

The paleosols and topography of sedimentary basin relationships in the upper Miocene Clay deposit, central Japan

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The Tokiguchi Porcelain Clay Formation is fluvial deposit distributed in central Japan in middle to late Miocene period. The sedimentary facies analyses were carried out in this formation. Those studies, however, were insufficient to reconstruct fluvial environment, because the fluvial deposit essentially have been bounded by short hiatuses due to sub-aerial erosion and paleo-surface formation. In this study, therefore, we focused on paleosols so as to reconstruct the weathering environment during the hiatuses. In general, paleosol formation in the fluvial sediments also depends on the supply of detritus and drainage conditions. Consequently it is very useful to research paleosol features for reconstruction of the topography in the small sedimentary basin where Tokiguchi Porcelain Clay Formation was deposited.

The clay-dominated sediments, which are interpreted to have been deposited in small sedimentary basin within a radius of 2 kilometers, were examined in two mines, Hishiya and Nakayama mines, across Toki and Tajimi Cities in Gifu Prefecture. The sediments in Hishiya mine shows the deposition in proximal area of the sedimentary basin, whereas those in Nakayama mine displays the facies formed in marginal area of the basin. On the sedimentary facies analysis, 13 facies are recognized in the formation. The sedimentary facies associations indicate the deposition mainly in backswamp environment with minor channel incision. Furthermore the coarse-grained sediments which were deposited as channel-bar and levee deposits intercalating debris flow deposits, with high accumulation rate, were particularly deposited in the marginal area of the basin. In contrast, the fine-grained sediments which were deposited with low accumulation rate in lakes and swamps, were particularly distributed in the proximal area of the basin. For this result, the fluvial system with lakes and swamps was developed near mountain slope side. In the whole are of the basin, approximately 20 paleosol horizons were founded in the lake and swamp deposits within a thickness of approximately 30 meters. In the proximal of the basin, these paleosol horizons range sparser. These paleosol horizons, with various pedogenic features, such as root with approximately 150 centimeters length and trunk traces with approximately 50 centimeters wide, pedogenic concretions, ped structures and microfabric of clay minerals, are formed thickly and developed clearly. In addition to, abundant siderite nodules covered with bright clay are present in lake deposit in the proximal area of the basin.

As a result the characteristics of the sedimentary facies could depend on the sedimentation rate depending on variation of the distance from the rim of the sedimentary basin. Besides the characteristics of the paleosol features could be affected by the drainage conditions due to morphological variation related to the location in the sedimentary basin. The characteristics of the sedimentary facies and paleosol features, however, suggest the large change of water level in the whole sedimentary basin. Concretely the redox condition had shifted from reductive condition in lakes or swamps to oxic condition in bushy grounds. The plausible cause for this change of redox condition in the sedimentary basin could be responsible for water-level change which was frequently occurred by damming of rivers formed from debris flow deposition.

Keywords: paleosols, Miocene, terrestrial environment, Tokiguchi Porcelain Clay Formation, sedimentary facies analysis