Paleobiogeography of Cenozoic ostracodes from the Sea of Japan

Paleobiogeography of Cenozoic ostracodes from the Sea of Japan

Tatsuhiko YAMAGUCHI[a] and Takahiro Kamiya[b]

(a) Faculty of Science, Kanazawa University, Kakuma-machi,Kanazawa,Ishikawa,920-1192,JAPAN
(b) Graduate School of Natural Science and Technology, Kanazawa University, Kakuma-machi,Kanazawa,Ishikawa,920-1192,JAPAN

Introduction

The Sea of Japan, an enclosed sea, began opening in ca. 21 Ma, early Miocene (Hoshi, 1999) and the opening finished in ca. 14 Ma, middle Miocene (e.g. Shimada et al., 2001). In the enclosed sea, modern benthic faunas have many endemic species. The endemism correlates with the geographic setting isolated from oceans such as the Pacific. The faunas of the sea consist of some biogeographic elements and are originated from faunas in some seas such as the Pacific and Indopacific (e.g. Nishimura, 1981). The origin of the macrofaunas such as molluscs and decapods in the sea were discussed, based on their fossil records (e.g. Ozawa et al., 1986; Karasawa, 1993; Ogasawara, 1996). However, ostracodes, a meiofauna, in the sea have never discussed. Ostracodes were reported from Cenozoic deposits along the Sea of Japan (e.g. Ozawa, 1996; Yamada et al., 2003) as well as modern sediments in the sea (e.g. Ozawa et al., 2004). Here we examined paleobiogeographic characters of the ostracodes, focusing the periods during the opening of the Sea of Japan to discuss faunal changes of the ostracodes.

Data set.

Eocene–Oligocene.—Eocene Iojima Group in Nagasaki Prefecture (Yamaguchi, in press), Oligocene Itanoura Formation in Nagasaki Prefecture (Yamaguchi, 2004), and Waita Formation in Fukuoka Prefecture (Yamaguchi and Kamiya, submitted).

Miocene.—Middle Miocene Yeonil Group in southern Korea (Huh and Paik, 1992), Lower Miocene Sunagozaka Formation in Ishikawa Prefecture (Ishizaki, 1963; Tanaka et al., 2004; Yamaguchi, unpub. data), Middle Miocene Fujina and Omori Formations in Shimane Prefecture (Tanaka et al., 2002; Tanaka, 2003), and Asagaya Formation in Ishikawa Prefecture (Yamaguchi, unpub. data), and Upper Miocene Kamikoani and Fujikotogawa Formations in Akita Prefecture (Yajima et al., 1988; Irizuki, 1994).

After the Miocene.—Pliocene Tentokuji and Sasaoka Formations in Akita Prefecture (Irizuki, 1989, 1996; Yamada et al., 2003) and Yabuta Formation in Toyama Prefecture (Cronin et al., 1994). Pleistocene Omma Formation in Ishikawa Prefecture (Ozawa, 1996). Modern sediments off Mishima, Oki, Noto, Tsugaru, Terui, and Rebun (Ozawa et al., 1999; Tsukawaki et al., 1997, 1998, 1999, 2000).

Paleobiogeographic elements

We identified 80 genera of Cenozoic shallow marine ostracodes around the Sea of Japan as five paleobiogeographic elements: Cosmopolitan, Tethyan-Indopacific, Circum-Arctic, and endemic elements, and the others.

---

[a] Electronic Address: tyamagu@nihonkai.kanazawa-u.ac.jp

[b] Electronic Address: takamiya@kenroku.kanazawa-u.ac.jp

Cosmopolitan elements.—They are distributed worldwide during the Cenozoic and contain the genera *Acanthocythereis*, *Cytheropteron*, *Cytherella*, *Cytherelloidea*, *Krithe*, *Munseyella*, and *Trachyleberis*.

The Tethyan-Indopacific elements.—McKenzie (1983) recognized the tribe Paijenborchellini and Buntoniini and the genera *Callistocythere* and *Schizocythere* as characteristics of the Tethyan fauna. The tribes and genera mainly occur from the late Cretaceous and Paleogene deposits in Mediterranean, northern Africa, Middle East, and northern India, and are considered to have lived in warm-water conditions. The elements contains the genera, which are found in the Neogene deposits from the Indopacific region such as the South China Sea and Java Sea (e.g. *Eopaijenborchella* and *Neomonoceratina*).

Circum-Arctic elements.—Genera are found mainly in the high latitudes of the North Pacific and Atlantic. They consist of genera such as *Baffinicythere*, *Hemicythere*, *Laperousecythere*, and *Robertsonites*, which contain cryophic and circumpolar species of Cronin and Ikeya (1987).

Endemic elements.—They are found around only Japan (e.g. *Falsobuntonia* and *Hanaiborchella*).

Results and Discussion

During the Cenozoic, the number of genera increases. The Eocene–Oligocene faunas are characterized by the high ratio of the cosmopolitan elements. After the Neogene the ratio of the cosmopolitan elements decreases and those of the endemic and Circum-Arctic elements, while the ratio of the Tethyan-Indopacific elements does not change distinctive. The Circum-Arctic elements consist of Neogene cold-water genera, while the Tethyan-Indopacific elements comprise warm-water genera. The increase of the Circum-Arctic elements is concordant with the climatic cooling trend during the Neogene. Because the Tsushima warm-current has flown in the Sea of Japan for the Neogene, the ratio of the Tethyan-Indopacific elements has been consistent.

Through the early Oligocene to early Miocene, cosmopolitan elements decrease from 63 to 43%, while the Circum-Arctic elements appear. The appearance might correlate with the global climatic cooling during the early Oligocene, although the early Oligocene to earliest Miocene data are few.

During the early and middle Miocene, the Circum-Arctic elements from the ostracodes in the Ishikawa and Shimane Prefectures distinctive increased from 5 to 24%. The Tsushima warm-current did not flow into the sea episodically in the middle Miocene and marine climate of the sea changed cooler (e.g. Nomura, 1992). The enclosed sea established in the middle Miocene because the southwestern part of the Sea of Japan opened during ca. 16–14 Ma (Shimada et al., 2001). Hence, the increase of the Circum-Arctic elements correlates with climatic cooling and the geographic isolation ceased by the enclosed sea.

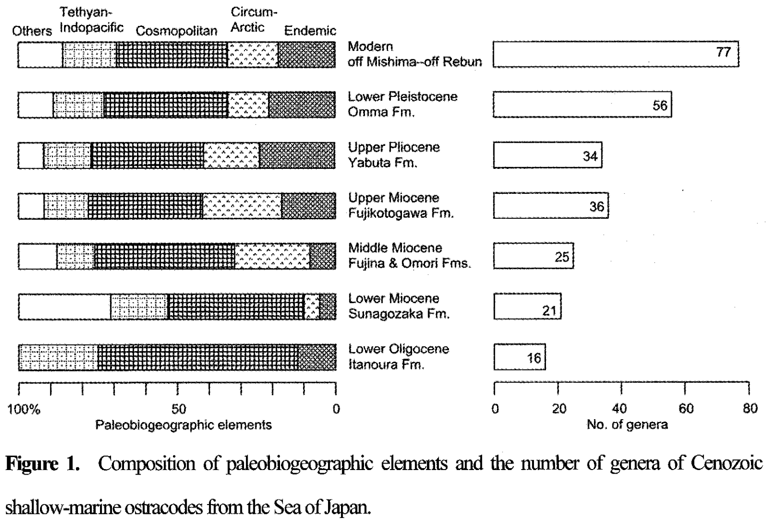

Figure 1. Composition of paleobiogeographic elements and the number of genera of Cenozoic shallow-marine ostracodes from the Sea of Japan.