa in the shaft of spinigers. It is distinguished from *M. variegata* by the following characteristics of the latter species: all the peristomial cirri are of equal length or with the posterior dorsals only slightly longer than the rest, oral paragnaths diadem-shaped with a flat base and a side having 4 cusps, and two median maxillary paragnaths. It is distinguished from *M. piccola* Paxton, 1983, *M. bansei* (Hartmann-Schröder, 1979), *M. eniwetokensis* Reish, 1961, and *M. ochotensis* Buzhinskaya, 1981 because in all of these the peristomial segment is very short and the shaft of spiniger has internal transversal septa; and in the first three species there are two median maxillary paragnaths rather than one. Moreover, *M. piccola* has cirriform peristomial cirri, extended notopodial lobes above the dorsal cirrus with several setae, and long and cirriform dorsal and ventral parapodial cirri. *Micronereis bansei* has ciliated parapodia, and mature females have enlarged dorsal cirri with lamellar extensions. *Micronereis eniwetokensis* has peristomial cirri broadest near the point of attachment and tapered distally, and the inner margin between notopodium and neuropodium is ciliated; *M. ochotensis* has larger palps, ciliated parapodia, and subulate parapodial cirri of similar size. *M. antarctica* is distinguished from *M. minuta* (Knox and Cameron, 1970) and *M. halei* Hartman, 1954 by the accessory parapodial cirri of both of these species; *M. minuta* also has peristomial cirri terminating in short fingerlike

projections and two median maxillary paragnaths; further, *M. halei* lacks paragnaths.

*Etymology*.—This new species has been named *antarctica* since this is the first species of *Micronereis* known for Antarctic waters.

*Ecological remarks*.—*Micronereis antarctica*, new species, occurs from the intertidal down to 30 m deep in the subtidal zone off South Bay, Doumer Island. The highest densities of this polychaete were found between 12 and 20 m depth, which corresponds to a zone dominated by species of the red algal genera *Iridaea*, *Plocamium*, *Ptilonia* and *Callophyllis*. *Micronereis antarctica* was the most abundant polychaete species in the benthic samples taken in 1995 (26% of the total number of individuals), while in 1993 samples was the second most important polychaete species (9%) after *Neanthes kerguelensis* (McIntosh, 1885).

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