Sedimentological and organic geochemical characteristics of the turbiditic sequences in the Miocene Abetsu Formation, Hokkaido, Japan

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In the middle Miocene of central Hokkaido, island-arc collision resulted in the formation of narrow foreland basins, Ishikari and Hidaka basins, extending about 400 km north-south and several tens of kilometers wide. Previous studies (Kawakami, 2013) have shown that a number of turbidite beds, Kawabata Formation, containing large amounts of terrestrial organic matter derived from higher plants have been identified. This suggested that a sedimentary system in which terrestrial organic matter was directly transported from the land to the deepseafloor was prevalent in the Ishikari Basin. In the present study, we conducted sedimentological and organic geochemical analyses on turbidites of the Abetsu Formation deposited in the Hidaka Basin to reconstruct sedimentary processes that occurred in the Hidaka Basin in the middle Miocene.

In the Hobetsu area of Mukawa-city, south-central Hokkaido, sand and mud alternations deposited in the Hidaka Basin during the middle to late Miocene are widely distributed. The upper part of the Abetsu Formation (coarse-grained sandstone alternation) and the Nibutani Formation (fine-grained sandstone alternation) are exposed at the Horokanbe-sawa River.

We analyzed two thin, fine-grained turbiditic sequences collected from the upper part of the Abetsu Formation. These are mainly composed of three units from the lower part: massive sandstone part, organic lamination part, and mudstone part. For organic geochemical analysis, the turbiditic sequences were divided into units about 1 cm thick, focusing on the changes in sedimentary structure. Biomarker composition of these units were analyzed using GC/MS. Thin sections of the turbidite sequences were observed and performed grain size measurement under transmitted light microscope.

The massive sandstone and the lamination parts are composed of fine/very fine-grained sands, and show a gradational structure from the upper part of the massive sandstone to the lamination part. The uppermost mud layer consists mainly of silt. Organic particles like plant fragment are observed throughout the sequences, but they are scattered in the massive sandstone part. Interestingly, the organic particles are extremely concentrated in the lamination section, where they are the main particles forming the lamination.

Diterpenoids (gymnosperm components), triterpenoids (angiosperm components), and *des-A* terpenoids (angiosperm components generated by microbial degradation under anoxic conditions) were detected as major biomarkers in the turbidites from the Abetsu Formation. The concentrations of diterpenoids and *des-A* terpenoids nearly constant throughout the sequences, whereas the triterpenoids significantly vary, and especially, concentrated in the from the top of the massive sandstone to the lamination part.These results suggests that the turbulent flow-forming turbidites in the Abetsu Formation contained large amounts of components originated from angiosperms. In the Kawabata Formation, the *des-A* terpenoids were remarkably abundant rather than triterpenoids and diterpenoids in the turbidites (Furota et al.,

2014).These differences indicate that the terrigenous matter in the turbidites of the Abetsu Formation was transported from different type land area and/or different source vegetation to the deep sea.

The terrestrial/marine organic matter ratio using steroid (sterane) composition was evaluated in the turbidite sequence. The sterane index shows a high proportion of terrestrial organic matter over the massive sandstone and lamination part, with a rapid shift to marine organic matter in the mudstone part. This trend is observed in the both Abetsu turbidites, but some sequences having a higher contribution of marine organic matter throughout the sequence. Such trends were also confirmed by the pristane/phytan index (Pr/Ph), which indicates the redox condition and contribution of terrestrial organic matter.

Keywords: turbidite, Hokkaido, Organic geochemistry

