A cancrid crab, *Cancer* (*Metacarcinus*) *minutoserratus* Nagao, 1940 from the Mio-Pliocene Uchu Member, Otari Formation of Nagano Prefecture, central Japan

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Abstract

A specimen of *Cancer* (*Metacarcinus*) *minutoserratus* Nagao, 1940 is first described from the Upper Miocene to Lower Pliocene Uchu Member, Otari Formation in Nagano Prefecture, central Japan. This species has been recorded from the Lower Pliocene deposits in the Pacific side of northeast Japan. This species was distributed in the Pacific Ocean and Japan Sea around northeast Japan in the Late Miocene to Early Pliocene.

Key words: *Cancer* (*Metacarcinus*) *minutoserratus*, decapod crustacean, Nagano, Otari Formation, Pliocene.

Introduction

In October of 1998, a fossil of cancrid crab was found by the junior author (H.N.) from a cliff outcrop of the right bank of the Himekawa River near Miyamoto, Otari Village, Kita-Azumi County, Nagano Prefecture, central Japan (36°47'03"N, 137°52'05"E) (Fig. 1). The strata in this cliff is mainly composed of massive fine grained sandstone with alternation of fine grained sandstone and mudstone assigned to the lowermost part of the Uchu Member, Otari Formation (Fig. 2).

The Otari Formation is widely distributed in the upper stream of the Himekawa River and attains a maximum 2,500 m in thickness. It is mainly composed of sandstone, mudstone, conglomerate and pyroclastic rocks, and divided into the lower, middle and upper parts from the lithologic characters. The lower part of the Otari Formation is called the Uchu Member

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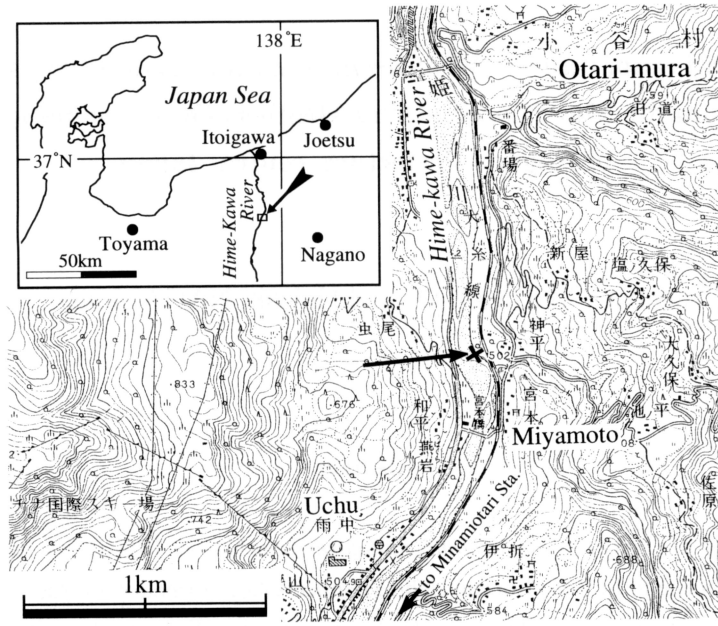

Fig. 1. Index map showing the fossil locality. Using the topographic map is part of the 1:25,000 scale map sheet "Uchu" published by the Geographical Survey Institute of Japan.

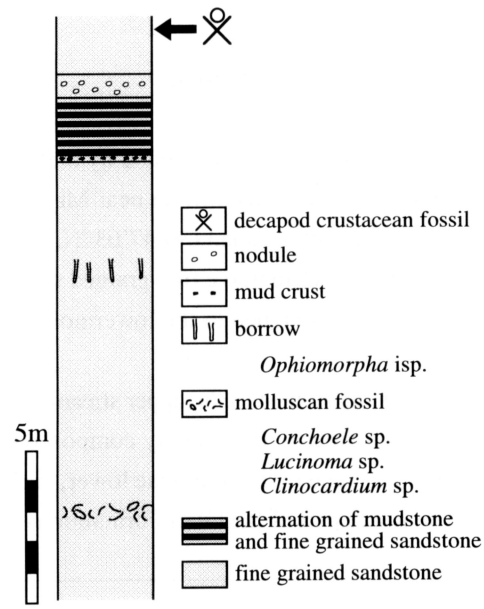

Fig. 2. Columnar section of lowermost part of the Uchu Member, Otari Formation at the decapod fossil locality.

which is mainly composed of sandstone, mudstone and conglomerate (Kosaka, 1991). Research Group for Himekawa Region (1958) stated that the Uchu Member is the Late Miocene to Early Pliocene in age from the molluscan fossils and that it is correlated with the Shigarami Formation of the standard succession in the Nagano area. The present specimen was obtained in a massive fine grained sandstone above alternation of fine grained sandstone and mudstone. Some molluscan fossils such as *Conchocele* sp., *Clinocardium* sp., and *Lucinoma* sp., which were yielded from fine grained sandstone of lower horizon in this locality. The present specimen remains a propodus of right cheliped, which is identified with *Cancer* (*Metacarcinus*) *minutoserratus* Nagao, 1940. It is first reported from the Uchu Member and the Japan Sea side area.

The purpose of this paper is to describe the present specimen and also to discuss the biogeographic significance of the species. The senior author (T.S.) is responsible for the description of the present specimen and the junior author is responsible for the stratigraphy of the fossil locality. The described specimen (GSJ F15645) is housed in the Geological Survey of Japan, Tsukuba.

Systematic description

Infraorder Brachyura Latreille, 1803
Section Heterotremata Guinot, 1977
Family Cancridae Latreille, 1803
Genus *Cancer* Linnaeus, 1758

Subgenus *Metacarcinus* A. Milne Edwards, 1862

Type species.—*Cancer magister* Dana, 1852, by original designation.
Stratigraphic range.—Miocene to Recent.

Cancer (*Metacarcinus*) *minutoserratus* Nagao, 1940
Figs. 3, 4.

Cancer minutoserratus Nagao, 1940, p. 69, pl. 23, figs. 1-10; Imaizumi, 1962, p. 243 ; Takeda et al., 1984, p. 157, text-figs. 5, 6.

Description.—Ornamentations of propodus moderately well preserved, but fixed finger lacking apex and palm laterally compressed by deformation. Propodus large, robust, and covered with coarse granules. Fixed finger robust, stout, oval in cross section; lateral and mesial surfaces covered densely with coarse granules. A row of pits lies within a broad groove on their surfaces. Palm relatively long, rectangular in outline, longer than height, about 2.5

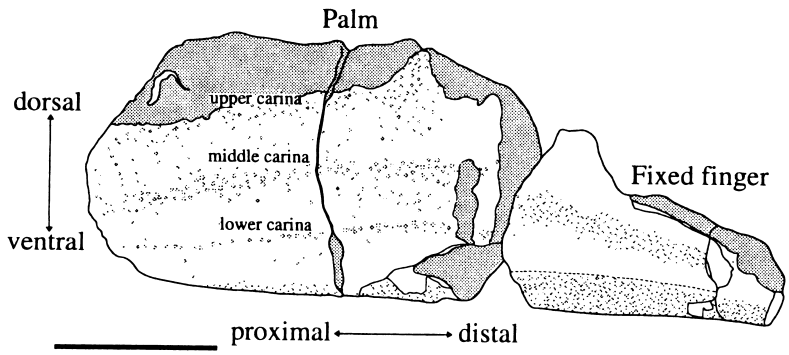

Fig. 3. *Cancer* (*Metacarcinus*) *minutoserratus* Nagao, 1940, GSJ F15645, lateral view of right propodus. Scale bar equals 10 mm.

times as long as length of fixed finger. Dorsal margin bears irregularly serration. Ventral margin covered densely with small granules. Lateral surface of middle to lower parts remains three longitudinal granulated carinae; upper and middle carinae randomly granulated; lower carina with a row of some small granules. Area between upper and middle carinae with a reticulate pattern of granules. Upper part of mesial surface smooth, but middle part covered with small, sparsely distributed granules.

Measurements.—Length of fixed finger 11.8+ mm, height of fixed finger 8.5 mm, thickness of fixed finger 5.8 mm, length of palm 28.9+ mm, height of palm 18.0+ mm, thickness of palm 7.8+ mm, length of dorsal margin of palm 14.2+ mm.

Remarks.—The present specimen agrees with Pliocene species *Cancer (Metacarcinus) minutoserratus* Nagao, 1940 in having a serrulated dorsal margin and in the granulation on the lateral surface of the palm. This species was originally described from the Lower Pliocene Tatsunokuchi Formation in Sendai City, Miyagi Prefecture by Nagao (1940) (Fig. 5; Loc. 1). Some additional materials were recorded from the Lower Pliocene in northeast Japan, *viz.*, Tatsunokuchi Formation of Sendai City and Kogota Town, Toda County in Miyagi Prefecture (Takeda et al., 1984) (Fig. 5; Loc. 1), Yushima Formation of Ichinoseki City and Maesawa Town in Iwate Prefecture (Imaizumi, 1962; Takeda et al., 1984) (Fig. 5; Loc. 2). *Cancer* (*Metacarcinus*) *minutoserratus* is closely related to *Cancer magister* Dana, 1852 (type species of the subgenus *Metacarcinus*), which is inhabitant on shallow sea bottom and distributed in the Pacific coast of Alaska to Monterey Bay, California (Nations, 1975). It is called "Dungeness Crab", "Common edible crab" by American peoples and exploited for the fisheries resources.

The recent eight species belong to the subgenus *Metacarcinus*, living in the shallow sea of the Pacific Ocean (western North America, western South America, New Zealand, and Tasmania Island), Atlantic Ocean (eastern North America, western Europe), and Norwegian Sea (Nations, 1975). The recent subgenus *Metacarcinus* from coast of Japan has been recorded from off Kushiro, the Pacific coast of Hokkaido by Abe (1981). Abe (1981) reported a living male of

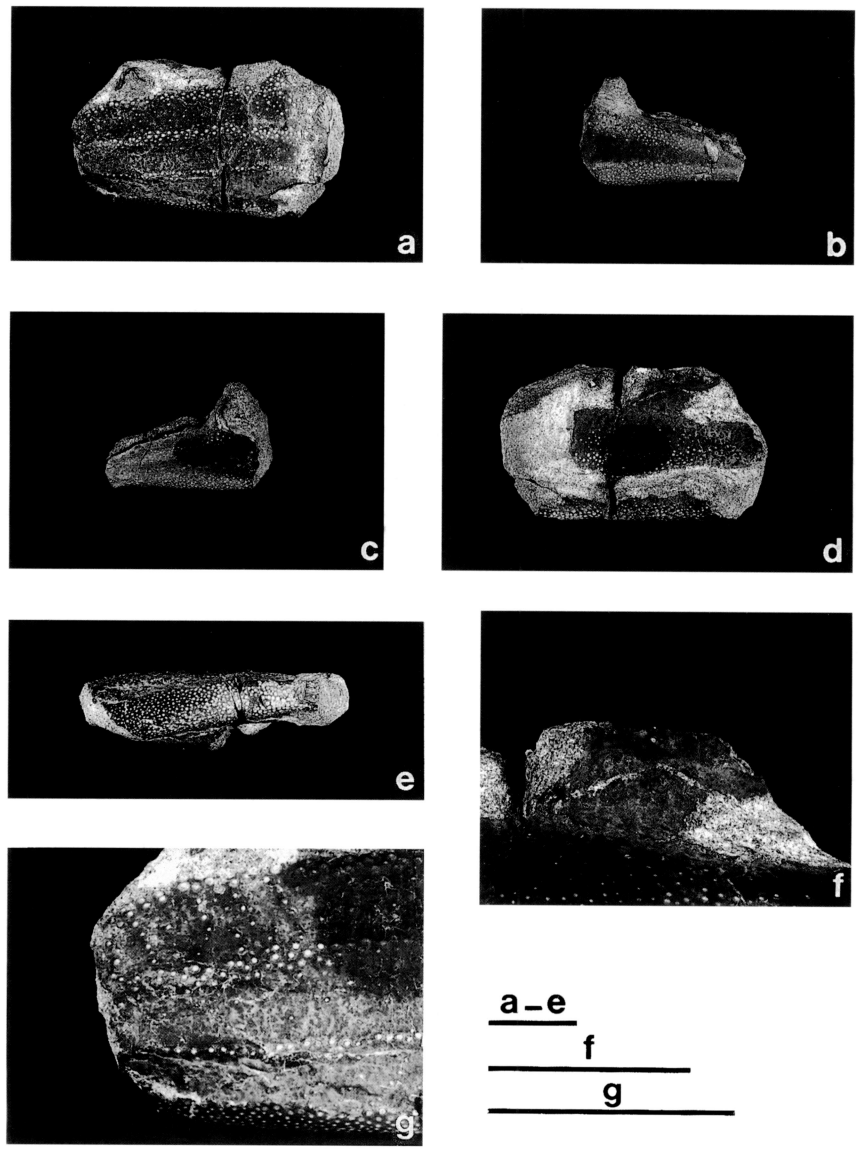

Fig. 4. *Cancer* (*Metacarcinus*) *minutoserratus* Nagao, 1940, GSJ F15645, fixed finger and palm of right propodus, a: lateral view of palm, b: lateral view of fixed finger, c: mesial view of fixed finger, d: mesial view of palm, e: ventral view of palm, f: mesial view of dorsal margin of palm, g: lateral view of proximal half of palm. Scale bars equal 10 mm.

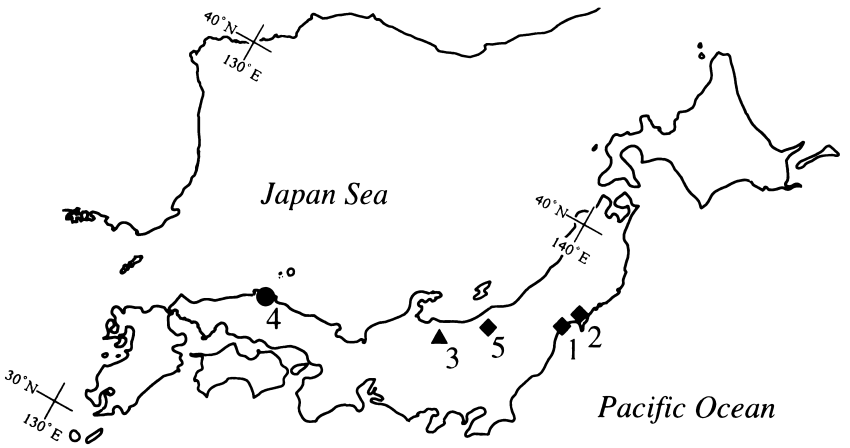

Fig. 5. Geographic distribution of subgenus *Metacarcinus* in Japan. *Cancer* (*Metacarcinus*) *minutoserratus*. 1: Tatsunokuchi F. (Nagao, 1940; Imaizumi, 1962), 2: Yushima F. (Imaizumi, 1962; Takeda et al., 1984), 3: Uchu M. (this study), *C.* (*M.*) *izumoensis*, 4: Fujina F. (Sakumoto et al., 1992), *Cancer* (*M.*) sp., 5: Shiroiwa F. (Sakumoto, 1998). ◆: Middle Miocene, ▲: Late Miocene to Early Pliocene, ●: Early Pliocene.

C. magister Dana, 1852, which was trawled from a depth of 15m, off Kushiro.

Three extinct species of subgenus *Metacarcinus* such as *C.* (*M.*) *izumoensis* Sakumoto, Karasawa and Takayasu, 1992, *Cancer* (*M.*) sp., and the present species, which were recorded from the Mio-Pliocene in Japan (Fig. 5). The first species was originally described from the Middle Miocene Fujina Formation in Shimane Prefecture, southwest Japan (Sakumoto et al., 1992) (Fig. 5; Loc. 4). The second species was reported from the Lower Pliocene Shiroiwa Formation in Niigata Prefecture by Sakumoto (1998) (Fig. 5; Loc. 5).

The present species has ever been reported from the Lower Pliocene along the Pacific side of northeast Japan (Fig. 5; Locs. 1, 2). The discovery of the present specimen indicates that this species was distributed in the Japan Sea side area during the time from the Late Miocene to Early Pliocene.

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References

Abe, K., 1981, First record of the dungeness crab, *Cancer magister* Dana from northern Japan. *Res. Crust.*, no. 11, 13-16. (in Japanese)

Dana, J. D., 1852, *Crustacea. United States Exploring Expeditions during the years 1838, 1839, 1840, 1841, 1842, under the Command of Charles Wilkes, U.S.N., Vol. 13.* C. Sherman, Philadelphia, 1620 p.

Guinot, D., 1977, Propositions pour une nouvelle classification des Crustacés Décapodes Brachures. *C. R. Acad, Sci, Paris, Ser. D, 285*, 1049-1052.

Imaizumi, R., 1962, Miocene *Cancer* (Brachyura) of Japan. *Sci. Rep., Tohoku Univ., Ser. 2, Spec. Vol.*, no. *5*, 223-246.

Kosaka, T., 1991, Geology of the Omine Belt and its geological significances in a tectonic history of the Fossa Magna region, central Japan. *Jour. Fac. Sci., Shinshu Univ.*, **26**, 75-140. (in Japanese)

Latreille, P. A., 1803, *Histoire naturelle, générale et particulière, des crustacés st des insectes, Vol. 3.* F. Dufart, Paris, 468 p.

Linnaeus, C., 1758, *Systema Naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis, Edit. 10, Vol. 1.* Laurentii Salvii, Halmiae, 824 p.

Milne Edwards, A., 1862, Monographie des crustacés fossiles de la famille des cancéines. *Ann. Sci. Nat. Zool., Ser. 4*, **18**, 31-85.

Nagao, T., 1940, On a new brachyura crab from the Tatunokuti bed of Sendai, Miyagi Prefecture. *Jour. Fac. Sci., Hokkaido Imp. Univ., Ser. 4*, **6**, 69-73.

Nations, J. D., 1975, The genus *Cancer* (Crustacea: Brachyura): Systematics, biogeography and fossil record. *Sci. Bull. Nat. Hist. Mus., Los Angeles County*, no. 23, 1-104.

Research Group for Himekawa Region, 1958, Tertiary formations along the northern part of the Itoigawa-Shizuoka Tectonic Line. *Jour. Geol. Soc. Japan*, **64**, 431-444. (in Japanese)

Sakumoto, T., 1998, A decapod crustacean, *Cancer* sp. (Brachyura, Cancridae) from the Pliocene Shiroiwa Formation, Myoken-machi, Nagaoka City, Niigata Prefecture, central Japan. *Bull. Nagaoka Municipal Sci. Mus.*, no. 34, 97-100. (in Japanese)

Sakumoto, T., Karasawa, H. and Takayasu, K., 1992, Decapod crustaceans from the Middle Miocene Izumo Group, southwest Japan. *Bull. Mizunami Fossil Mus.*, no. 19, 441-453. (in Japanese)

Takeda, M., Oishi, M. and Fujiyama, I., 1984, A record of Pliocene cancrid crab, *Cancer minutoserratus* Nagao, from the Yushima Formation, Iwate Prefecture, with a note on subgeneric diversity of *Cancer* in Japan. *Bull. Iwate Pref. Mus.*, no. 2, 157-163.