

Activity of mud volcano and its significance to applied earth sciences

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Mud volcano is a small mount composed of erupted mud that is originated from deep underground, distributing widely in offshore and onshore in the tectonically active area and is discussed about the relationship to the gas hydrate formation (Mirkov, 2000).

We discuss about onshore mud volcano with regard to the significance to applied earth sciences.

Excavation of underground construction:

The Nabetachiyama Tunnel that was excavated in Tertiary sedimentary rocks in Tokamachi City, Niigata Prefecture met the serious trouble caused by swelling of rock mass. It took about 20 years to complete the excavation of only 645 m interval.

As a result of geological, topographic and geophysical investigation, it was revealed that geological and topographic depression structures are recognized on the surface of the earth above the tunnel troubled zone and 3 mud volcanoes are distributed in and/or around the depression. Also, mud breccia composed of scaly mud filled with pressurized saline groundwater is distributed under the topographic depression (Tanaka et al. 2007). Mud breccia that is possibly caused by hydro-fracturing by abnormal pore water pressure is thought to be one of the reasons for swelling rock mass.

Long-term stability of underground construction:

Activity of mud volcano is seriously destructive such as the recent activity of the mud volcano at the Sidoarjo area, Indonesia last year. Also, the conduit of mud volcano is generally composed of mud breccia (Barber et al.,1986;Chigira & Tanaka, 1997;Miyake & Miyata,2003; Hamada et al.,2007) which is composed of severely fractured mudstone and scaly clay and thought to be formed by hydro-fracturing. Hence, it is supposed that the fracturing process is destructive and underground construction is destructed by the intrusion of conduit.

Slope stability:

Upward groundwater flow is caused by abnormal pore water pressure generated in deep underground. When a pressurized groundwater called geo-pressure (Ohki et al.,1992) penetrates through the fractures from deep underground, pore water pressure of landslide increase and become easy to move (Furuya et al.,2005; Ishihara et al.,2006).

Also, when sedimentary rock filled with saline pore water originated from deep underground comes in touch with fresh water, it is slaked and weakened rapidly due to the dispersion of clay minerals (Nakata et al.,2004) causing the landslide activity.

Regional groundwater flow:

Generally, groundwater flows controlled by the hydraulic potential which is consistent with topographic profile. However, groundwater that stays in deep underground for a long time is occasionally flows upward by abnormal pore water pressure through fractures and anticline independent of topographic profiles and erupts to ground surface at mud volcano.

It is thought that pressurized groundwater caused by abnormal pore water pressure is distributed widely in deep underground (Miyakawa et al.,2007). The upward flow of groundwater from deep underground causes the serious problem about the radionuclide migration from the radioactive waste disposal facility to biosphere.

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