

The volume expansion of pyroclastic rocks by the crystal growth of Halloysite at the Higashidoori

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We find the ground deformation by volume expansion of pyroclastic rocks at the Higashidoori Nuclear power station site. The Tomari formation is strongly altered by light brown colored weathering with halloysite crystallization. The Tomari formation mainly consists of lapilli tuff including andesitic lava. The Gamanosawa formation is laid on the Tomari formation consists of alternated sandstone, mudstone, conglomerate and tuff layers. These stratum are covered by the middle terraces deposit including the Toya tephra: 110 ka and Towada red tephra: 80 ka. Towada red tephra in the middle terrace deposit is not deformed on this site.

The convex deformation is formed absorbing the water of montmollironite in fault zone (clay rich zone). Strongly weathered surface rocks of the Tomari and Gamanosawa formation are also deformed toward upper parts around fault zone. This deformation is also formed regardless of fault zone.

Montmollironite distributes at the deeper area (the Tomari formation) which consists of weakly weathered rocks. Halloysite crystallized from montmollironite at shallow area. Plagioclase disappears with the crystallization of halloysite by XRD results. Halloysite which formed tube shapes covered the all over the materials are changed the shape to aggregation of fan shapes by SEM observation. Halloysite crystals increases a distance of the space between minerals under the micro scopic observation.

To assume that Ti is immobile elements with weathering in the rock, the volume of weathered rocks (lapilli tuff: the Tomari formation) increases in 1.3 to 1.5 times to compare with fresh rocks.

Montmollironite crystallizes the surface of minerals at first. After crystallization of montmollironite, halloysite crystallizes on the montmollironite to be affected by weathering at shallow depth.

Crystal growth of halloysite causes the volume expansion of rock and the deformation of ground surface. The old faults plane and joints slip as the appearance reverse faults by crystal growth at this site.

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