

## A COMMENT ON THE GEOLOGICAL FORMATION OF THE MISHIMA ISLANDS (TAKESHIMA, IOUJIMA AND KUROSHIMA) AS INFERRED FROM THEIR FRESHWATER CRUSTACEAN FAUNAS

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### Abstract

Freshwater crustacean faunas of the Mishima Islands, which constitute Takeshima, Ioujima and Kuroshima, were investigated. Three species, *Caridina typus*, *Macrobrachium lar* and *Geothelphusa dehaani* were recorded. The geological formation of the Mishima Islands was discussed, with notes on the biology and distribution patterns of their freshwater crustacean faunas. It is revealed that the three Islands were connected to the Chinese mainland about 1.0 million years ago, wherein only Takeshima had been submerged by sea-level rising that exterminated its *G. dehaani* population.

Key words: crustacean fauna, formation process, *Geothelphusa dehaani*, Mishima Island, sea-level rising

### Introduction

The composition of crustacean fauna inhabiting the inland waters of islands was noted to coincide with geological history, life history of organisms, and so on. In the Ryukyu Islands located between the Kyushu Island and Taiwan, SHOKITA (1979, 1996) discussed the formation of the freshwater crustacean faunas, particularly the origin of the Japanese freshwater crabs, by comparing the composition and geographical distribution of the crustacean fauna inhabiting the inland waters of the Islands. In addition, he speculated that the ancestral species of the freshwater crustaceans, especially the landlocked and true freshwater species, already existed on the Ryukyu Islands about 1.0 Ma (million years ago), instead of later immigration via the last land bridge linking the Ryukyus with the Chinese mainland.

Following SHOKITA (1996), this study compares the freshwater crustacean fauna of the Mishima Islands (Takeshima, Ioujima and Kuroshima) and infers their geological formation, which remains obscure in the light of geological studies.

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### Material and Methods

A biological survey was conducted in the inland waters of the Mishima Islands (Fig. 1) on September 27-29, 1999. From the brackish water to the freshwater areas on each island, decapod crustaceans were collected manually or with a scoop net. Sampling was done during daytime only. Specimens were fixed with 10% formalin and preserved in 70% ethyl alcohol for future study.

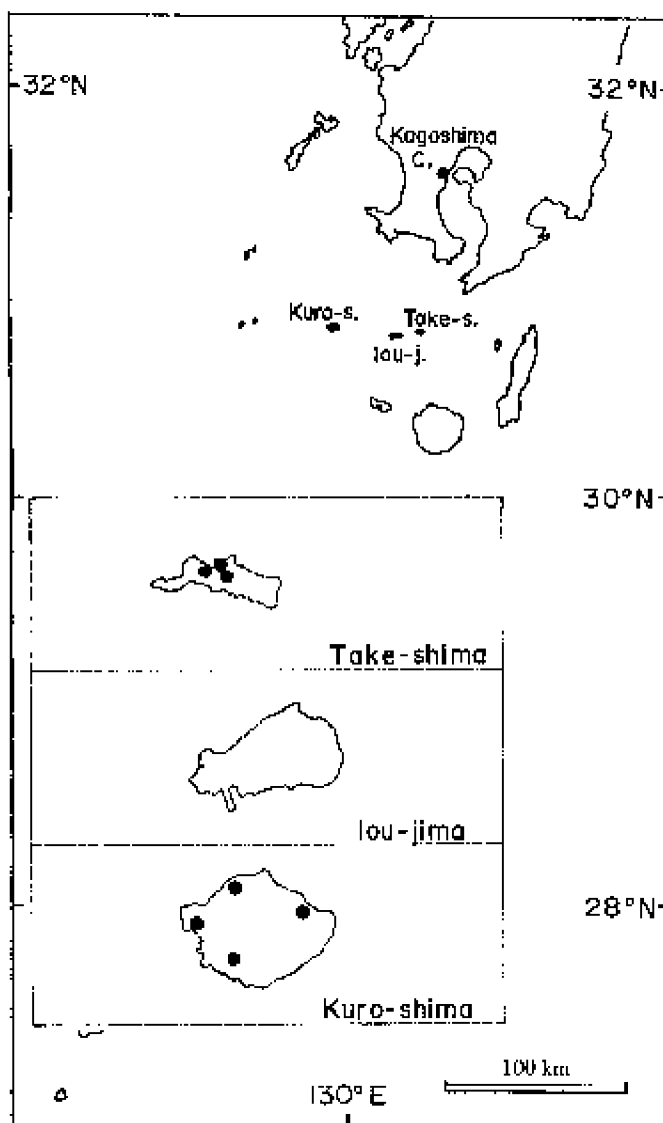


Fig. 1. Map showing the sample sites (solid circles) in Takeshima and Kuroshima, and their locations.

### Results and Discussion

Among the three islands, Ioujima lacked a river system hence, no freshwater crustaceans were found in the island. However, three species belonging to three families (Table 1) were collected from Takeshima and Kuroshima. Among them, *Caridina typus* (Fig. 2) and *Macrobrachium lar* (Fig. 3) are diadromous crustaceans, which inhabit both freshwater and seawater areas at certain stages of their life cycle. Both species are common in the area along where the Kuroshio Current flows. The distribution of the two species may indicate that the crustacean faunas of Takeshima and Kuroshima are strongly effected by the Current, wherein it served both as transport and barrier mechanisms for interisland migrations.

Table 1. List of Inland Water Crustacean Decapods Captured in Takeshima and Kuroshima

Family and Species	Takeshima	Kuroshima	Life style
Atyidae			
<i>Caridina typus</i>	present	present	Diadromous
Palaemonidae			
<i>Macrobrachium lar</i>	present	-----	Diadromous
Potamidae			
<i>Geothelphusa dehaani</i>	-----	present	Freshwater



Fig. 2. Dorsal view of *Caridina typus* collected in Takeshima.



Fig. 3. Dorsal view of *Macrobrachium lar* collected in Takeshima.



Fig. 4. Dorsal view of *Geothelphusa dehaani* collected in Kuroshima.

*Geothelphusa dehaani* (Fig. 4) is a true freshwater crab, which was found in Kuroshima but not in Takeshima. Since *G. dehaani* also inhabits the adjacent islands, such as Kuchierabujima and Yakushima (SUZUKI & TSUDA, 1991; SUZUKI & SATO, 1994), it suggests that this crab might have occurred in Takeshima about 1.0 Ma when the island was connected to the Chinese mainland.

KIMURA (1996) noted that the Ryukyu Islands nearly connected to the Chinese mainland, through Taiwan as a land bridge, during two development periods approximately during 1.6



Fig. 5. Distant view of Takeshima, Ioujima, and Kuroshima. Left; Takeshima (left side) and Ioujima (right side), Right; Kuroshima.

to 1.0 Ma and 0.2 to 0.02 Ma. He mentioned that there was a deep channel at the Kerama and Tokara gaps. Based on the depths around the Mishima Islands, there is no possibility that Takeshima and Kuroshima were connected to the Kyushu Island about 0.2 to 0.02 Ma and, in that period, *G. dehaani* immigrated into the two islands. The maximum altitudes of Takeshima, Kuroshima (Fig. 5), Kuchierabujima, and Yakushima are 194 m, 622 m, 657 m and 1935 m, respectively. Takeshima and Kuroshima were connected to the Chinese mainland about 1.0 Ma, but thereafter only Takeshima was submerged by sea-level rising and was never connected with Kyushu.

Thus, it is inferred that the population of *G. dehaani* in Takeshima was possibly exterminated by submergence since 1.0 Ma, whereas that of Kuroshima has been isolated from other island populations for a long time, probably more than one million years. The *G. dehaani* population in Kuroshima is being studied with regards to speciation.

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