



# ANTARCTIC SCIENCE NEWS



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compiled by Dr. Alvarinho J. Luis

## New species of marine worm discovered in Antarctica

A team of scientists has discovered a new species of polychaete, a type of marine annelid worm, 9-meters deep underwater near Japan's Syowa Station in Antarctica, providing a good opportunity to study how animals adapt to extreme environments.



Two species of the *Flabegraviera* genus: *Flabegraviera fujiae* (left), the new species discovered in the study, and *Flabegraviera mundata* (right). Scale bar: 1cm.

International efforts are currently underway in Antarctica to build long-term monitoring systems for land and coastal organisms from an ecological conservation standpoint. To this end, the accumulation of continent-wide fauna information is essential, but Japan is lagging behind in gathering and analyzing such data around Syowa Station, particularly in regard to coastal marine life.

To address this problem, in 2015 a team of researchers, including Keiichi Kakui, from Hokkaido University, and Megumu Tsujimoto, a postdoctoral researcher at Japan's NIPR, started researching marine specimens stored at the institute, as well as newly collected specimens. As a part of this process, they conducted microscopic analyses to examine two annelid worms that scuba divers collected 8-9 meters deep on January 16th, 1981, at Nishinoura near Syowa Station.

The worm found 9 meters deep turned out to be a new, unnamed polychaete -- a variety with a thick, gel-like coat and conspicuous, long notochaeta. The team named the new species *Flabegraviera fujiae*, taking after the icebreaker ship "Fuji" used in the expedition in 1981. The specimen collected 8 meters deep was recognized as *Flabegraviera mundata*, and was deemed to have been collected at the shallowest depth ever recorded for the *Flabegraviera* genus.

This study is a major step forward in understanding marine life in the coastal region near Syowa Station, says Dr. Keiichi Kakui. The *Flabegraviera* genus, to which the three species belong, is unique to the Antarctic and considered a good example for studying how polychaetes adapt to extreme environments.

Now that it has become clear that polychaetes inhabit depths reachable by scuba divers, the researchers hope to conduct experiments using living specimens to gain a deeper understanding of marine life in the area, helping to create an information infrastructure vis-à-vis local biodiversity.

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## A new species and the shallowest record of *Flabegraviera* Salazar-Vallejo, 2012 (Annelida: Flabelligeridae) from Antarctica

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### Abstract

A new species of polychaete, *Flabegraviera fujiae* sp. nov., is described and the first report of *F. munda* (Gravier, 1906) from the shallow water around Syowa Station, Antarctica, is presented. *Flabegraviera fujiae* sp. nov. resembles *F. profunda* Salazar-Vallejo, 2012 but is discriminated from the latter by having eyes and an exposed cephalic cage. The specimen of *F. munda* was collected from a depth of 8 m, providing the shallowest record of this species to date.

**Key words:** Polychaeta, taxonomy, Antarctica, Syowa Station, Nishinoura

### Introduction

*Flabegraviera* Salazar-Vallejo, 2012 is a sedentary polychaete genus, members of which have only been found on the seabed around Antarctica. Among about 25 genera in the family Flabelligeridae (Jumars *et al.* 2015), it particularly resembles *Annenkova* Salazar-Vallejo, 2012, *Flabehlersia* Salazar-Vallejo, 2012, *Flabelliderma* Hartman, 1969, *Flabelligera* Sars, 1829, and *Flabesymbios* Salazar-Vallejo, 2012, because they share: 1) the cephalic cage, which is a complete cylinder surrounding the head, and 2) the multi-articulated neurohooks, each having a distally bent tip called the crest (Salazar-Vallejo 2007). *Flabegraviera* is distinguished from the aforementioned five *Flabelligera*-like genera by having a very thick, gel-like tunic and conspicuous, long notochaetae. It currently consists of two species, *Flabegraviera munda* (Gravier, 1906) and *Flabegraviera profunda* Salazar-Vallejo, 2012. *Flabegraviera munda* was originally described as *Flabelligera munda* by Gravier (1906), but later transferred to *Flabegraviera* by Salazar-Vallejo (2012).

In recent years, understanding marine diversity and ecosystems around Antarctica in relation to human-induced impacts, including climate change, has become increasingly necessary (Constable *et al.* 2014; Chown *et al.* 2015). Therefore, we should increase our taxonomic knowledge of marine organisms in the southern polar region to facilitate speedy and accurate species identification (Kaiser *et al.* 2013). Although the macrobenthic fauna around Antarctica has been well documented through a long history of research, our knowledge on the benthic fauna in some parts of East Antarctica is still extremely limited because this area is largely inaccessible (Clarke *et al.* 2004; Griffiths *et al.* 2014).

The faunal diversity around Syowa Station, a Japanese research station located in East Antarctica, has been studied in the terrestrial environment including soil, vegetation, and lakes and in the marine environment including sea ice, shallow-water, and deep sea (Ohshima 1979; Numanami & Kosaka 1984; Hamada *et al.* 1986; Hoshiai & Tanimura 1986; Okutani 1986; Sugawara *et al.* 1995; Tsujimoto *et al.* 2014). There were a few intensive, shallow-water, macrobenthic faunal surveys conducted around Syowa Station in the 1980s (Watanabe *et al.* 1982; Numanami & Kosaka 1984; Hamada *et al.* 1986). However, in these studies, many of the animals were only briefly reported, leaving our knowledge on the biodiversity of macrobenthic fauna around this area largely limited; polychaetes in particular were left completely unidentified even to the family level.

During dive sampling in 1981 at Nishinoura near Syowa Station KW collected two flabelligerid worms. We identified these two specimens as an undescribed species and *F. munda*, respectively. The latter specimen provides the shallowest record of *F. munda* to date.

## Material and methods

Two worms were collected by SCUBA diving from 8–9 m depth in Nishinoura (69°00.4' S, 39°34.5' E) near Syowa Station, Lützow-Holm Bay, Antarctica, in 1981 during the 22nd Japanese Antarctic Research Expedition (JARE 22) summer operation by Yasushi Nakajima and Kentaro Watanabe. Detailed information about sampling method is provided by Nakajima *et al.* (1982) and Watanabe *et al.* (1982). Worms were fixed and preserved in 70% ethanol immediately after the collection at Syowa Station, then later stored at the National Institute of Polar Research (NIPR) in Tokyo, Japan. The preserved specimens were observed by a stereoscopic microscope (Nikon SMZ1500 and OLYMPUS BX51); photographs were taken by a digital camera (Nikon D5200 and OLYMPUS OMD-EM5). All the specimens have been transferred to the National Museum of Nature and Science, Tsukuba (NSMT), Japan.

## Results

### Systematics

#### Family Flabelligeridae de Saint-Joseph, 1894

#### Genus *Flabegraviera* Salazar-Vallejo, 2012

(New Japanese name: Kibukure-habouki-zoku)

#### *Flabegraviera fujiae* sp. nov.

(New Japanese name: Fuji-kibukure-habouki)

(Figs 1–2)

**Type material.** Holotype. NSMT-Pol-H-609. Complete (some chaetae broken, dissected), sex undetermined, non-reproductive-adult, Nishinoura (69°00.4' S, 39°34.5' E), 9 m depth, sandy mud, 16 Jan., 1981.

**Description.** Holotype (NSMT-Pol-H-609) 9.4 cm long, 1.8 cm wide. Body fusiform, covered by very thick tunic (Fig. 1A). Tunic transparent, gel-like, covering whole body except cephalic cage (partially eroded); sediment grains attached dorsally, ventrally, and laterally (size in long axis ~40 µm), not immersed in tunic. Body papillated; papillae long, clavate, forming sheath covering chaetae, mostly eroded. Lobe on dorsum of chaetiger 1 absent. Dorsal and ventral surface irregular.

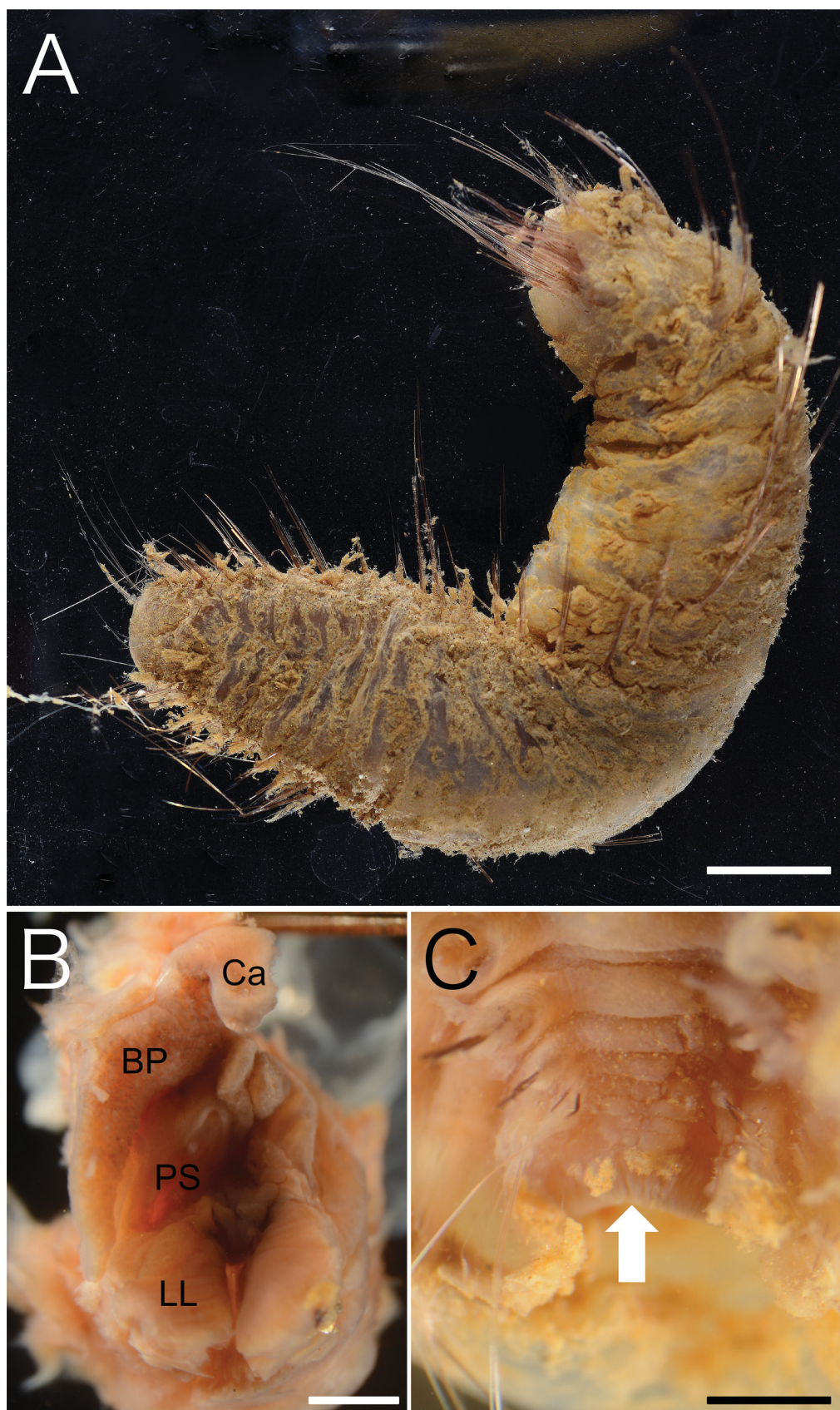
Prostomium low cone. Branchiae 6–8 rows, about 110 filaments per side, 3–5 mm long, decreasing in size ventrally, black in ethanol. Branchial plate crescent-like, bisected by well-developed caruncle (Fig. 1B). Palps long (6 mm), cylindrical, pink in ethanol. Four black eyes present. Lateral and dorsal lips well developed; ventral lip reduced. Nephridial lobes present.

Chaetigers 33 in number; chaetiger 1 comprising cephalic cage. Cephalic cage 1.6 cm long, exposed whole, about 1/5 body length (9/10 body width), comprising 39 notochaetae and 24 neurochaetae per side. Chaetal transition from cephalic cage to body abrupt.

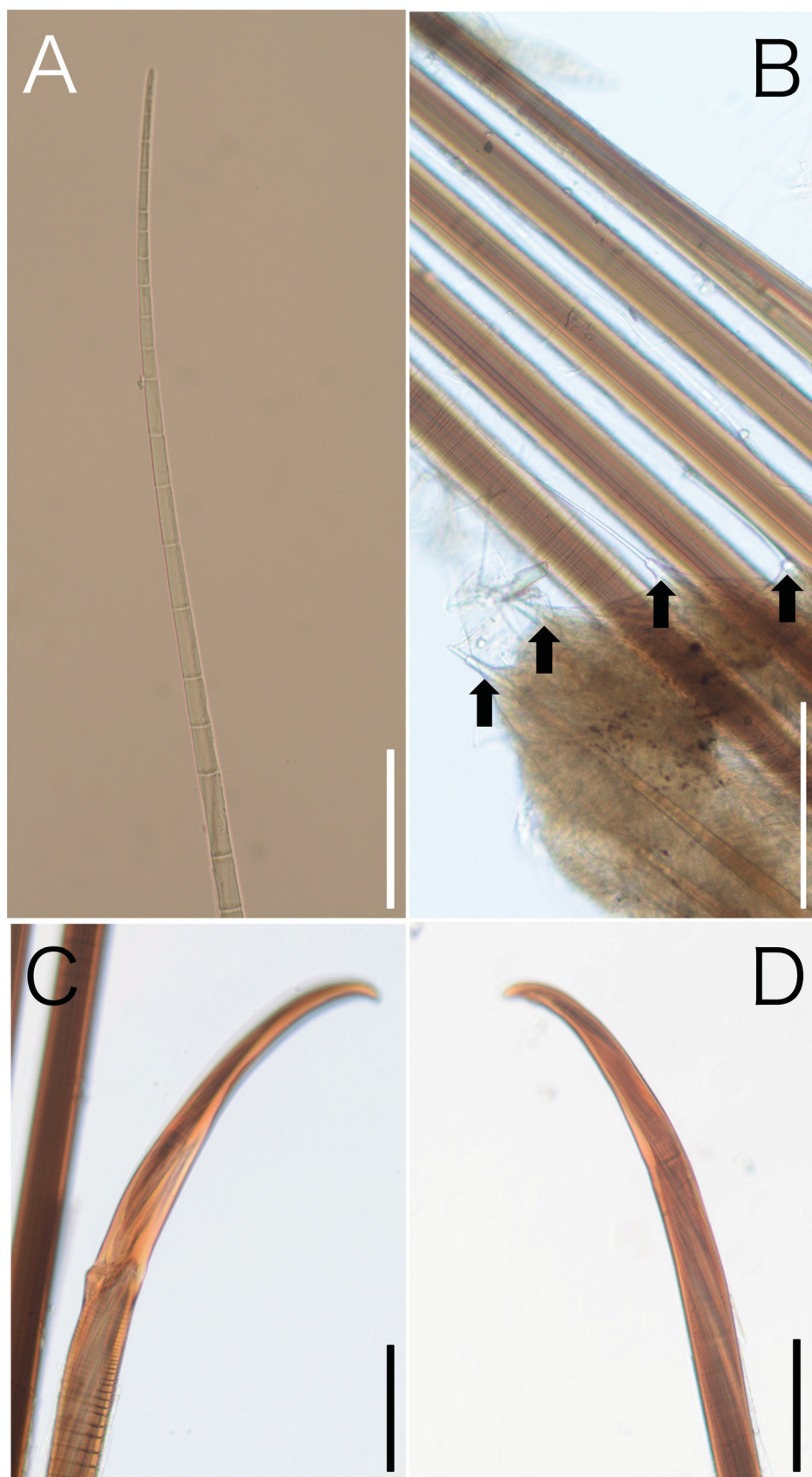
Parapodia well developed, completely covered by tunic, notopodia and neuropodia widely separated. Gonopodial lobe absent.

Chaetal bundles arranged into a straight series not like *F. munda*. Notochaetae of two types: 1) multiarticulated, 1.2–3.4 cm long, 5–7 per fascicle (Fig. 2A); and 2) not multiarticulated, 3 mm long, 8–10 per fascicle (Fig. 2B). Neurochaetae multiarticulated capillaries in chaetiger 1. Neurohooks in chaetigers 2–33 (Fig. 2C, D), 3–5 per fascicle, ankylosed, 0.7–0.9 cm long, pale orange, covered by a cylindrical shaft; crest bending region ankylosed. Multiarticulated neurohooks absent.





**FIGURE 1.** *Flabegraviera fujiae* sp. nov., holotype, NSMT-Pol-H-609. A, Entire body, body twisted, anterior region in lateral view, posterior region in ventral view; head upper side; B, Head, frontal view; left half of branchial plate has been partly removed; branchiae and palps have been removed (BP, branchial plate; Ca, caruncle; LL, lateral lip; PS, palp scar); C, Posterior end, ventral view; arrow indicates ventral anal margin. Scale bars = 10 mm (A); 1 mm (B, C).



**FIGURE 2.** Micrographs of chaetae in *Flabegraviera fujiae* **sp. nov.**, holotype, NSMT-Pol-H-609. A, Chaetiger 29, tip of notochaeta; B, Same, base of notochaeta; black arrows indicate type 2 notochaetae; C, Chaetiger 6, tip of smaller neurohook; D, Chaetiger 27, tip of neurohook. Scale bars = 50  $\mu$ m (A); 200  $\mu$ m (B); 100  $\mu$ m (C, D).



Posterior end exposed, truncate; last two segments achaetous; pygidium simple; no anal cirri; anus without pigment (Fig. 1C).

**Etymology.** The species is named after the Japanese icebreaker *Fuji*, utilized for the research operation during which KW collected the holotype. The derivation is made after the vessel's name taken as a feminine proper name. The new specific name is thus a noun in the genitive case. The Japanese name literally means 'Fuji's thickly dressed flabelligerid', derived from *kibukure* (thick-dressed) and *haboukigokai* (flabelligerid polychaete).

**Remarks.** Morphologically, *Flabegraviera fujiae* **sp. nov.** resembles *Flabegraviera profunda* Salazar-Vallejo, 2012 because in both species the notochaetal arrangement follows a straight-line, the neurohooks are anchylosed, and the tunic carries sediment grains. However, *F. fujiae* can be discriminated from *F. profunda* by the relative size and exposure of the cephalic cage, which is exposed almost entirely in *F. fujiae*, whereas it is covered by the tunic in *F. profunda*. In addition, the cephalic cage is about 1/5 body length in *F. fujiae*, compared to about 1/10 in *F. profunda*. An additional difference is that *F. fujiae* has eyes. Our specimen was collected from a depth of 9 m, that is markedly shallower than the previous records for *F. profunda*, collected in sediments at 330–450 m water depth (Salazar-Vallejo 2012).

### *Flabegraviera mundata* (Gravier, 1906)

*Flabelligera mundata* Gravier, 1906, 537–538; Gravier 1907, 37–39, Pl. 4, Figs 31–32, Text figs 22–23; Gravier 1911, 110–112, Pl. 8, Fig. 87; Benham 1921, 108–109; Monro 1939, 130; Hartman 1952, 233; Hartman 1953, 50; Hartman 1966, 37–39, Pl. 11, Figs 1–4; Hartman 1967, 124; Hartman 1978, 170; Rozbaczylo 1985, 159; Hartmann-Schröder & Rosenfeldt 1989, 72; Knox & Cameron 1998, 72, Figs 137–139.

*Flabegraviera mundata*: Salazar-Vallejo 2012, 43–44, Fig. 18.

(New Japanese name: Kibukure-habouki)

(Figs 3–4)

**Material examined.** Nontype specimen. NSMT-Pol-113161. Complete (some chaetae broken, dissected), sex undetermined, non-reproductive adult, Nishinoura (69°00.4' S, 39°34.5' E), 8 m depth, sandy mud, 16 Jan., 1981.

**Description.** Nontype (NSMT-Pol-113161) 6.0 cm long, 1.1 cm wide, fusiform, covered by very thick tunic (Fig. 3A). Tunic transparent, gel-like, covering whole body and posterior portion of cephalic cage; sediment grains not attached. Body papillated; papillae long, clavate, forming sheath around base of chaetae. Lobe on dorsum of chaetiger 1 absent. Dorsal and ventral surface irregular.

Prostomium low cone. Branchiae 5–7 rows, about 120 filaments per side, 3 mm long, decreasing in size ventrally, colorless in ethanol. Branchial plate crescent-like, bisected by well-developed caruncle. Palps long (8 mm), cylindrical, grooved, pink in ethanol. Four black eyes present. Lateral and dorsal lips well developed, ventral lip reduced. Nephridial lobes present.

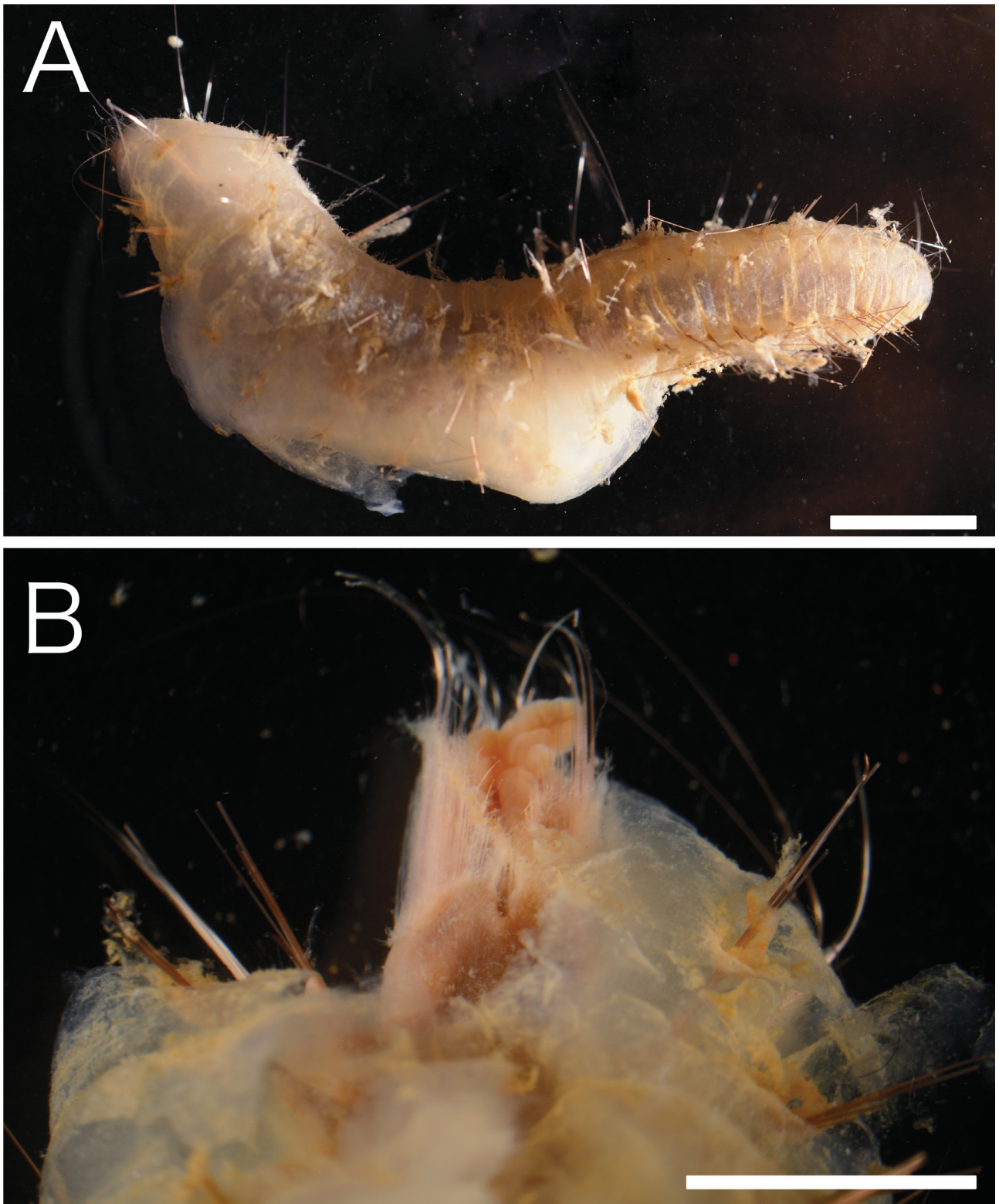
Chaetigers 30 in number; chaetiger 1 comprising cephalic cage. Cephalic cage 0.7 cm long, exposed for anterior 0.2–0.3 cm (Fig. 3B), about 1/10 body length (6/10 body width), comprising 36 notochaetae and 30 neurochaetae per side. Chaetal transition from cephalic cage to body abrupt.

Parapodia poorly developed, completely covered by tunic; notopodia and neuropodia widely separated. Gonopodial lobe absent.

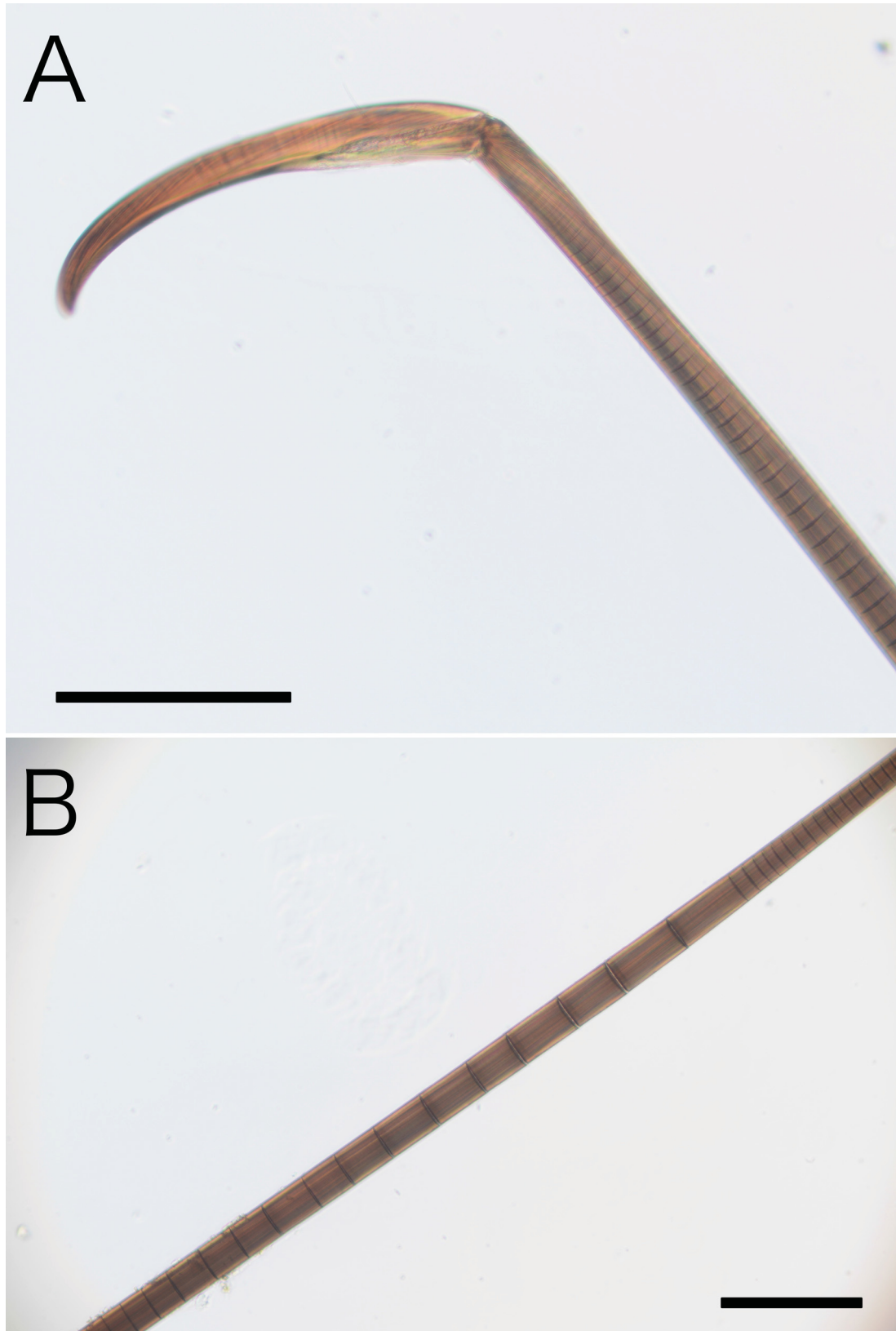
Chaetal arrangement from chaetiger 1 (using “u” for upper, “m” for middle, and “l” for lower (cf. Salazar-Vallejo 2012)): ululumluml.... Notochaetae of single type, multiarticulated, 1.1–2.6 cm long, sickle-like, 4–6 per fascicle. Neurohooks in chaetigers 2–30 (Fig. 4A), 3 per fascicle, multiarticulated, 0.6–1.1 cm long, dark orange, covered by cylindrical shaft; handle anchylosed basally and distally, articulated in between, with 17 articles, progressively longer towards distal end (Fig. 4B); crest distinct, width : length = 1 : 7.

Posterior end not exposed; pygidium simple; no anal cirri; anus without pigment.

**Remarks.** The syntype specimens of *Flabegraviera mundata* (Gravier, 1906) were collected from 40 m and other specimens from a 20–385 m depth range (Salazar-Vallejo 2012). Our specimen was collected from 8 m depth, making it the shallowest record of the species. The finding of this species and also *F. fujiae* **sp. nov.** in shallow water means good opportunities for future research on adaptation of annelids to extreme environments, since the locality can be sampled using SCUBA.



**FIGURE 3.** *Flabeggraviera mundata* (Gravier, 1906), NSMT-Pol-113161. A, Entire body, lateral view; B, Same, anterior end, ventral view; tunic has been removed on left side. Scale bars = 10 mm (A); 5 mm (B).



**FIGURE 4.** Micrographs of chaetae in *Flabegraviera mundata* (Gravier, 1906), NSMT-Pol-113161. A, Chaetiger 27, distal region of neurohook; B, Same, middle area of neurohook, right top is distal side. Scale bars = 200 μm.



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