

Paleoenvironmental changes recorded by pioneer plant biomarkers in the sediments deposited across the Cenomanian/Turonian boundary in the Tomamae area, northern Hokkaido, Japan

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Pioneer plants such as lichen, moss and fern can live even in extreme environment and firstly colonize in damaged ecosystems. The lichen is thought to appear during early time in earth's history, but there were scarce records because its fossil was hardly preserved in sediment due to its peculiarity for living place and structure of body. Recently, the molecular fossils (biomarkers) for lichen were reported in ancient sediments (e.g., Watson et al., 2005). In the present study, we searched and analyzed organic molecules derived from pioneer plant, especially lichen, in the sediments deposited during the Cretaceous disturbance event from Hokkaido, Japan. Also, we reconstruct paleoecology of the pioneer plant and paleoenvironment recorded by their biomarkers.

We analyzed sedimentary rocks across the Cenomanian - Turonian boundary (CTB) in the Saku Formation, Yezo Group, were collected from the Omagari-zawa sections of the Tomamae area, northern Hokkaido, Japan. The sediments used correspond to the OAE2 intervals (1st build-up, trough, 2nd build-up and Plateau phases), decided by $\delta^{13}\text{C}$ stratigraphy (Omatsu et al., 2014) and Os isotope stages. For the biomarker analysis, the extractions of freeze-dried sediments were fractionated using silica-gel column and analyzed by GC-MS.

By the sterane and hopane analyses, we confirmed the high contribution of terrigenous matter input and low maturity of organic matter (vitrinite reflectance ca. 0.4% level; lignite to subbituminous coal rank) in the Omagari-zawa section. These results are similar to those in Ando et al.(2017). The dibenzofurans and its alkyl derivatives are detected in all samples of the Omagari-zawa section. It is thought that the 1- and/or 9-methyl dibenzofurans are likely to be originated from lichen. We proposed that the "1-methyl dibenzofuran (1-MDBF) ratio" can be indicators for relative abundances of lichen in the other plants. The 1-MDBF ratios vary in the sediments across the CTB; the ratios increase during the 1st build up stage, consistently low values during the Trough, and tend to increase from the 2nd build up to Plateau stages. Furthermore, the increasing spikes are observed in the horizons just below decreasing of Os isotope ratios in the Trough stage, and just above the stage for active LIPs. It is presumed that the variations are attributed to environmental and climatic changes in paleo-Hokkaido across the CTB.

Keywords: pioneer plant, lichen, biomarker, Yezo Group, C/T boundary, Cretaceous