DEEP GROUNDWATER HYDROLOGY IN THE BOGALA GRAPHITE MINE

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Abstract

Sri Lanka has a very good reputation for its high grade quality graphite. Thousands of pits and mines, which had operated before the Second World War, were mainly situated in the wet zone of the country. Although most of these mines and pits have been abandoned today due to problem of ground water, Bogala and Kahatagaha are still in operation as they utilize advanced mining techniques. Bogala Graphite Mine which has penetrated into hard rock more than 400 m below ground level, discharges about a million gallons of fresh water daily incurring about 15 percent of its mining cost. The mineralization of Bogala comprises several veins of graphite and large veins of syenite pegmatite. These larger veins are known as Na, Mee and Kumbuk. Today most of mining activities are carried out on these veins below 200m from earth surface.

Three main rock types are observed at Bogala area. They are Garnet Boitite Sillimanite Granitic Gneiss, Charnockitic Gneiss and Quartzite. Most of major mineralized and unmineralized fault structures in the area are running with these rock types forming different fracture intensities in each rock. It is noticed that the high fracture intensities are in Quartzite and Garnet Boitite Sillimanite Granitic Gneiss rocks with comparison to the Charnockitic Gneiss. In addition, miner joint patterns are also perceived and some of them have same characteristics of major faults. Most of major faults and joints in the area

are interconnected. Weathered profile in Bogala area is rather high in Garnet Boitite Sillimanite Granitic Gneiss than other two rocks type. However average thickness of the weathered layer in the area is lower with compare to other areas of the country. Furthermore solution channels are seen in Mable bands in the area. The degree of weathering is comparatively high at mineralized (graphite) fractures and, associated rock walls at shallow levels.

The rainfall is main recharging factor in Bogala area. It is observed that considerable capacity of surface water that reaches subsurface levels after percolating though the soil layer and flowing though mineralized and unmineralized fractures, weathered rock of vein zones, and solution channels developed by dissolution of Marble. As a result of this, around one millions gallons of ground water is pumped out from the mine daily.

The productivity of the hard rock aquifers is determined by factors such as intensity, connectivity, extension, opening, infilling of fractures, degree of weathering and character of weathering products. In Bogala mine these hydrogeologic factors are gradually decreased with depth. However, it is observed that considerable quantity of ground water accumulate in the deepest level of the mine. How could it be happened? It is due to water draining from shallow level (above 100m depth) to deepest zones of mine through tens of abandoned and functioning Winzes (accesses from lower to upper levels of graphite veins), old ore blocks(after graphite extraction; filled with rocks dump) and tunnels. Therefore it may conclude that major fractions of ground water in Bogala mine probably comes from hard rock aquifers occurred above 130 m depth.