Carbon isotopic stratigraphy of the Torinosu-type Limestone and palaeoceanography from late Jurassic to early Cretaceous

Yoshihiro Kakizaki[1]; Akihiro Kano[2]

[1] Earth & Planet, Hiroshima Univ.; [2] Soc. Cul. Studies, Kyushu Univ.

Late Jurassic to Early Cretaceous was a period of the accelerated global carbon circulation. The breakup of the supercontinent Pangea generated new seaways, expanded coastal settings and humid climates, and intensified weathering, which increased the continental flux of inorganic nutrients and carbonate alkalinity to seawater. In the eutrophied ocean, flourished calcareous planktons and reef-builders contributed to fix both organic and inorganic carbons.

These pictures have been drawn mostly with geologic and geochemical information collected from the Tethyan areas. However, the Tethys only covered less than 20% of the oceanic surface, and the rest was another ocean, Palaeo-Pacific that was even much larger than the present-day Pacific. The accomplished picture of the mid-Mesozoic global oceanography therefore requires improvement of the information from this huge ocean. Here we present the chemostratigraphic study of Late Jurassic to Early Cretaceous, which is first done for marine sediments in the Palaeo-Pacific.

The study object is so-called ”the Torinosu-type limestones” that was deposited in the western Palaeo-Pacific is now distributed nearly all through the Japanese Islands. We measured carbon isotopic composition of 189 limestone samples collected in ca. 1-m-interval from the several sections in Fukushima. Kochi and Ehime Prefectures, which were dated by Sr isotopic ratio of brachiopod fossils. dcarbon isotopic values of measured specimens range from -8.3 to +2.2 per mill. However, substantial diagenetic alternation was suspected for the specimens having low values because they generally exhibit significant correration between carbon and oxygen isotopic values, relatively high Mn concentration, or diagenetic components such as cement. dd

After rejecting these altered values, we succeeded to construct a composite carbon isotopic profile in the western Palaeo-Pacific Ocean during a 12-m.y. period from Kimmeridgian (late Jurassic) to Berriasian (earliest Cretaceous), in which the carbon isotopicd values appear a relatively narrow range from +0.5 to +2.2 per mill. This profile shows a distinct difference from the well-established Tethyan profile in terms of the Kimmeridgian records that are more than 1.0 per mill lower than the Tethyan values.

The higher Tethyan values likely reflected on vigorous production and burial of organic carbon that is consistent to ubiquitous occurrence of petroleum source rocks in the Tethys but not in Palaeo-Pacific. Seawater exchange between the two oceans was restricted in degree to leave the difference in carbon isotopic value d of dissolved inorganic carbon. This interregional difference declined during Tithonian and disappeared in Berriasian. The isotopic homogenization likely resulted from the increased seawater exchange in response to the development of the Hispanic and Mozambique corridors during Tithonian.

Our Palaeo-Pacific data provide new insight to mid-Mesozoic ocean models that are mainly based on Tethyan records. However, the information from the Palaeo-Pacific marine carbonates is still fragmentary and needs more attention in order to improve our understanding on carbon cycle and ocean circulation during this greenhouse epoch and before the onset of Oceanic Anoxic Events.