Paleoenvironmental reconstruction by biomarker and kerogen analyses of sediments around the Triassic-Jurassic boundary from North America

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The extinction event during the end-Triassic is known to be one of the largest mass extinctions in the Phanerozoic, and are thought to be closely associated with the eruption of the Central Atlantic Magmatic province (CAMP) (e.g. Marzoli et al., 2004). Reconstruction of paleoenvironment and paleoecology around the Triassic-Jurassic boundary (TJB) from the areas near the CAMP provide understandings for environmental system and its relation to the TJB crisis. In the present study, we analyzed sedimentary organic matter such as biomarkers and kerogen in sediments from eastern North America rift basin around the TJB to improve the analyses for reconstructing paleoenvironments, and to examine variations of terrestrial environments.

We used lacustrine sediments (black shales, glay siltstone and red sandstones) deposited in the eastern North America rift basins such as Hartford and Newark Basins across the TJB and early Jurassic. Crushed rock samples (5–10 g) were extracted with ultrasonication, by successive treatment with organic solvents. Thereafter, residues were treated sequentially in a water bath shaker with HCl and HF. We analyzed pyrolysis and thermochemolysis of kerogen by using GC-MS equipped Curie-point pyrolyzer. Thermochemolysis was performed with tetramethyl ammonium hydroxide (TMAH).

Organic matter in sediments from North America are confirmed to be of high maturity that reached oil window. The β-carotane (lacustrine algae origin) was identified as a main free biomarker in all sediments. Interestingly, phenol compounds released from kerogens are mainly detected in a black shale from the East Berlin Formation in Hartford Basin. The phenol compounds released kerogen were hardly detected from other black shale samples. These results suggest that the kerogen in the black shale preserved terrestrial plant-derived materials because of more efficiently transportation and deposition affected by environmental change.

[1] Marzoli, A. et al., 2004. Geology 32, 973–976.