Paleolipidomics of resistant macromolecules in terrestrial plant fossil: Paleochemotaxonomy and paleoenvironmental reconstruction

KEN SAWADA[1], YUMA MIYATA[1], HIDETO NAKAMURA[1], MASAMICHI TAKAHASHI[2]

[1] Faculty of Science, Hokkaido University, Sapporo, Japan.
e-mail: sawadak@mail.sci.hokudai.ac.jp
[2] Faculty of Science, Niigata Univ., Niigata, Japan.

Resistant macromolecules (RMMs) composing living plant tissues are more refractory against microbial degradation and diagenesis, and are well preserved as major parts in plant fossils and plant-derived organic particles in sediment. Monomer compositions of the RMMs vary depending plant taxa, organs and physiological factors including growth conditions and stages. Thus, the RMM analysis may serve as powerful technique for evaluating paleobotany, paleovegetation and paleoenvironment. In the present study, we analyzed plant fossils from the Cretaceous strata in Japan to examine chemotaxonomic characteristics of the RMMs in the fossils.

Angiosperms and gymnosperms mesofossils were collected from the Cretaceous 1) Ashizawa Formation, Futaba Group, Fukushima, and 2) Mikasa Formation, Yezo Group, Hokkaido. These mesofossils include fruits, flower, leaf, stem, seeds and woods. The residues removed free compounds were hydrolyzed, and these released compounds were analyzed by GC-MS. Also, pyrolysis and thermochemolysis of plant fossils by using GC-MS equipped Curie-point pyrolyzer. Additionally, statistical analysis were calculated using SPSS software. We used hierarchical clustering to group fossils with similar lipid distributions among species or organs.

As main hydrolyzed products (ester-bound molecular units) from all fossils, C_6-C_{28} *n*-alkanoic acids and C_8-C_{28} *n*-alkanols were detected. Phenolic compounds released were much minor, especially in charred fossils. Carbon number distributions appears to be different between the organs; low C_{18}/C_{16} ratios in cuticles (e.g. flowers, fruits and leaves) and high C_{18}/C_{16} ratios in woods, which indicates those of cutin and suberin, respectively. Statistical analysis were calculated in lipid distribution for these released alkyl lipids from each fossils. Cluster analysis revealed a recognizable patterns of distributions of released alkyl lipids. All woody fossils are present in a cluster excluded non-woody ones. From these results, we propose that the paleolipidomics-like detailed paleochemotaxonomy of plant fossil are possible by making a comprehensive evaluation for various *n*-alkyl lipid units bound in the RMMs.