

Axiidea and Brachyura (Decapoda) from the Pliocene–Pleistocene Ananai Formation, Shikoku, Japan

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Abstract

Four species of decapods are reported from the Ananai Formation of the Pliocene–Pleistocene Tonohama Group in Aki City, Kochi Prefecture, Shikoku, Japan. *Ctenocheles* sp. (Axiidea: Ctenochelidae), *Anatolikos japonicus* (Ortmann) (Brachyura: Cancridae), and two species of *Charybdis* (Brachyura: Portunidae) are included. *Charybdis* (*Charybdis*) *kinugawai* Karasawa, a new portunid is described.

Key words: Decapoda, Axiidea, Brachyura, Ananai Formation, Pliocene–Pleistocene, Japan

Introduction

The Pliocene–Pleistocene Tonohama Group is distributed in the western part of the Muroto Peninsula, Kochi Prefecture, Shikoku. This group consists of the Nobori, Ananai, and Ropponmatsu Formations in ascending order (Katto and Masuda, 1993; Iwai et al., 2006). Matsubara (2004) reviewed the geologic age of the Tonohama Group based upon the previously known microfossils. He showed that the Nobori Formation was assigned to the late early Pliocene–early late Pliocene (4.20–3.21 or 3.12 Ma; Berggren et al., 1995) and that the geological age of the Ananai Formation was the late Pliocene (2.78 or 2.73–1.97 Ma) (=late Pliocene–early Pleistocene based upon Cohen and Gibbard, 2011).

The Tonohama Group contains rich marine fossils (i.e., Iwai et al., 2006). However, decapods have been very rare; Mimoto et al. (1986) recorded three brachyurans, *Charybdis* sp., *Leucosia* sp., and *Parthenope* sp., from the Ananai Formation and, subsequently, Mimoto (2001) described one axiidean Callianassoidea gen. et sp. indet., and four brachyurans, Xanthoidea ? gen. et sp. indet., Leucosiidae gen. et sp. indet., and *Macrocheira* sp., from the Nobori Formation. The junior author (YK) collected seven specimens of decapods from fine-grained sandstone of the Ananai Formation exposed at Tonohama (Loc. 3 of Iwai et al., 2006), Aki City, Kochi Prefecture. The purpose of this work is to describe and figure one axiidean and three brachyurans including a new species of the portunid genus *Charybdis* de Haan, 1833.

The described specimens are housed in the Mizunami Fossil Museum (MFM).

Systematics (By Karasawa)

Infraorder Axiidea de Saint Laurent, 1979
Superfamily Callianassoidea Dana, 1852
Family Ctenochelidae Manning and Felder, 1991
Subfamily Ctenochelinae Manning and Felder, 1991
Genus *Ctenocheles* Kishinouye, 1926

Ctenocheles sp. (Fig. 1.1, 1.2)

Material examined: Incomplete propodi of 1st pereopod, MFM142181, 142182.

Remarks: The Japanese fossil species of *Ctenocheles* comprise *Ctenocheles sujakui* Imaizumi, 1958, from the lower Oligocene Kishima Formation (Imaizumi, 1958; Karasawa, 1993, 1997; Karasawa and Fudouji, 2000) and an unnamed species from the middle Miocene Shimo Formation (Karasawa et al., 2011). *Ctenocheles balssi* Kishinouye, 1926, is only known from the Japanese waters (Sakai, 2010). However, I do not make sufficient comparison because of the poorly preserved material.

Infraorder Brachyura Linnaeus, 1758
Section Eubrachyura de Saint Laurent, 1980
Superfamily Cancroidea Latreille, 1802
Family Cancridae Latreille, 1802
Subfamily Cancrinae Latreille, 1802

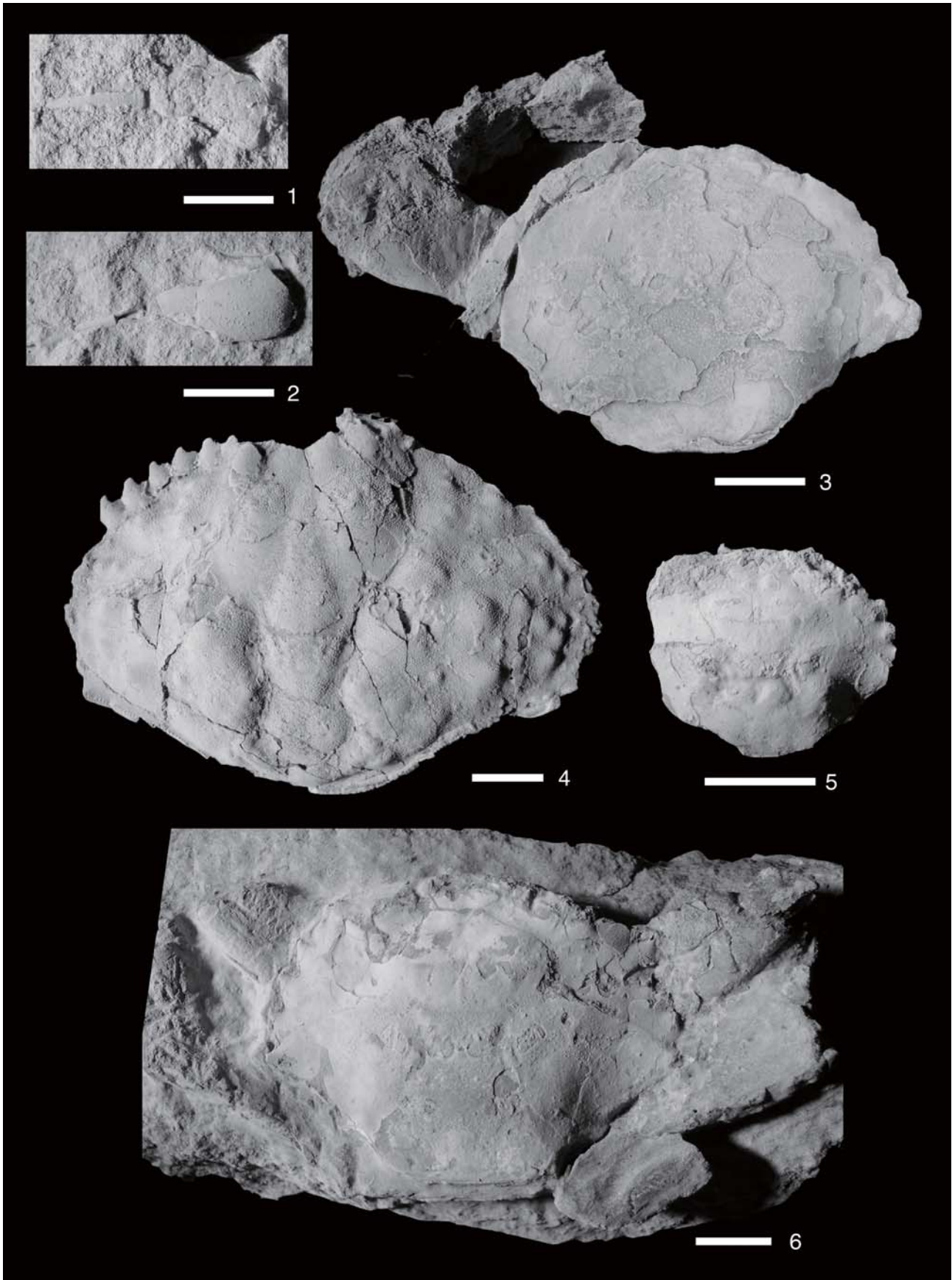


Fig. 1. 1, 2. *Ctenocheles* sp., 1, MFM142181, right propodus of 1st cheliped, mesial view; 2, MFM142182, left propodus of 1st cheliped, lateral view. 3. *Charybdis* sp., MFM142184, carapace, dorsal view. 4. *Anatolikos japonicus* (Ortmann, 1893), MFM142183, carapace, dorsal view. 5, 6. *Charybdis* (*Charybdis*) *kinugawai* Karasawa, new species, 5, MFM142022 (paratype), carapace, dorsal view; 6. MFM142021 (holotype), carapace, dorsal view. Scale bar = 1 cm.

Genus *Anatolikos* Schweitzer and Feldmann, 2000

***Anatolikos japonicus* (Ortmann, 1893)**

(Fig. 1.4)

Cancer japonicus Ortmann, 1893, p. 427, pl. 17, fig. 5.

Anatolikos japonicus (Ortmann, 1893); Schweitzer and Feldmann, 2000, p. 229.

Material examined: One nearly complete carapace, MFM142183.

Remarks: The extant species ranges from Japan to Taiwan (Sakai, 1976; Ng et al., 2001). The fossil records of the species have been known from the Pleistocene Dainichi Formation of the Kakegawa Group (Karasawa, 1993, 1997) and Pleistocene Onma and Zukawa Formations (Karasawa, 1993; 1997). Hu and Tao (2000) reported the present species from the Pleistocene Ryukyu Group in Taiwan (Hu and Tao, 2000, p. 130, pl. 5, figs. 3, 6); however, the illustrated specimen should be identical with a species of the xanthid *Etisus* H. Milne Edwards, 1834, in that a smooth carapace has 12 anterolateral spines, the well-defined sterno-abdominal cavity is located on a wide posterior thoracic sternite 4, and the propodus of the cheliped is smooth laterally and ventrally. Therefore, the fossil record of *A. japonicus* is restricted in Japan.

Superfamily Portunoidea Rafinesque, 1815, sensu Karasawa et al., 2008

Family Portunidae Rafinesque, 1815, sensu Karasawa et al., 2008

Subfamily Thalamitinae Paul'son, 1875, sensu Karasawa et al., 2008

Genus *Charybdis* de Haan, 1833

***Charybdis* sp.**

(Figs. 1.3)

Material examined: MFM142184, 142185.

Remarks: Within the present specimen the details of the frontal and anterolateral margins are not known. I do not make sufficient comparison because of the poor-preserved carapaces.

Subgenus *Charybdis* de Haan, 1833

***Charybdis (Charybdis) kinugawai* Karasawa, new species**

(Figs. 1.5, 1.6; Fig. 2)

Material examined: MFM142021 (holotype), 142022 (paratype).

Diagnosis: Carapace wider than long, length about 75 percent carapace width. Front with 8 teeth; median frontal teeth broadly

triangular, directed anteriorly, slightly projecting submedians; submedians triangular, directed posterolaterally, separated from medians by V-shaped notch; laterals narrowly triangular, directed anteriorly, separated from submedians by deep U-shaped notch, tip not reaching tip of submedians; inner orbital teeth low, triangular, directed posterolaterally. Anterolateral margins bearing 6 triangular teeth. Posterolateral margin sinuous, forming reentrant with posterior margin. Posterior margin nearly straight, about 34 percent carapace width. Vaulted metagastic and cardiac regions and medial parts of epibranchial regions ornamented with small granules irregularly arranged. Frontal, protogastric, mesogastric, epibranchial, and metagastic ridges present. A row of small granules sparsely arranged forming strongly convex arc on hepatic, anterolateral, and distal epibranchial regions.

Etymology: The trivial name honors Y. Kinugawa, who collected the type specimens and generously donated them to the Mizunami Fossil Museum.

Description: Carapace wider than long, length about 75 percent carapace width, widest at position of last anterolateral spine; carapace gently vaulted transversely and longitudinally. Front-orbital margin about 55 % carapace width. Median frontal teeth broadly triangular, directed anteriorly, slightly projecting submedian teeth. Submedian frontal teeth also triangular, directed posterolaterally, separated from median frontal teeth by V-shaped notch. Lateral frontal teeth narrowly triangular, directed anteriorly, separated from submedian frontal teeth by deep U-shaped notch, tip not reaching tip of submedian frontal teeth. Inner orbital teeth low, triangular, directed posterolaterally. Upper orbital margin concave with 2 closed fissures. Anterolateral margins bearing 6 triangular teeth including outer orbital tooth; 1st (=outer orbital tooth) and 2nd teeth directed anteriorly; third, fourth, and fifth teeth directed posterolaterally; sixth tooth directed laterally; third and fourth teeth larger than others. Posterolateral margin sinuous, forming reentrant with posterior margin. Posterior margin nearly straight, about 34 percent carapace width. Dorsal surface with poorly defined regions; anterior half nearly smooth, but posterior half, vaulted metagastic and cardiac regions and medial parts of epibranchial regions ornamented with small granules, which are irregularly arranged. Frontal ridges short, obtuse, medially interrupted. Protogastric and mesogastric ridges poorly defined, transverse, finely granulated, medially interrupted. Epibranchial ridges finely granulated, forming convex arc, not joining transverse, finely granulated metagastic ridge. A row of small granules sparsely arranged forming strongly convex arc on hepatic, anterolateral, and distal epibranchial regions.

Pereiopods poorly preserved. Ventral aspects unknown.

Remarks: The present new species resembles the extant species, *Charybdis (Charybdis) sagamiensis* Parisi, 1916, but differs in that the carapace is much wider than long and the metagastic and cardiac regions and medial parts of the epibranchial regions are ornamented with small, irregularly arranged granules. The unnamed fossil species of *Charybdis*, associated with carapaces, have been known from the Ananai Formation (Mimoto, ed., 1986) and Pliocene Shimajiri Group (Karasawa and Nobuhara, 2008); however, the present specimens cannot be compared with these specimens because of poorly preserved carapaces within latter specimens.



Fig. 2. *Charybdis (Charybdis) kinugawai* Karasawa, new species, MFM142021 (holotype), carapace, dorsal view. Scale bar = 1 cm.

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