Paleoweathering condition in the middle Miocene to the early Pliocene period in the Japanese Islands

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The middle Miocene to Pliocene is recognized as a period that has changed the East Asian monsoon. In the Japanese Islands, the Middle Miocene to Pliocene fluvial formations include aluminous clayey horizons with well-preserved pedogenic features and are known as pottery material. These formations, therefore, can be a useful to reconstruct of weathering conditions. Description of paleosols and geochemical and mineralogical research were carried out in the Middle Miocene (10-11 Ma) and the Early Pliocene (3-4 Ma) sediments in the central Japan in order to illuminate the weathering condition in far east Asian margin.
Each of the formation was mainly deposited in lacustrine environment. Paleosols can be divided into 11 pedotypes. In the Middle Miocene, the main pedotypes, which are characterized by thick soil horizons with Bt horizons, gilgai microrelief and rich illuviated clay, are equivalent to vertisol and ultisol. In the Early Pliocene, the main pedotypes, which are characterized by thinner soil horizons, prominent relict beds and rarely illuviated clay, are correspond to ultisol and inceptisol. Hydromorphic paleosols, besides, are developed in the Early Pliocene.
The major elemental geochemistry of the lake sediments shows that the Middle Miocene sediments were supplied from severe weathered sources with CIA values of 80-94. The Pliocene sediments show the CIA values of 72-90 suggesting the relatively weak weathering condition. Behavior of major and REE elements within paleosol profiles shows a marked loss of Na_2O without leaching of REE, which should inherit the composition of source rocks, in the middle Miocene. In the early Pliocene, eluviation of Na_2O are less reconstructing the weakly developed paleosols. The clay mineral composition of the middle Miocene sediments, additionally, shows higher kaolinite contents than that of the early Pliocene sediments.

The weathering condition in the middle Miocene to Pliocene in Japanese Islands may be affected by the influence of warm water current and initiation of the Eastern Asian monsoon. The middle Miocene period (10-11 Ma) is considered to have been under the intenser weathering condition than one in the early Pliocene period (3-4 Ma), which corresponds with the initiation of drying in Asian interior and the invasion of tropical sea water into the middle latitude in the northwest Pacific Ocean.

Keywords: chemical weathering , Middle Miocene-Early Pliocene, clay minerals, paleosol, geochemistry, fluvial sediments

