AGING EFFECT ON MECHANICAL PROPERTIES OF ARGILLACEOUS SEDIMENTS

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Intrinsic change of physical properties in the early stages of the diagenesis was investigated for common argillaceous sediments. Many bulk density-depth relationships were collected from the drilling sites at different areas including some sedimentary basins and deep sea bottoms and compiled to examine the compaction process of sediments. A clear relationship was found to exist between the increasing ratio of bulk density with depth and the sedimentation rate. To elucidate the geological and geotechnical significance of this observed relationship, a simple equation was applied to the long-term compaction process. The result of theoretical analyses showed good agreement with the actual density-depth relation over a wide range of depth. The estimated value of secondary compression coefficient showing the aging rate is approximately 0.6 times the compression index. This characteristic value is also found to be valid for increasing stiffness and strength due to aging.

Some physicochemical and mechanical properties of a kaolin clay-water-electrolyte system were measured to understand the aging process during consolidation. The electrical conductivity in the pore fluid increased with time during primary consolidation, whereas it decreased with time during secondary compression. These changes in the dissolved ion concentrations can be interpreted as changes in soil structure that are consistent with corresponding changes in rigidity. A physicochemical model of the inter-particle bonding based upon the experimental studies was proposed in order to understand the mechanism of increasing stiffness and/or increasing strength under natural geological conditions.