

The Geological Effect on Consolidation Characteristics of The Chuseki-so in Tokyo Lowland

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This study is intended to clarify the consolidation characteristics of Chuseki-so (Alluvial Deposits), and to examine the relation between formation process and cause of consolidation characteristics. To serve such purposes, carried out is the stress rate controlled loading triaxial consolidation test under K_0 conditions up to undrained shearing. The mechanical analysis of grain size distribution, XRD and microscopic observation were also carried out for representative samples.

The test samples were undisturbed core, which were obtained from Site GS-KM-1c, Komatsugawa area, Tokyo, where the Chuseki-so reaches 60 m thick, and is divided into the Yurakucho Formation above the Nanagochi Formation below 29 m from the ground level. The consolidation test samples from the Yurakucho Fm. were from at GL-3m, GL-9m, GL-16m and GL-25m, respectively, and from the Nanagochi Fm. were from at GL-29m, GL-36m, GL-38m and GL-53m, respectively.

The stress path accompanied with the consolidation process was examined. By integrating these results, the following conclusion and interpretation were obtained.

In the early stage of consolidation, the stress path marks characteristic phenomenon as follows:- the minimum peak of the stress ratio appears on the path. The stress ratio at the minimum peak indicates about 0.25 to 0.30, the axial strain, ϵ_{ax} nearly equal to 2%. The stress ratio begins to increase up to 0.45 to 0.50, with increment of axial strain and axial effective stress, and reaches precompression pressure. This phenomenon means the diagenetic effect by cementation. In the process of increment in stress ratio, the structure of cementation is broken, and the structure of soil (as a plastic material) becomes more dominant rather than the cementation structure. By the microscopic examination, such deformation characteristics depend on the linkage structures of soil, which are bonded by cementing materials.

The XRD analysis for mud samples suggests a peak of CaCO_3 (aragonite?), which may play the role of cementing material.

On the basis of these interpretations, and summarizing the previous geotechnical interpretation on over-consolidation, proposed is a new classification, which consists of three geological effects. These effects are aging effect, diagenetic effect and environmental evolution effect. Considering the mechanism of these geological effects, the consolidation status was examined. Once soil particles or peds (flocks) are deposited, they suffer geological effects, which change by environment, but the most emphasized effect or final effect eventually dominates in the soil characteristics.

All the samples indicate over-consolidation state. The cause of over-consolidation below GL-20m, in the Yurakucho Fm. was subject to the cementation by diagenetic effect, and that of delayed consolidation in the Nanagochi Fm. was subjected to the aging effect in the early stage and to the cementation in the secondary stage. These consolidation states are closely associated with evolution of sedimentary environment.

On the other hand, the shallower part of The Chuseki-so above GL-20m in the Yurakucho Fm. suffers land subsidence associated with squeeze by pumping groundwater after 1920, that is effect of artificial environment change.