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Characterization and petrophysical properties of hydrothemally altered lacustrine volcanistic rock in Geyser Valley (Kamchatka) and its transformation by weathering

Irina Gvozdeva, Oleg Zerkal, and Evgeny Samarin

Moscow State University, Geological Faculty, Department of Engineering and Ecological Geology, Moscow, Russian Federation (gvozdira@yandex.ru)

I.P. Gvozdeva, O.V. Zerkal, E.N. Samarin
(Department of Engineering and Ecological Geology, Geological Faculty,
Moscow State University, Moscow)
CHARACTERIZATION AND PETROPHYSICAL PROPERTIES OF HYDROTHERMALLY ALTERED LACUSTRINE VOLCANISTIC ROCK IN GEYSER VALLEY (KAMCHATKA) AND THEIR TRANSFORMATION BY WEATHERING

Work is devoted to the study of volcano sedimentary hydrothermally altered rocks in Geyser Valley (Kamchatka peninsula, Russia). The Geyser Valley is one of the most unique nature objects in Russia. There are quite large geyser fields. The valley of the river is part of the Uson-Geysernaya depression, where hydrothermal activity is very high. Besides geysers here are hot springs, mud pots and fumarols.
In the late Pleistocene (about 45-35 thousand years ago) the lake was located in the site of the modern valley of the Geysernaya river, where sediments accumulated intensively. Sedimentary material came from several sources in the form of pyroclastic flows, ash falls, was supplied by permanent and temporary water streams. The total deposit thickness reached several hundred meters. In the late Pleistocene there was breakthrough of reservoir and further conditions for the lacustrine deposits formation did not arose. Later the rocks were intensively processed by thermal water.
In 2007 large landslide was formed in lower part of the Geysernaya River on their left slope. Deposits of Geysernaya (Q34grn) series and Pemsovaya (Q34pmz) series were involved in landslide displacement. The headscarp was formed up to 100 m and a length of 800 m, exposing the volcano-sedimentary section of hydrothermally altered rocks - a unique opportunity for sampling and subsequent laboratory study. Thickness of lake sediments is interbedding of coarse-grain, medium-grain, fine-grain tuffites predominantly acidic composition.
The study of thin sections revealed that all samples are lithoclastic and vitroclastic hydrothermally altered tuffits. Currently, the primary minerals and volcanic glass is largely replaced by clay minerals of the smectite group. Pores and cracks are made zeolites (heulandite and clinoptilolite). All this points to the low-temperature (<200 ° C) hydrothermal conditions with a pH near neutral. Tyere are acid plagioclase and quartz in most samples The high content of smectite causes high hygroscopy of deposits. Rocks are highly porous - of 37-65%, primarily low density - 0,9-1,65 g/cm3 wave velocities - from 0.74 km/s for porous to 3.42 km/sec for dense varieties. All samples are characterized by low strength characteristics: uniaxial compressive strength - 1.2 - 21.7 MPa, uniaxial tension - 0,6-4,7 MPa. By water saturation strength decreases rapidly. Soft coefficient ranges from 0.22 to 0.57.
Proving to be on the land surface as a result of slope deformation, volcanic-sedimentary hydrothermally altered rocks are destroyed quickly by precipitation and temperature fluctuations Rock turned to sand, silt and clay depending on the original composition. It was found that often weathered to clayey state tuffites inherit structural and textural features of the primary species. The composition also varies: increased content of clay minerals (to 90%), decreasing the content of zeolites (not to exceed 10%). Quartz and plagioclase form sans fraction. Physical and mechanical properties vary widely: the density of the soil increases slightly up to 1,57-1,59 g/cm3 for sands, 1,2-1,79 g/cm3 for clays, porosity of 51-52% and 49-78% respectively, moisture 22-23% and 43-98/ Clays are in a state of semi-solid to fluid. The high content of smectite determines high plastic properties. Plasticity Index varies widely from 11 to 57. Cohesion and the internal friction angle obtained from shear tests also change widely. For clayey sand grip reaches 137 kPa, internal friction angle - 17 degrees. In clay grip ranges from 13 kPa to 120 kPa, and the internal friction angle - from 11 degrees to 31 degrees.
Large variation of properties of the investigated soils is explained by the inhomogeneity of volcano-sedimentary formations both vertically and laterally, varying degrees of hydrothermal alteration and of weathering, fracturing

and cracks filling
The obtained datas can adequately characterize the volcanic-lacustrine sediments in the valley of the Geysernaya river and use them in calculations of slope stability and for and geological mapping.