Paper B19

Electrical Resistivity Imaging to characterize weathered basalt and granite

AHMAD TAJUDDIN HJ. IBRAHIM & CHE NOORLIZA LAT

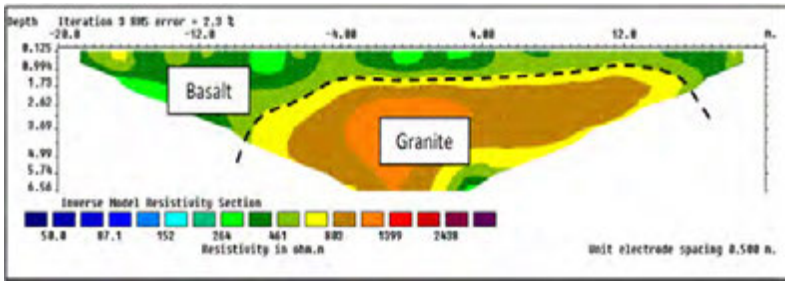
Department of Geology, University of Malaya, 50603 Kuala Lumpur
Email Address: ahmadt@um.edu.my

This electrical resistivity imaging project was carried out in the Kuantan, Pahang area where there are abundant exposures of basalt and granite of weathering grades IV (severely weathered) to VI (residual soil). Four profiles, measuring 40 to 80 meters long, were taken at 1 and 2 m spacing, respectively. Grain size analysis was done on the soil samples taken at the sites. The soil samples were further tested for resistivity and moisture content. Electrical resisitivity is said to vary with grain size distribution and water content, and is in turn related to the soil strength.

It was observed that basalt and granite gave different range of readings. The resistivity range for weathered basalt is about 300 to 800 Ωm while for granite, it is between 800 to 4000 Ωm. The range indicates the difference in the amount of weathering the rocks had been through, along with other factors such as amount of moisture available.

Grain size analysis showed that the soils originated from basalt had more finer grain materials than that of granite. As expected, soil resistivity was found to be inversely correlated to soil moisture content; the higher the moisture content, the lower the resistivity. For this test, we start with dried samples, then increased the moisture content until the resistivity reading shows little or no variation. The resistivity-moisture content curves for granitic soils displayed a slower decay covering a larger range of values compared to basalt of similar moisture content. The range of resistivity are 100 to 6000 Ωm for granitic soil and 80 – 1000 Ωm for basaltic soils. The presence of clay and higher percentage of ferromagnesium minerals in basaltic soil contributed to the lower resistivity readings.

This study shows the effectiveness of this method in identifying not only the type of rocks in the subsurface (granite or basalt) but also the varying degrees of weathering within the rocks. The lab results are in tandem with the field results, showing basalt as having lower resistivity values. Dried soil samples give higher resistivity values as compared to the ones obtained in-situ because of the the highly resistive air filling the spaces in between the unconsolidated grains. Resistive zones are associated with higher strength; thus integrating these results with geotechnical information makes this method an invaluable tool in site investigation. This study illustrates that subsurface geology of the area can be studied using this efficient, economical and time-saving method reducing the reliance on invasive and expensive alternatives such as drilling.



Warta Geologi (Newsletter of the Geological Society of Malaysia), Vol. 36, No. 2, April-June 2010