Eocene-Oligocene climatic changes based on fossil ostracode faunas in the northwestern Kyushu, southwestern Japan

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During the Eocene-Oligocene transition the Antarctic ice sheets developed abruptly and caused global climate cooling (e.g. Zachos et al., 2001). Changes of fossil biota were reported worldwide to follow the event (e.g. Wei, 1991; Funakawa, 2003). The significant expansion of the ice sheets in the earliest Oligocene (ca. 33.5-33.1Ma) are represented by distinct positive peak with abrupt shift in foraminiferal oxygen-isotope records from deep-sea drilling cores, which was defined as the Oi1 event (Miller et al., 1991; Zachos et al., 1996). In southwestern Japan, the Eocene-Oligocene marine climate has been discussed on the basis of changes of fossil molluscan faunas (e.g. Shuto, 1991; Honda, 1994; Ogasawara, 2000). The previous studies mentioned that the marine climate changed stepwise from the tropical to the temperate realms through the middle Eocene to early Oligocene and reflected the global climatic cooling. However, the marine climate in Japan has never been discussed on the correlation between the foraminiferal oxygen-isotope records and the faunal changes. Furthermore, any taxa except molluscs have not been discussed yet on the marine climatic changes. We examined fossil ostracodes from the northwestern Kyushu region, southwestern Japan and discussed marine climate, correlating fossil ostracodes with fossil molluscs and the oxygen isotope records.

At least 70 ostracode species occur from the four formations in the region: the Okinoshima and Funazu Formations of the Iojima Group, the Itanoura Formation of the Nishisonogi Group and the Waita Formation of the Ashiya Group. These formations are assigned to about 44 to 29 Ma (the middle Eocene to the early Oligocene) on the basis of planktonic foraminifer, calcareous nannofossils and molluscan biostratigraphy (e.g. Mizuno, 1964; Okada, 1992; Ibaraki, 1994). Fossil ostracode faunas from the Eocene Okinoshima and Funazu Formations of the Iojima Group and the lower Oligocene Itanoura Formation of the Nishisonogi Group, which are correlated with calcareous nannofossil Zone CP14 to CP16b (43.7 to 32.8 Ma) (e.g. Okada, 1992; Matsubara, 2002), are dominated by Acanthocythereis volubilis with other tropical / subtropical genera such as Abrocythereis, Cytherella and Eopaijenborchella. Meanwhile, early Oligocene ostracode fauna from the Waita Formation of the Ashiya Group, which is correlated with planktonic foraminifer zone P.21a (29.4 to 28.5 Ma) (e.g. Ibaraki, 1994), includes Palmoconcha sp. as dominant species. The dominant genus is suggestive of the temperate realm. Hence, fossil ostracode faunas changed through 32.8 to 29.4 Ma and represent climatic changes from the tropical / subtropical to the temperate realms. The faunal changes of fossil ostracodes is concordant with that of fossil molluscs between the Maze and the Nishisonogi Stage of the northwestern Kyushu region (e.g. Shuto, 1991; Honda, 1994). Furthermore, those are consistent with the molluscan faunal change between the Galvinian and the Matlockian Stages of the northeastern Pacific such as Washington and Oregon (e.g. Squire, 2003). Consequently, faunal changes of fossil ostracodes and molluscs of the Kyushu region reflect early Oligocene climatic cooling in shallow marine of the northern Pacific and the climatic cooling was late for the Oi1 event.