

Paleoweathering condition in the Middle Miocene and the Pliocene in Setouchi Province: Geochemical composition of fluvial muddy sediments

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The Middle Miocene to Pliocene fluvial sediments, which are distributed in Setouchi Province, are characterized by the finer sediments had been used as a high quality resource of ceramics. In general, finer sediments are suitable for examination of the paleoweathering condition, because their chemical compositions show representative value of paleoweathering degree reflecting their wide catchment area at that time. The geochemical composition is a result of the complicated influence of paleoweathering condition and fluvial processes involved in hydrodynamic sorting. This study examine geochemical variations within the fluvial muddy sediments of the Middle Miocene Tokiguchi Porcelain Clay Formation and the Pliocene Iga Clay Formation in order to assess the paleoweathering condition considering hydrodynamic sorting.

The sedimentary environments of the each formation are considered to be deposition in lake-pond and floodplain environments with partly channel and natural levee. The muddy sediments in the Middle Miocene were collected from three mines in the Gifu Prefecture and those in the Pliocene were taken from two mines in the Mie Prefecture. Then the geochemical analysis were made using XRF and ICP-MS.

The Middle Miocene sediments display clear negative linear trends between SiO₂ and other major elements, which is result of quartz dilution by effective hydrodynamic sorting. On the other hands, the Pliocene sediments have relatively high concentrations of Na₂O and CaO. Almost samples, furthermore, have positive correlation between SiO₂ and Na₂O, CaO and K₂O. Those results are caused by its sandy nature with richness of feldspar grains led by less hydrodynamic sorting and relatively felsic source rock in the Pliocene sediments.

On the A-CN-K diagram, the Middle Miocene sediments show high weathering ratio (CIA value: 79-93). The Pliocene sediments, meanwhile, can be divided into highly CIA value (80-94) and low CIA value group (70-75). The grain size effect (Al₂O₃/SiO₂) to the chemical weathering index is unclear in the Middle Miocene sediments and obvious in the Pliocene sediments. Moreover, ΣREE, which is generally higher in clay sized sediments than the parent rocks, in the Middle Miocene sediments are higher than those in the Pliocene sediments.

Also, the Middle Miocene sediments are characterized by the clear hydrodynamic sorting effect and high chemical weathering ratio. The Pliocene sediments, whereas, show bimodal chemical weathering ratio and the less hydrodynamic sorting. These results indicate that the variety of weathering degree in provenance and/or source rock composition. Additionally, typical geography probably affected the formation of facies variation in finer and coarser sediments, which made weathering variation along the basin.

Keywords: weathering , geochemical composition, Miocene, Pliocene, Setouchi Province, fluvial sediments