Lithostratigraphy and organic carbon isotope stratigraphy in the lower Triassic pelagic sequence along Kiso River, Inuyama

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After the largest mass extinction in the Phanerozoic occurred at the Permian/Triassic (P/T) boundary, the biotic recovery from the mass extinction needed ca. 5Myr which corresponds to the entire early Triassic. Recently, it was demonstrated that continuous carbon cycle instability characterized by large amplitude carbon isotopic oscillations was present during the early Triassic which was reported from shallow-marine carbonates deposited in tropical Tethys. This suggests a causal relationship between unstable carbon cycle and delayed biotic recovery. To explore the relationship between the global carbon cycle fluctuations and biotic recovery, however, it is important to obtain the information about superocean Panthalassa which occupied the great majority of the world ocean, and to compare it with the information obtained from shallow-marine environments in Tethys. If carbon isotopic fluctuations observed in Tethys reflect changes in the isotopic composition of total carbon in the atmosphere-ocean system, it would be possible to correlate sedimentary records of Tethys and Panthalassa by using the carbon isotope stratigraphy.

Jurassic accretionary complex in Japan contains Permo-Triassic pelagic sedimentary sequence deposited on the deep sea floor of Panthalassa, the latter is considered to have recorded global environmental changes. However, continuous lithostratigraphy of such a pelagic sequence covering the entire early Triassic has never been reconstructed because the pelagic sequence were intensely faulted and folded during the accretionary process. Especially black shale horizon, which is considered to have accumulated during the earliest Triassic, became the slip zone (decollement).

In this study, we carried out detailed geological mapping of the Jurassic accretionary complex in Mino Terrane exposed along Kiso River, Inuyama, central Japan to reconstruct the continuous lithostratigraphy of the lower Triassic pelagic sequence. We reconstructed the continuous columnar section of ca. 12m-thick that is composed of 14 lithological units by correlating and stacking columnar sections made for individual fault-bounded blocks. Radiolarian index fossils of the late early Triassic (Spathian) and the early middle Triassic (Anisian) were previously reported from the upper part of this sequence. Although index fossils older than Spathian have never been reported from the study area, lower black shale unit is considered as corresponding to the earliest Triassic judging from its lithostratigraphic association.

Carbon isotopic analysis of total organic carbon in these lower Triassic pelagic sediments was conducted to reconstruct continuous carbon isotopic record covering the entire early Triassic and compared with carbon isotopic record from Tethys. The result suggests that general trend and amplitude of both carbon isotopic curves are similar and can be correlated, although there are some differences in the interval corresponding to Smithian. If we can completely confirm the Tethys-Panthalassa correlation by resolving this problem, it will become possible to compare environmental changes between shallow and deep-water environments.