Variations in paleovegetation and transport of terrigenous matter reconstructed by terrestrial plant biomarker compositions in sediments from IODP Site U1423 over the last 4 Ma

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The objectives of our study are to reconstruct long time-scale variations in paleovegetation in the East Asia and transport of terrigenous material to the East Asian marginal sea, and to evaluate long time-scale biogeochemical cycles in the marginal sea during the Pliocene to Pleistocene (over the past 4 million years). Sedimentary plant remains such as spore/pollen and plant mega-/mesofossils are commonly used for reconstructing paleovegetation, and recently, plant-derived organic molecules, biomakers, are also applied. In the present report, we focus on terrestrial plant biomarkers such as plant wax-derived *n*-alkanes as well as terrestrial plant terpenoids, in which structures vary depending on taxonomic differences. Moreover, we compare between the data for plant biomarkers and spore/pollen in the same samples.
The sediment cores studied were recovered at Site U1423 in the eastern part of the Japan Basin at 41º 41.95’ N, 139º4.98’ E by Integrated Ocean Drilling Program (IODP) Expedition 346. Lipids were extracted with dichloromethane / methanol, and separated to aliphatic, aromatic and polar fractions. Lipids were identified and quantified by GC/MS.
Concentrations of long chain *n*-alkanes increase from ~1.7 Ma. This result implies that plant waxes were more efficiently transported by eolian dust due to global cooling during the early Pleistocene. Triterpenoids such as α-amyron, β-amyron and friedelin, and diterpenoids such as sugiol and dehydroabietic acid were mainly identified in all samples. The plant terpenoid concentrations were found to increase from ~1.3 Ma. The sugiol is found to be consistently abundant, although the remarkable decreasing spikes are observed during 3.5 - 3.3 Ma and 1.25 –1.05 Ma. The relative abundances of ferrugiol is higher during ca. 3.5 - 3.0 Ma and ca. 1.3 - 0.6 Ma. The sugiol and ferrugiol are known to be derived from Taxodiaceae and Cupressaceae. Thus, these families were possibly abundant in Hokkiado and/or the Japan Sea side of northern Honshu Island over the 4 million years. The relative abundances of dehydroabietic acid, which is typical conifer biomarker, frequently varied and several increasing peaks are observed for 4 million years. Interestingly, the increasing peaks of dehydroabietic acid are found to be correlated to those of the relative abundances of Taxodiaceae estimated by pollen analysis. Such increasing peaks of pollen-based Taxodiaceae abundances are presumably related to Asian monsoonal climate such as warm and humid conditions. From these results, it is suggested that the indicator using dehydroabietic acid, rather than sugiol and ferrugiol, is more sensitively respond against the monsoonal climatic changes. Gymnosperm / angiosperm ratios estimated by terpenoid / diterpenoid ratios increase during 3.0 - 1.5 Ma, which is concordant with results of conifer / broad-leaf wood ratios based on pollen compositions. Thus, gymnosperm-dominant paleovegetation in land areas around Site U1423 might be distributed during the Pliocene to early Pleistocene.

キーワード：古植生、バイオマーカー、日本海北海道沖

Keywords: paleovegetation, biomarker, Japan Sea off Hokkaido

