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Cenozoic decapod crustacean assemblages from northeast Japan

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Abstract

Decapod crustacean faunas from the Cenozoic of NE Japan are discussed and summarized in relation to marine climates and molluscan faunas.

Introduction

The study area is the whole of northeastern Japan, as delimited by the Fossa Magna, a major tectonic line that splits the Japanese main islands into a southwest and northeast part geologically (Fig. 1). The fossil crustaceans of this area are quite varied and have heretofore not received the attention they deserve

Results

In the Paleogene fauna, there are no species in common with SW Japan. Even at the generic level, there are almost no common elements to SW Japanese faunas. The decapod fauna of the Upper Eocene to Lower Oligocene of Hokkaido is rather related to that from the Pacific coast of North America (Kato, 1999; Schweitzer, 2001). Typical Tethyan elements are rarely observed in the Paleogene of NE Japan; this in contrast to SW Japan (Karasawa, 1999).

Although the Early Miocene decapod fauna in NE Japan is represented by few localities, the numbers of specimens are not small owing to an abundant occurrence of the grapsid, *Miosesarma japonicum* Karasawa. Considering that *Miosesarma* occurs in association with subtropical or warm-water molluscan assemblages, and in view of abundant records from SW Japan (Karasawa, 1990, 1993; Sakumoto, 1997), *M. japonicum* apparently had a southerly origin and seems to have migrated into NE Japan by way of warm-water currents in the late Early Miocene times.

The most diversified decapod assemblages in the Cenozoic of Japan are recognized in lower Middle Miocene rocks. At least fifteen decapod assemblages have been recorded, based on dominant species and other components. The reason of this high diversity is not only the extensive distribution of fossiliferous marine strata deposited in various environments but also the warm marine climate of the Pacific region in this period, the so-called 'the Mid Neogene Climatic Optimum,' e.g., Tsuchi (1990, 1992). Karasawa (1993, 1997, 1999) discussed the relationships between the warm-water species in the Neogene decapod faunal succession in SW Japan and warm marine climatic events proposed by Barron & Baldauf (1990) and Tsuchi (1990). Among the Neogene warm phases proposed as three 'climatic optima' and one 'warm episode', the climatic optimum 1, termed 'the Mid Neogene climatic optimum' has been recognized as the molluscan Kadonosawa Fauna (e.g. Chinzei, 1978, 1981) or the tropical spike (Itoigawa, 1989) in lower Middle Miocene strata. In SW Japan, the decapod fauna of this time interval is the most diversified in the whole Cenozoic and for the whole of SW Japan, and contains genera indicative of subtropical to tropical environments, i.e., *Thalassina*, *Ozius*, *Glabropilum-*

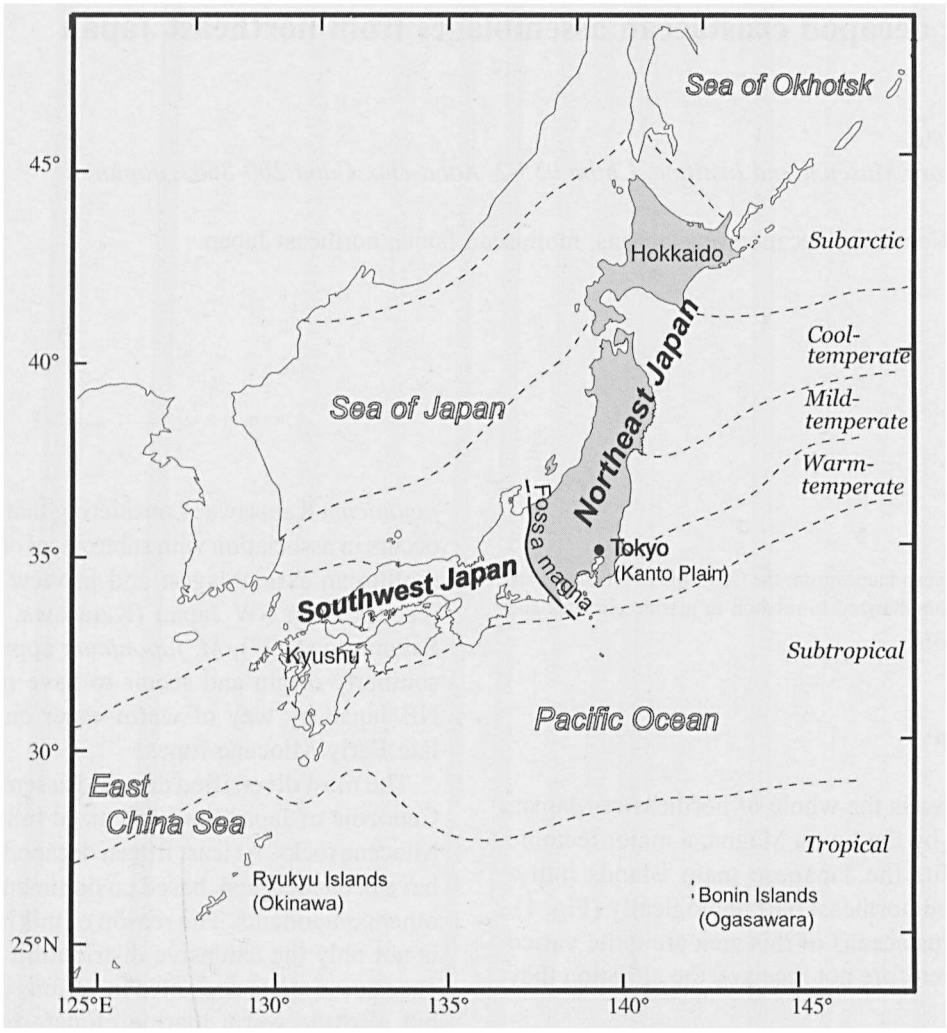

Fig. 1. Map showing the study area and the marine zoogeographic divisions of the Recent Japanese waters (after Ogasawara, 1994).

nus, *Typilobus*, *Daira*, *Euryozius*, in addition to the warm Indo-Pacific or Tethyan element. Despite the distribution of molluscan assemblages indicative of subtropical environments in the southern part of NE Japan, however, such typical tropical to subtropical decapod species were not found.

After the middle Middle Miocene, occurrences of decapod crustacean fossils decrease so that it is difficult to define decapod assemblages. Nevertheless, the tendency in late Middle to Late Miocene decapod faunas is repetitious occurrences of *Cancer* (*Metacarcinus*) spp. and *Hyas* spp. These are usually obtained in association with cold-water type molluscan fauna, the Shiobara-Yama Fauna (Chinzei, 1963; Iwasaki, 1970, 1981). In SW Japan, Karasawa (1993, 1997, 1999) concluded that the decapod fauna from the Middle Miocene Kukinaga Group and the Late Miocene-Pliocene Miyazaki Group correspond to climatic optimum 2 and 3, respectively. With regard to the latter, the subtropical to tropical genus *Daldorfia* was observed also in Upper Miocene of the Pacific coast of NE Japan (Kato, 2002). This taxon suggests subtropical marine climate that may corresponds to the molluscan Zushi Fauna (Ozawa & Tomida, 1992; Ozawa et al., 1995) and climatic optimum 3. However, a decapod fauna indicative of former warm marine climates was not recognized in the late Middle Miocene of NE Japan.

The latest Miocene to Early Pliocene decapod

Table 1. Numbers of species and genera, those common to both NE and SW Japan, and those of extant species at various stratigraphic ages.

Stratigraphic age	northeast Japan	southwest Japan	Common sp. and gen.	Total	Identified living sp. and gen.
Late Pleistocene	60/49	24/20	3/10	81/59	47/59
Middle Pleistocene	16/15	48/34	3/8	61/41	30/41
Early Pleistocene	7/6	4/3	2/2	9/7	5/7
Late Pliocene	5/3	24/21	0/2	29/22	10/22
Early Pliocene	7/6	10/10	0/0	17/16	2/16
Late Miocene	12/8	6/5	0/1	18/12	1/12
Late Middle Miocene	3/3	7/6	0/0	10/9	1/10
Middle Middle Miocene	3/3	16/12	2/2	17/13	0/17
Early Middle Miocene	35/23	56/47	11/13	80/57	2/52
Early Miocene	12/11	29/24	5/9	36/26	0/23
Late Oligocene	–	2/2	–	2/2	0/1
Early Oligocene	1/1	9/8	0/0	10/9	0/4
Late Eocene	5/5	–	–	5/5	0/2
Middle Eocene	7/6	7/7	0/1	14/12	0/3

number of species / number of genera

fauna is still characterized by the abundance of *Cancer* (*Metacarcinus*) spp. and *Hyas* spp. throughout. Whereas no descendant of the former lives in the NW Pacific, the fossil record of the latter is in accord with the distribution of the extant species in Recent Japanese waters, viz., obtained from the Sea of Japan side. On the other hand, occurrences of decapod species indicative of a warm marine environment are quite few in the northern part of NE Japan, in post-Late Miocene time. Considering these facts, the recent cold-water decapod fauna of northern Japan seems to have originated during the Late Miocene to Early Pliocene.

The Late Pliocene decapod fauna is represented by relatively limited horizons. However, the decapod fossils from the Kanzawa Formation, Nakatsu Group, Kanto Plain occur in association with molluscan fossils indicating a warm environment, the 'Kakegawa Fauna' (Masuda & Ogasawara, 1981), which is a molluscan fauna correlative to the warm episode in Tsuchi (1990, 1992). Karasawa (1993) recognized three decapod assemblages in the Upper Pliocene to Lower Pleistocene of the Kakegawa Group, central Japan. However, none was observed in NE Japan. The decapod fauna associated with the Kakegawa molluscan fauna seems to be characterized by the oldest records of several extant species rather than containing warm-water species (Karasawa, 1997).

The diverse Pleistocene decapod faunas in NE Japan are observed in thick, exhaustively investigated Pleistocene strata in the Kanto Plain. These decapod-bearing strata were deposited in various environments. Since the depositional environments of these decapod-bearing horizons are mostly different from those of SW Japan, the number of the species in common to that area is not large (Table 1). The vast majority of taxa are assignable to extant species, but three are noteworthy extinct species, *Cancer* (*Metacarcinus*)'n. sp., *Chaceon matsushimai* Kato & Koizumi and *Grynaminna grandis* (Karasawa & Goda), recognized in the Pleistocene of NE Japan. *Cancer* (*Metacarcinus*) n. sp. from the Lower Pleistocene of the Kanto Plain is the latest record of the subgenus in the NW Pacific. In the Middle to Upper Pleistocene of NE Japan, all taxa identified at the species level are assigned to extant ones, except for *Grynaminna grandis*. While this species is the most dominant decapod element in the Middle to Upper Pleistocene of Japan, the only congener, *G. tamakii* Poore, is known only from a quite restricted area in Kyushu, SW Japan, as a relict (Poore, 2000).

Conclusion

On the whole, decapod species indicative of subtropical to tropical marine climates in the Cenozoic of NE Japan are evidently fewer than those in

SW Japan, so that the optimal events recognized in the decapod fauna are not as clear as those there. In contrast, cold-water elements are clearly recognized in the Middle Miocene to Lower Pliocene of NE Japan.

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