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New records for pedunculate barnacles (Cirripedia: Thoracica) from the Miocene Higashibessho Formation in Toyama Prefecture, central Japan

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Abstract

Three species of pedunculate barnacles (Cirripedia, Thoracica) are recorded from the upper Lower Miocene Higashibessho Formation in Toyama Prefecture, Japan. *Arcoscalpellum s.l. hamurorum*, a new species of Scalpellidae represents the fourth record for the genus from the Miocene of Japan. The occurrence of *Lepas kuwayamai* Karasawa, Tanaka, and Okumura (Lepadidae) extends the known geologic range for the species to the late Early Miocene. Scalpellidae genus and species indeterminate is known from too few plates to permit more confident identification.

Key words: Multicrustacea, Scalpellomorpha, fossil

1. Introduction

Karasawa (2020) reviewed Cenozoic pedunculate barnacles which are deposited in the Mizunami Fossil Museum (MFM). At that time, he first recorded the scalpellid of an undetermined genus and species from the Miocene Higashibessho Formation in Toyama Prefecture. During the paleontological survey of the Higashibessho Formation by the junior author (KA), and M. and T. Hamuro (Imizu, Toyama), new specimens of pedunculate barnacles were collected. The purpose of this paper is to describe one lepadid and two scalpellids species including a new species of *Arcoscalpellum s.l.* Hoek, 1907, sect Karasawa (2020).

Specimens described here occurred in mudstone of the lower part of the Higashibessho Formation exposed at two localities around Yamada-Nakanose (Localities 1 and 2 of Amano et al., 2022), Toyama

City, Toyama Prefecture. The detailed information on geology and paleontology for the localities has been given by Amano et al. (2022). Molluscan fossils of the Higashibessho Formation suggest a depositional environment within the upper bathyal to lower sublittoral zone (Amano et al., 2004). Yanagisawa (1999) showed that the geological age of the lower part of the Higashibessho Formation was late Early Miocene (NPD3A–NPD3B Zone of Yanagisawa and Akiba's (1998) scale of diatoms). All specimens are deposited in the Mizunami Fossil Museum (MFM).

2. Systematics

Order Scalpellomorpha Buckeridge and Newman, 2006

Superfamily Lapadoidea Darwin, 1852 [1851]

Family Lepadidae Darwin, 1852 [1851]

Genus *Lepas* Linnaeus, 1758

Type species: Lepas anatifera Linnaeus, 1758, by subsequent designation of Pilsbry (1907) (ICZN Direction 66).

Included fossil species: See Karasawa (2020).

***Lepas kuwayamai* Karasawa, Tanaka, and Okumura, 2004**

(Fig. 1.1)

Lepas kuwayamai Karasawa, Tanaka, and Okumura, 2004, p. 91, fig. 1; Karasawa, 2020, p. 26, figs. 5.1–5.3.

Diagnosis: Plates thick, strongly calcified. Scutum subtriangular, slightly higher than wide, with clear growth lines; very weak radial striae sometimes present; apicoumbonal ridge weak; ocludent margin slightly convex; upper tergo-lateral margin straight or gently convex; lower tergo-lateral margin strongly convex; basal margin slightly concave; umbonal tooth absent. Tergum flattened without radial striae; ocludent margin convex, rounded; carinal margin gently convex; scutal margin slightly concave. Carina broad, boat-shaped, with rounded apex and wide, triangular basal margin; umbo basal (adapted from Karasawa, 2020, p. 26).

Remarks: The present specimen is the second record of this species, previously known from the Lower Miocene Akeyo Formation of the Mizunami Group in Gifu Prefecture (Karasawa et al., 2004).

Material examined: MFM83446, scutum (external mold) from Loc. 1 of Amano et al. (2022).

Superfamily Scalpelloidea Pilsbry, 1907

Family Scalpellidae Pilsbry, 1907

Genus *Arcoscalpellum* s.l. Hoek, 1907, sect
Karasawa (2020)

Type species: Scalpellum velutinum Hoek, 1883 (= *Scalpellum michelottianum* Seguenza, 1876) by original designation.

Included fossil species: See Karasawa (2020).

***Arcoscalpellum* s.l. *hamurorum*, new species**

(Figs. 1.4–1.17)

[new Japanese name: hamuro-myouga]

Diagnosis: Plates thick; growth lines well-developed; scutum subquadrilateral, about twice as high

as wide, with weak apicobasal ridge; tergum subtriangular, about half higher than wide, with weak apicobasal ridge; tectum of carina gently convex transversely, separated from narrow parietes by weak ridges, with apical umbo; upper latus flattened, subtriangular, much higher than wide; inframedian latus small, subtriangular, slightly wider than high; carinal latus subtriangular, higher than wide, with strongly convex carinal margin and blunt apex strongly curved towards carina; rostral latus low, wide.

Derivation of name: In honor of Masui Hamuro and her husband, Toshikazu Hamuro (Imizu, Toyama), for their contribution to geology and paleontology of Toyama Prefecture.

Type locality: Yamada-Nakanose (Loc. 2 of Amano et al., 2022), Toyama City, Toyama Prefecture; mudstone of the lower part of the Higasibessho Formation (late Early Miocene).

Description: Plates thick; growth lines well-developed. Scutum subquadrilateral, about twice as high as wide, with weak apicobasal ridge; outer surface steeply depressed on tergal side, gently curved on ocludent side; apex blunt; tergal margin nearly straight; lateral margin nearly straight; ocludent margin slightly convex; basal margin nearly straight. Tergum flattened, subtriangular, about half higher than wide, with weak apicobasal ridge; apex blunt; upper carinal margin slightly sinuous; lower carinal margin gently convex; ocludent margin gently convex; scutal margin slightly convex, about as long as ocludent margin; basal angle blunt; umbo apical. Carina gently curved inward, widened basally; apex blunt; umbo apical; tectum gently convex transversely, separated from narrow parietes by weak ridges. Upper latus flattened, subtriangular, about 1.8 times as high as wide, with sharp apex curved towards scutum; tergal margin weakly convex; scutal margin nearly straight; basal margin gently convex. Inframedian latus small, subtriangular, slightly wider than high, with blunt apex; outer surface gently concave axially; carinal and scutal margins nearly straight; basal margin gently concave. Carinal latus subtriangular, about 0.8 times as high as wide, with blunt apex strongly curved towards carina; outer surface steeply depressed on upper latus side, gently

curved on carinal side; carinal margin strongly convex; upper latus margin moderately concave; basal margin nearly straight. Rostrum and rostral latus showing inner surface, but detailed characters unknown; rostral latus low, wide. Some wide scales of peduncle preserved.

Remarks: The hitherto known Miocene species of *Arcoscalpellum* from Japan are represented by three: *A. s.l. isaonishikawai* Karasawa, 2020, from the Lower–Middle Miocene Bihoku Group in Hiroshima Prefecture; *A. s.l. joei* Karasawa, 2020, from the Lower Miocene Yotsuyaku Formation in Iwate Prefecture; and *A. okinawanum* Noda, 1975, from the Upper Miocene Tomigusuku Formation in Okinawa Prefecture. Thick plates without radial striations on external surfaces readily distinguish the new species from *A. s.l. isaonishikawai*. The new species differs from *A. s.l. joei* in that the tergum has a weak apico-basal ridge, the upper latus is subtriangular in outline, and the tectum of the carina is separated from parietes by weak ridges. The carina of *Arcoscalpellum okinawanum* has longitudinally striated parietes, which the new species lacks.

The scalpellids including *Arcoscalpellum s.l.* have been extremely rare in the Japanese fossil record and the previously known specimens have been the isolated or disarticulated plates (Noda, 1975; Nomura and Takakura, 2009; Karasawa, 2020). Therefore, the holotype (MFM83500) with the nearly completed capitulum composed of articulated plates, associated with fragments of peduncle plates, is the best-preserved specimen in the fossil record of Japan.

Material examined: Holotype, MFM83500, capitulum associated with scales of peduncle from Loc. 2 of Amano et al. (2022); paratype, MFM83501, scutum from Loc. 1 of Amano et al. (2022); paratype, MFM83502, carina from Loc. 1 of Amano et al. (2022); paratype, MFM83503, terga from Loc. 1 of Amano et al. (2022).

Scalpellidae genus and species indeterminate

(Figs. 1.2, 1.3)

Remarks: A subtriangular scutum with a well-developed apicobasal ridge and sharp apex readily distinguishes the present material from the scutum of

Arcoscalpellum s.l. hamurorum, new species. The material is referred to the scalpellid scutum of an undetermined genus and species from the Higashibescho Formation described by Karasawa (2020) (Fig. 1.2). Other plates will be necessary to confirm a further identification of the material.

Material examined: MFM83447, scutum (external mold) from Loc. 1 of Amano et al. (2022); referred specimen, MFM84028, scutum from mudstone of the Higashibescho Formation at Kashio, Yatsuomachi, Toyama City, Toyama Prefecture (Karasawa, 2020, p. 33).

3. Acknowledgements

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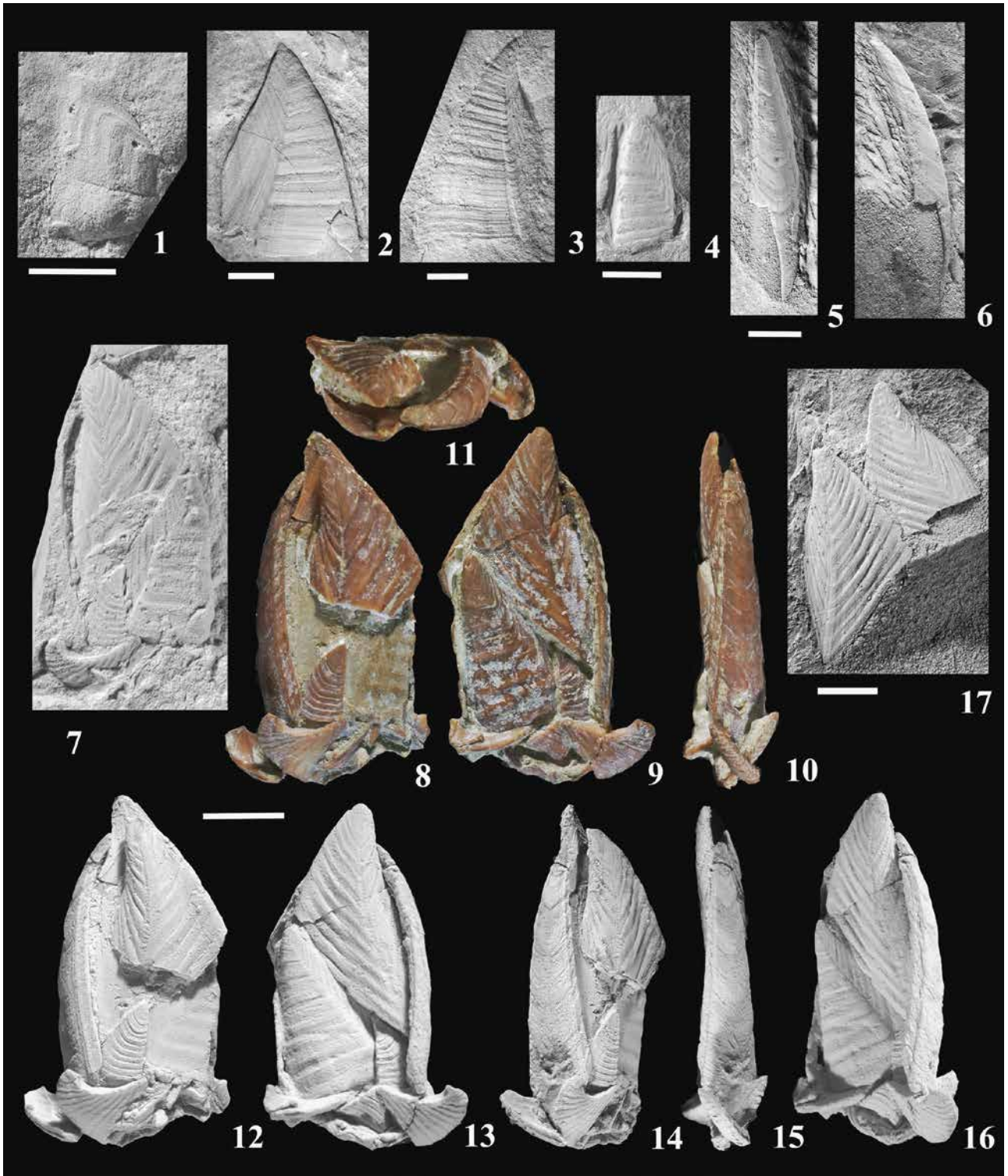


Fig. 1. 1, *Lepas kuwayamai* Karasawa, Tanaka, and Okumura, 2004, MFM83446, scutum. 2, Scalpellidae, genus and species indeterminate, MFM84028, scutum (reproduced from Karasawa, 2020, fig. 9.1b). 3, Scalpellidae genus and species indeterminate, MFM83447, scutum. 4–17, *Arcoscalpellum s.l. hamurorum*, new species, 4, paratype, MFM83501, scutum; 5–6, paratype, MFM83502, carina; 7–16, holotype, MFM83500, capitulum; 17, paratype, MFM83503, terga. Scale bar = 5 mm. 1, 3, 7, latex cast of external mold. 1–4, 6–9, 12, 13, 17, lateral view; 5, 10, 14–16, carinal view; 11, dorsal view. 1–7 and 12–17 are whitening images coated with ammonium chloride sublimate.

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Appendix

Arcoscalpellum s.l. hamurorum Karasawa and Amano, new species LSID: urn:lsid:zoobank.org:act:7028B1E9-EB24-4422-B684-8B90BBC29070

新称: ハムロミヨウガ