

## 論文内容の要旨

### **Mid-Cretaceous biogeographic revolution in the North Pacific – evidence from spatiotemporal changes in benthic and nektonic organisms**

白亜紀中期の北太平洋における海洋生物群分布の変革

伊庭靖弘

The Cretaceous period is a well-known greenhouse interval in the Earth's history. The Pacific was the largest ocean during this period, and is therefore an important region for our understanding of macroevolutionary dynamics of marine biota on a global scale. The purpose of this study is to reveal the spatiotemporal changes of marine biota in the North Pacific during the mid-Cretaceous from the viewpoint of paleobiogeography. For this purpose, extensive field survey was carried for the litho- and biostratigraphy, and sedimentary facies of the marine Cretaceous deposits in selected areas of Japan and northern California. Furthermore, macrofossils recovered from various horizons in the study areas were examined taxonomically. In addition to these original data, an extensive literature survey was made for pre-Late Aptian Early Cretaceous macrofaunas from the circum-North Pacific regions was made. In order to reveal paleobiogeographic relationships of North Pacific regions with Tethyan and Boreal realms, spatiotemporal changes of the following taxa (having different habitats and modes of life) were analyzed on the basis of the obtained data: A) Mesogean reference key taxa (e.g., rudistid bivalves), B) Mesogean indicators (e.g., orbitolinid foraminifera), C) nerineacean gastropods, D) Tethyan non rudist bivalves (*Neithea* and *Rastellum*), E) warm-water bivalve *Plicatula*, F) belemnites, and G) hoplitid ammonites. These taxa are important for Cretaceous marine paleobiogeography as they define or characterize the Tethyan Realm and/or Arctic-Boreal Realm.

As a result of analyses, the following trends in temporal biotic changes were recognized in the North Pacific: 1) Continuous distribution of the Tethyan biota during the Early Neocomian–early mid-Cretaceous, 2) Step-wise demise of the Tethyan biota during the Late Aptian–early Cenomanian and complete disappearance in the latest Albian–early Cenomanian interval, and 3) Long-term scarcity of the Tethyan biota throughout the Late Cretaceous. These biotic changes clearly indicate

that the North Pacific belonged to the Tethyan Realm under tropical-subtropical conditions throughout the Early Cretaceous, and that the North Pacific became gradually independent from the Tethyan Realm during the Late Aptian–early Cenomanian, followed by a long-term faunal disconnection with Tethyan Realm throughout the Late Cretaceous. Similar biotic trends were also recorded in the equatorial Pacific regions. Such biotic trends in the equatorial–North Pacific have not been recognized in other regions and indicate the paradox of the mid-Cretaceous global warming climatic trends. This large-scale biogeographic change is consistent with simulated global changes in the ocean current system (especially a change in warm water circulation), and ocean heat transport triggered by the formation of new large ocean gateways and a increase in atmospheric CO<sub>2</sub> during mid-Cretaceous.

After the demise of the Tethyan biota, mollusks in the North Pacific became endemic. This demise event is clearly distinguishable from the extinction event. In this respect, the demise is defined as “vacariance event”, which was caused by the separation of the North Pacific from the Tethyan Realm. This demise event is an instigator of marine faunal evolution, changes in ecosystem, as well as the formation of a new biotic province in the North Pacific. Its influence was maintained for 45 million years until the Eocene, and should be considered as one of the most important bio-events in the Cretaceous.

The Albian demise of belemnites and their subsequent long-term absence in the Pacific throughout the Late Cretaceous clearly indicates a faunal disconnection between the North Pacific and the Boreal Realm during this time interval. This idea is also supported by fossil records of Arctic–Boreal type ammonites. The North Pacific terminated faunal interchange with the Tethyan Realm and the Arctic–Boreal Realm in the Albian. The mid-Cretaceous termination of faunal interchange between the Arctic-Boreal and the Pacific was presumably triggered by closures of the gateways, as a physical barrier. The long-term disconnection between the Arctic sea and the North Pacific from the Late Cretaceous to the Paleogene was an important background physical factor to maintain the provincialism of marine biota in the North Pacific.