



# A new deep-sea species of *Flabelligena* from off the South Orkney Islands, the Southern Ocean

Naoto Jimi<sup>‡</sup>, Akito Ogawa<sup>§</sup>, Shimpei F Hiruta<sup>‡</sup>, Minoru Ikehara<sup>¶</sup>, Satoshi Imura<sup>#,□</sup>

<sup>‡</sup> National Institute of Polar Research, 10-3 Midoricho, Tachikawa, Tokyo, Japan

<sup>§</sup> Graduate School of Science, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo, Japan

<sup>‡</sup> Center for Molecular Biodiversity Research, National Museum of Nature and Science, 4-1-1 Amakubo, Tsukuba, Ibaraki, Japan

<sup>¶</sup> Center for Advanced Marine Core Research, Kochi University, Monobe-otsu 200 Nankoku, Kochi, Japan

<sup>#</sup> National Institute of Polar Research, 10-3 Midoricho, Tachikawa, Japan

<sup>□</sup> Department of Polar Science, SOKENDAI (The Graduate University for Advanced Studies), 10-3 Midoricho, Tachikawa, Tokyo, Japan

Corresponding author: Naoto Jimi ([beniimo7010@gmail.com](mailto:beniimo7010@gmail.com))

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## Abstract

## Background

A new acrocirrid species, *Flabelligena hakuhoae* **sp. nov.**, is described from off the South Orkney Islands, the Southern Ocean. Individuals of the new species were collected by rock dredging, 2036–2479 m in depth.

## New information

The new species can be distinguished from its congeners by the number of branchiae, position and length of paired ventral large papillae and length of body papillae.

## Keywords

Antarctica, Southern Ocean, Polychaeta, *Hakuho maru*

## Introduction

Acrocirridae Banse, 1969 (clade Cirratuliformia) consists of 43 species in nine genera distributed from the intertidal zone to the deep seafloor (Magalhães and Bailey-Brock 2011, Martínez et al. 2019). They are found in sandy areas and under rocks, but some genera are pelagic (Osborn et al. 2009).

*Flabelligena* Gillet, 2001 belongs to the Acrocirridae. It has a minute body, body papillae, spinulose or serrated (not cross-barred) notochaetae, 1–3 pairs of branchiae and a pair of frontal palps (Aguirrezabalaga and Ceberio 2006). They live in sandy areas, mainly in bathyal to abyssal depths. The six described *Flabelligena* species are known mainly from the North Atlantic Ocean, three of which are known from the Southwest Atlantic, Mediterranean and South Indian Oceans (Aguirrezabalaga and Ceberio 2006). Several polychaetes faunal surveys have been carried out around the Southern Ocean (e.g. Hartman 1953, Hartman 1964, Hartman 1966, Hartman 1967, Monro 1939). However, with the exception of *Flabelligena amoureuxi* Gillet, 2001 from off the Crozet Island (South Indian Ocean) and *F. erratica* (Orensanz, 1974) from off Falkland Islands (South Atlantic Ocean) (Gillet 2001, Orensanz 1974), there are no records of *Flabelligena* from around the Southern Ocean.

During the research cruise KH19-06-Leg4 by R/V *Hakuho maru*, the first author found individuals of *Flabelligena* from off the South Orkney Islands. In this paper, we describe the specimens as a new species.

## Materials and methods

Specimens were collected from off the South Orkney Islands (Fig. 1A), the Southern Ocean (60°33.54'S, 35°24.43'W–60°34.07'S, 35°23.40'W), 2036 – 2479 m in depth by a rock dredge (Fig. 1B) and extracted from the rock and silt sediments using a 32 µm sieve with seawater and fixed in 70% ethanol. After preservation, these specimens were observed with Nikon SMZ18 and Nikon ECLIPSE 80i microscopes and photographed with a Nikon D5200 digital camera. The paratype specimen was washed in a phosphate-buffered saline solution and dehydrated in a graded ethanol series, dried in a critical-point dryer (HITACHI HCP-1) using liquid CO<sub>2</sub> and coated with gold in an ion sputter (HITACHI E-1045) for SEM observations. Observations were conducted using an SEM instrument (HITACHI S-3000N). Type material is deposited in the National Museum of Nature and Science, Tsukuba (NSMT) and Invertebrate Collection of the Hokkaido University Museum (ICHUM).

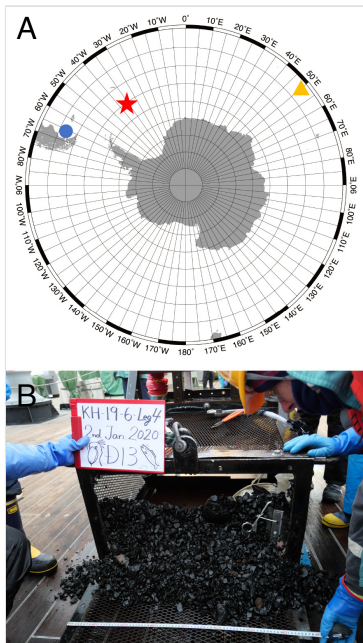


Figure 1. [doi](#)

Sampling sites and sediments of the type locality. **A.** Type localities of three *Flabelligena* species from the southern hemisphere: red star, *F. hakuhoae* sp. nov. in this study; blue circle, *F. erratica* in Orensanz (1974); yellow triangle, *F. amoureux* in Gillet (2001); **B.** The collection gear after sampling at the type locality (red star in A), off the South Orkney Islands, the Southern Ocean.

We followed the morphological terminology of Aguirrezabalaga and Ceberio (2006) and Martínez et al. (2019) in the taxonomic description below.

## Taxon treatment

### *Flabelligena hakuhoae* Jimi, sp. n.

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#### Materials

##### *Holotype:*

- phylum: Annelida; family: Acrocirridae; genus: *Flabelligena*; higherGeography: Southern Ocean; off the South Orkney Islands; waterBody: Southern Ocean; locality: off the South Orkney Islands; verbatimDepth: 2036-2479 m; samplingProtocol: rock dredge; eventDate: 02-01-2020; year: 2020; month: 1; day: 2; habitat: rocks and sands; identifiedBy: Naoto Jimi; language: en; ownerInstitutionCode: NSMT

**Paratype:**

- a. phylum: Annelida; family: Acrocirridae; genus: *Flabelligena*; higherGeography: Southern Ocean; off the South Orkney Islands; waterBody: Southern Ocean; locality: off the South Orkney Islands; verbatimDepth: 2036-2479 m; samplingProtocol: rock dredge; eventDate: 02-01-2020; year: 2020; month: 1; day: 2; habitat: rocks and sands; identifiedBy: Naoto Jimi; language: en; ownerInstitutionCode: ICHUM

**Description**

**Holotype (NSMT-Pol H-813)** 1.8 cm long, 1 mm wide (without chaetae, at widest chaetiger) for 27 chaetigers (incomplete). Body cylindrical (Fig. 2), rounded in anterior and posterior end, yellowish in life and after fixation, with darker pigmentation around the anterior end, without ventral centre line, surface papillated, slightly inflated laterally in chaetigers 5–11, subannulations absent. Body papillae presented on several areas. Papillae of body surface oval, each papilla about 15  $\mu\text{m}$  long and 10  $\mu\text{m}$  wide ( $n = 10$ ), not arranged in transverse rows, scattered. Papillae around branchial scars (Fig. 3) cylindrical, each papilla about 35  $\mu\text{m}$  long and 10  $\mu\text{m}$  wide ( $n = 10$ ), 5–6 papillae present around branchial scars. Papillae on prostomium (Fig. 3A), cylindrical, each papilla about 35  $\mu\text{m}$  long and 20  $\mu\text{m}$  wide ( $n = 10$ ), scattered. Papillae between noto- and neurochaetae (Fig. 5A and D), circular, each papilla about 30  $\mu\text{m}$  long and 30  $\mu\text{m}$  wide ( $n = 10$ ), one papilla between chaetae (Fig. 5D). Paired ventral large papillae present ventral side of parapodium in chaetiger 6 (Fig. 2B and D), short (72  $\mu\text{m}$  long and 55  $\mu\text{m}$  wide), conical, one pair.

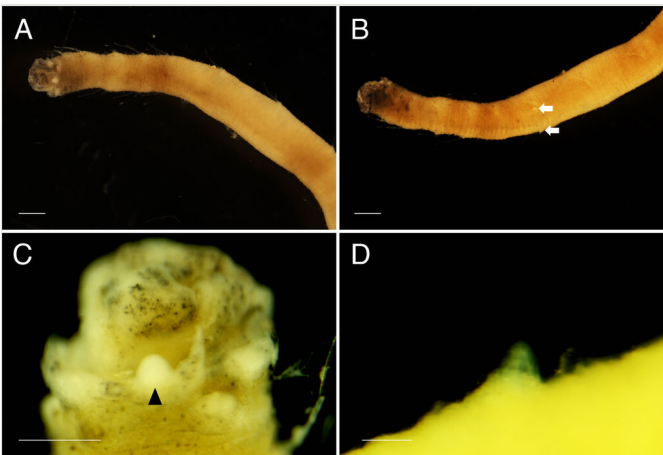


Figure 2. [doi](#)

*Flabelligena hakuhoae* sp. nov., holotype (NSMT-Pol H-813). **A.** Anterior end, dorsal view; **B.** anterior end, ventral view, arrows indicate ventral papillae; **C.** anterior end, dorsal enlarged view, an arrow head indicates a branchia; **D.** ventral large papilla, enlarged view. Scale bars: A–B, 500  $\mu\text{m}$ ; C, 125  $\mu\text{m}$ ; D, 50  $\mu\text{m}$ .

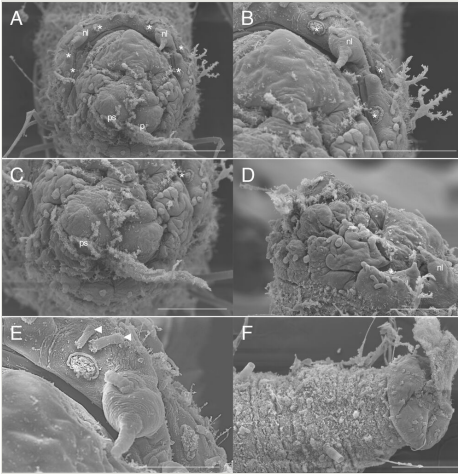


Figure 3. [doi](#)

*Flabelligena hakuhoae* sp. nov., paratype (ICHUM-6113), scanning electron micrographs. **A.** Anterior end, frontal view, proboscis is not everted; **B.** Anterior end, dorsal side, frontal view; **C.** Anterior end, ventral side, frontal view; **D.** Anterior end, lateral view; **E.** branchial scars and nephridial lobe, enlarged view; **F.** pygidium, dorsal view. Asterisks indicate branchial scars. Arrow heads indicate papillae around branchial scars. Abbreviations: nl, nephridial lobe; p, palp; ps, palp scar. Scale bars: A, 300  $\mu$ m; B–D, 200  $\mu$ m; E 100  $\mu$ m; F, 200  $\mu$ m.

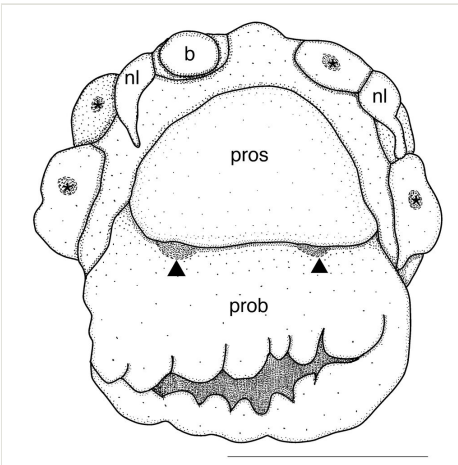


Figure 4. [doi](#)

*Flabelligena hakuhoae* sp. nov., holotype (NSMT-Pol H-813), anterior end, frontal view. Proboscis is everted. Abbreviation: b, branchia; nl, nephridial lobe; prob, proboscis; pros, prostomium. Asterisks indicate branchial scars. Arrow heads indicate palp scars. Scale bar = 500  $\mu$ m.

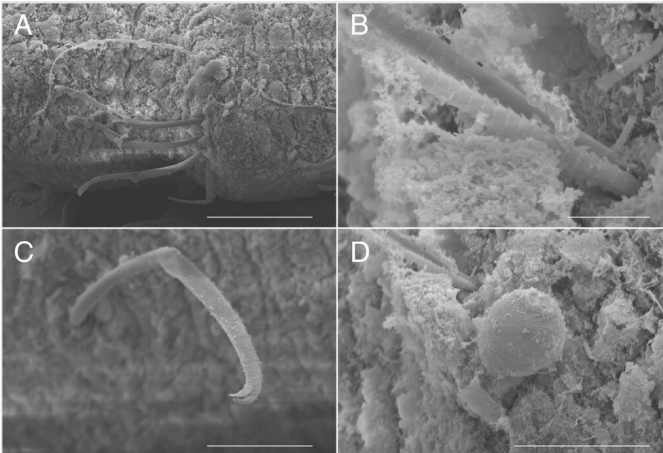


Figure 5. [doi](#)

*Flabelligena hakuhoae* sp. nov., paratype (ICHUM-6113), scanning electron micrographs. **A.** Notochaetae and neurochaetae, posterior region; **B.** Notochaetae; **C.** Neurochaetae; **D.** Body papilla under the notochaetae. Scale bars: A, 200  $\mu$ m; B, 10  $\mu$ m; C, 100  $\mu$ m; D, 50  $\mu$ m.

Prostomium subtriangular, eyes absent, nuchal organs absent. Peristomium distinct. Palp scars on anterior margin of prostomium, one pair (Figs 3, 4), palps cirriferous shape, with numerous cirri on ventral side. Branchial scars three pairs (Figs 3, 4), branchiae globular shape (Figs 2, 4). Nephridial lobe consists of nephridiopore papillae and globular base (Fig. 3B), two nephridiopore papillae per globular base (Fig. 3B). Notochaetae spinulose capillary (Fig. 5B), 1–2 per fascicle throughout the body. Neurochaetae compound (Fig. 5C): blades sickle-shaped, bidentate (one over another), inner edge of blade smooth; blade length 6/5 of shaft in chaetigers 1–17, as long as shaft in chaetigers 18–27; 1–2 per fascicle in chaetigers 1–17, 3–4 per fascicle in chaetigers 18–27. Pygidium lost.

**Paratype (ICHUM-6113, used in SEM observation)** 1.2 cm in length, 0.9 mm in width (without chaetae, at widest chaetiger), 23 chaetigers. Pygidium rounded (Fig. 3F), with many body papillae (about 15  $\mu$ m long and 8  $\mu$ m wide,  $n = 10$ ), without pygidial cirrus. Other characters the same as holotype.

### Etymology

The species is named after the *R/V Hakuho-maru*, a gear of the ship which collected the type specimens from the Southern Ocean. The specific name is a noun in the genitive case.

### Distribution

The new species is only known from the type locality, off the South Orkney Islands, the Southern Ocean (60°33.54'S, 35°24.43'W–60°34.07'S, 35°23.40'W), 2036 – 2479 m in depth.

## Taxon discussion

*Flabelligena hakuhoae* **sp. nov.** belongs to *Flabelligena* because it has the following features: retractile anterior region, absence of distinct body region, presence of various pairs of branchiae, composite falcigerous neurochaetae, simple spinulose or serrated notochaetae (Aguirrezabalaga and Ceberio 2006). This species is different from the other known species by having the following features (see Table 1): i) paired ventral large papillae present on the ventral side of parapodium in chaetiger 6; ii) three pairs of branchiae; iii) short body papillae between noto- and neurochaetae. *Flabelligena erratica* (Orensanz, 1974) and *F. gascognensis* Aguirrezabalaga and Ceberio, 2006 have paired ventral papillae between chaetigers 6–7, but do not have them at the ventral side of a parapodium in chaetiger 6 (Orensanz 1974, Aguirrezabalaga and Ceberio 2006). Additionally, *F. gascognensis* has long (as long as neurochaetae) papillae around the parapodium, while the new species does not have them (1/6 of neurochaetae). Two species, *F. amoureuxi* Gillet, 2001 and *F. erratica*, have been found in the vicinity of the Southern Ocean as well as this new one. The new species can be distinguished from the other two species by having three pairs of branchiae, paired ventral large papillae near the parapodium of chaetiger 6 and absence of eyes. *Flabelligena amoureuxi* has a pair of branchiae and does not have paired ventral large papillae and eyes. *Flabelligena erratica* has a pair of branchiae, paired ventral large papillae between chaetigers 6–7 and eyes (see Table 1).

Table 1.

A comparative table of *Flabelligena* (modified from Aguirrezabalaga and Ceberio 2006). The morphological features are based on original descriptions and figures.

	<i>F. cirrata</i> Hartman and Fauchald 1971	<i>F. amoureuxi</i> Gillet 2001	<i>F. erratica</i> Orensanz 1974	<i>F. biscayensis</i> Kolmer 1985	<i>F. mediterranea</i> Kolmer 1985	<i>F. gascognensis</i> Aguirrezabalaga and Ceberio 2006	<i>F. hakuhoae</i> sp. nov. This study
Pair of branchiae	1	1	1	2	2	3	3
Pair of ventral large papillae	absent	absent	one pair, between chaetigers 6–7	absent	one pair, between chaetigers 4–5	one pair, between chaetigers 6–7	one pair, ventral side of parapodium in chaetiger 6
Chaetigers	17–24	30	20–30	incomplete (11)	incomplete (8)	incomplete (25)	23–?
Notochaetae	serrated 1–2	spinulose 1	spinulose 1	spinulose 2–5	spinulose 2–5	spinulose ?–4	spinulose 1–2
Neurochaetae	composite 4–8	composite 3–5	composite 1–3	composite 1	composite 2–4	composite 2–4	composite 1–4
Eyes	0	0	2	0	0	0	0
Papillae between noto- and neurochaetae	short, 2/9 of neurochaetae	short, 4/15 of neurochaetae	short, 3/8 of neurochaetae	long, as long as neurochaetae	long, as long as neurochaetae	long, as long as neurochaetae	short, 1/6 of neurochaetae

	<i>F. cirrata</i> Hartman and Fauchald 1971	<i>F. amoueuxi</i> Gillet 2001	<i>F. erratica</i> Orensanz 1974	<i>F. biscayensis</i> Kolmer 1985	<i>F. mediterranea</i> Kolmer 1985	<i>F. gascognensis</i> Aguirrezabalaga and Ceberio 2006	<i>F. hakuhoae</i> sp. nov. This study
Type locality	New England (NW Atlantic)	Crozet Islands (Indian Ocean)	Argentina (SW Atlantic)	Bay of Biscay (NE Atlantic)	Mediterranean Sea	Bay of Biscay (NE Atlantic)	off the South Orkney Islands (Southern Ocean)
Depth (m)	466–530	215–980	288	2210	4690	545–1113	2036–2479

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## References

- Aguirrezabalaga F, Ceberio A (2006) *Flabelligena gascognensis* sp. nov. (Polychaeta: Acrocirridae), a new species from the Capbreton Canyon (Bay of Biscay, NE Atlantic). *Scientia Marina* 70: 141-147. <https://doi.org/10.3989/scimar.2006.70s1141>
- Gillet P (2001) *Flabelligena amoueuxi* new genus, new species (Polychaeta: Acrocirridae) from Crozet Islands (Indian Ocean). *Bulletin of Marine Science* 68: 125-131. URL: <https://www.ingentaconnect.com/content/umrsmas/bullmar/2001/00000068/00000001/art00012>
- Hartman O (1953) Non-pelagic Polychaeta of the Swedish Antarctic Expedition 1901–1903. *Further Zoological Results of the Swedish Antarctic Expedition 1901–1903* 4: 1-83.
- Hartman O (1964) Polychaeta Errantia of Antarctica. *Antarctic Research Series* 3: 1-133. <https://doi.org/10.1029/AR003>
- Hartman O (1966) Polychaeta Myzostomidae and Sedentaria of Antarctica. *Antarctic Research Series* 4: 1-158. <https://doi.org/10.1029/AR007>
- Hartman O (1967) Polychaetous Annelids collected by the USNS Eltanin and Staten Island cruises, chiefly from Antarctic seas. *Allan Hancock Monographs in Marine Biology* 2: 1-389.
- Hartman O, Fauchald K (1971) Deep-water benthic polychaetous annelids off New England to Bermuda and other North Atlantic Areas. Part II. *Allan Hancock Monographs in Marine Biology* 6: 1-327. URL: <http://digitallibrary.usc.edu/cdm/ref/collection/p15799coll82/id/20299>
- Kolmer DW (1985) Acrocirridae (Annélides polychètes) abyssaux: Golfe de Gascogne et Méditerranée. In: Laubier L, Monniot C (Eds) *Peuplements profonds du golfe de Gascogne. Campagnes BIOGAS*. IFREMER, Brest, 630 pp. [In French]. URL: <https://archimer.ifremer.fr/doc/00000/4350/>



- Magalhães W, Bailey-Brock J (2011) A new species of *Acrocirrus* (Polychaeta: Acrocirridae) from Coconut Island, Oahu, Hawaii. *Journal of the Marine Biological Association of the United Kingdom* 92 (5): 1019-1022. <https://doi.org/10.1017/S0025315411000634>
- Martínez A, Worsaae K, Núñez J (2019) 7.3.1.7. Acrocirridae Banse, 1968. In: Purschke G, Böggemann M (Eds) *Handbook of Zoology. Annelida. Volume 1: Annelida Basal Groups and Pleistoannelida, Sedentaria I.* 422-439 pp. URL: <https://www.degruyter.com/view/title/124841>
- Monro C (1939) Part 4 Polychaeta . B.A.N.Z.A.R.E. Reports, Series B 4: 87-156.
- Orensanz J (1974) Poliquetos de la provincia biogeográfica Argentina. X. Acrocirridae . *Neotropica* 20: 113-118.
- Osborn KJ, Haddock SHD, Pleijel F, Madin LP, Rouse GW (2009) Deep-sea, swimming worms with luminescent "bombs". *Science* 325 (5943): 964-964. <https://doi.org/10.1126/science.1172488>