

The study on the paleosols in the Tokiguchi Porcelain Clay Formation at Hishiya Mine in Toki, central Japan.

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The Seto Group, which is known as fluvial deposits distributed in central Japan in Miocene-Pliocene period, is divided into two formations as the Tokiguchi Porcelain Clay and the Toki Sand and Gravel Formations in ascending order (Akamine, 1954). The Tokiguchi Porcelain Clay Formation was researched from a point of view of clay mineralogy to clarify the factor in clay formation process (e.g., Kitazaki and Araki, 1952; Nozawa, 1953; Tanemura, 1964; Fujii, 1967) and sedimentology to demonstrate the depositional environment of clay deposition (e.g., Nakayama, 1991; Saneyoshi et al., 2000; Nakajima et al., 2004). But no precedent to assess environment of clay deposition both by clay mineralogy and sedimentology. This study aims to reconstruct detailed environment from paleopedology and to analyze clay minerals assemblage using a x-ray diffractometer. In addition, the attendant objective of this study is to demonstrate weathering condition of the Tokiguchi Porcelain Clay Formation. For this purpose, the Hishiya Mine in Toki City, Gifu prefecture, was selected as a study area.

On the sedimentary facies analysis, 12 facies are divided in this formation. These facies include the depositional environments mainly in backswamp with minor channel incision. Besides, 10 paleosol horizons can be recognized in the backswamp deposits.

These paleosol horizons contain various pedogenic features, such as root traces, pedogenic concretions, ped structures and microfabric of clay minerals. These paleosols are considered to have been formed in three different parts in the backswamp environments as follows: 1) deposits characterized by few root fossils and lack of microfabric of clay, with gray - blue soil colors, indicating water-saturated condition, 2) deposits containing limonite concretion and mottling by oxidized iron with reddish brown color indicating better-drained condition, 3) deposits including many root fossils, pyrite nodules, remarkable microfabric such as illuviated clay in cavity, slickensides and ped structure indicating oscillation in hydrological condition.

Clay mineral analysis focused on <2.0 micrometer size fractions was performed using ethylene glycol treatment, heat treatment, hydrochloric acid treatment and potassium chloride treatment. As a result, the clay mineral assemblage is composed of kaolinite, Al-vermiculite and mica minerals. There are no significant variation in clay mineral assemblage of the backswamp deposits. It is possible that acidic condition was prevailed in soil from sedimentation to earliest diagenetic stage, because the backswamp deposits contain a large amount of organic material as coal horizons and root fossils. Kaolinite and Al-vermiculite are thought to have been crystallized by weathering on the acidic soil condition.

As a result, The Tokiguchi clay formation was deposited in backswamp environments along river system. The soil condition in backswamp deposits was affected by oscillated water table and an abundance of organic carbon material, which possibly contributed to the concentration and crystallization of clay minerals in the Tokiguchi Porcelain Clay Formation.

Keywords: Tokiguchi Porcelain Clay Formation, Depositional environment, Paleosols, Weathering, Clay mineral assemblage