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Lithology Identification Using Electrical Resistivity Tomography Case Study: OAL's Construction Site

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Observatory Astronomy Lampung construction site is located at Mountain Betung, North – West of Lampung City. From geomorphology investigation, Mount Betung landscaped classified as volcanic mountain with pyroclastic flow mountaincharacteristics. Geological setting of this area showed those dominant lithology is pyroclastic, including andesite and breccia rocks. These feature correlate with our investigation around OAL construction site. We applied electrical resistivity tomography to investigate subsurface soil electrical properties. The result indicated that there are two different lithology, high resistivity in the top soil and low resistivity below. High resistivity suspected as pyroclastic deposit with a lot of volcanic rocks fragment, whereas the low resistivity suspect as volcanic deposit with high – saturated water, which indicated as clay.

Keywords: *Electrical Resistivity Tomography, Landslide, OAL, and Mt. Betung.*

1. INTRODUCTION

An astronomy laboratory namely Astronomy Observatorium of Lampung (OAL) is set up under the cooperation between ITERA, ITB, and Lampung Governments. It will be constructed on Mt. Betung, located in the North-West of Lampung city around Pesawaran district with an elevation of 1.240 mdpl to 1640 mdpl. Meanwhile, OAIL will be placed at the South – West from the top of Mt. Betung with the elevation around 1.000 m. It will be one of the largest astronomy laboratories in Indonesia. Mt. Betung is categorized as a pyroclastic flow, as we have been investigated in outcrop along the way to OAL site and found pyroclastic deposit which is a dominant rock surrounding the area. These pyroclastic deposits have a lot of volcanic rocks fragment. In this research, we investigated the lithology at Mt. Betung especially at OAL's construction site using high resolution 2D of electrical resistivity tomography (ERT). These methods play important role in order to provide information of soil's electrical properties distributed with the depth.

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Electrical properties of soils and rock are mainly dependent on water content, which crucially influences slope stability [1]. From the electrical properties, we could investigate lithology and determine potential landslide in the area [2, 3]. The aims of this study to understand lithology of OAL's construction site and to contribute in hazard analysis for OAL's building.

2. METHODOLOGY

2.1 Data and Location

The construction site was placed between two valleys. The acquisition of electrical resistivity tomography is located at the valley of OAL's construction site. The line of ERT acquisition was chosen by considering slope with the length of 180 m in SE – NW direction. The intervals between electrodes are 6 meters. This line is in the left side construction area with a slope around 22 to 50 degrees and with elevation around 904 to 920 mdpl. We implemented a dipole – dipole electrode configuration to delineate the distribution of electrical properties in the subsurface.

The acquisition conducted at the dry season and the condition of the top soil was dry.

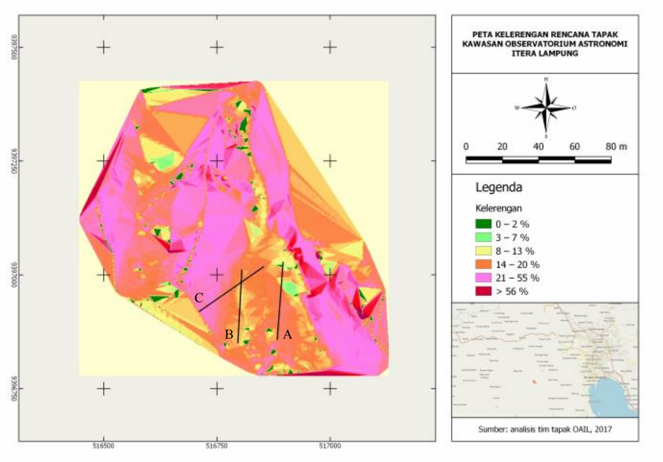

Figure 1. The location of OAL construction in Mt. Betung, the black line indicated as geo – electrical line acquisition with length 180 m.

Along the way to the construction site, we found fresh outcrop identified as volcanic breccia (see Figure 2). Meanwhile, at construction site, we identified as pyroclastic with a lot of volcanic rocks fragment (see Figure 3).

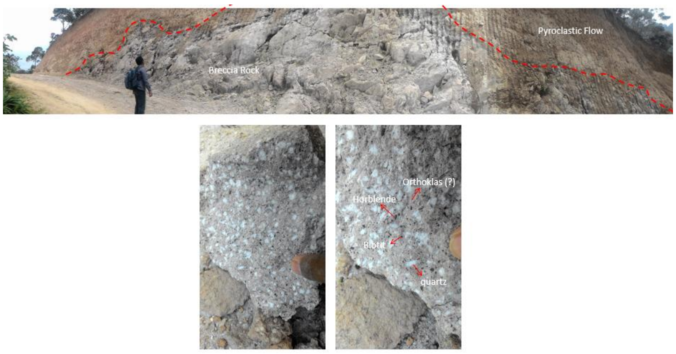

Figure 2. Outcrop pyroclastic flow and breccia volcanic rocks. The red line is boundary of pyroclastic deposits.

Figure 3. Outcrop pyroclastic flow with volcanic rock fragments.

2.2 Electrical Tomography Resistivity Method

The ERT method is one of geophysics method to investigate subsurface electrical properties by injecting a electric current directly to the subsurface and recording the responds in the surface. Generally, the ERT method implements ohm's law, where the resistance depends on resistivity properties and geometry factor of the material. Geometry factor is a configuration of the current and voltage electrodes during the acquisition.

3. RESULT AND DISCUSSION

In this study, we use electrical resistivity tomography method with length around 180 m, interval between electrodes 6 m. There are three line acquisition, line A (Figure 4.) and line B (Figure 5.) in direction North – South meanwhile line C NE – SW (see Figure 6). From the result in line A and line B, we identified two layers that have contrast resistivity value, high resistivity in top soil and moderate resistivity in below the top soil. High resistivity (> 1000 Ωm) is indicated as low saturated water and impermeable. These high resistivity is suspected as pyroclastic deposit with volcanic rock fragments, meanwhile medium resistivity (140 Ωm < ρ < 1000 Ωm) is categorized as tuff.

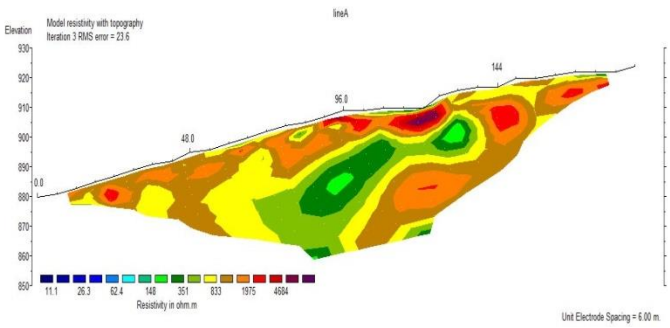

Figure 4. Electrical resistivity tomography at line A.

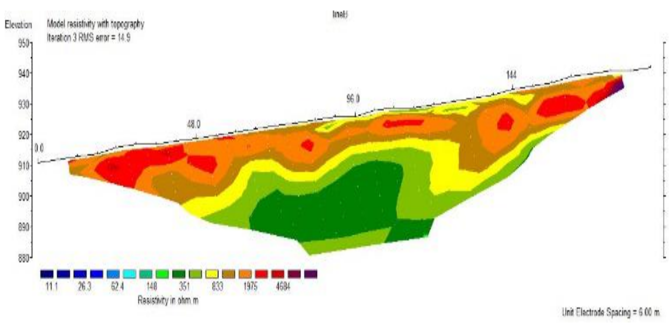

Figure 5. Electrical resistivity tomography at line B.

However, in line C (Figure 6.), we found different resistivity anomaly with line A and B. We found high contrast between low resistivity and high resistivity. Low resistivity indicates soil with high saturated water, suspected as clay. The low resistivity is correlated with west of survey line where we found small river and seepage around the surface.

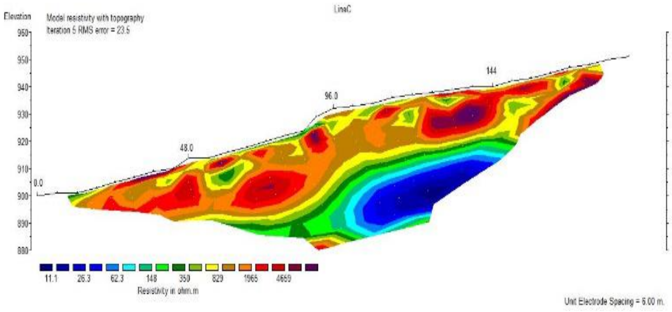

Figure 5. Electrical resistivity tomography at line C.

4. CONCLUSION

Electrical resistivity tomography is successful in identifying lithology around OAL's construction site. We found the three different lithologies, first high resistivity indicated as pyroclastic deposits with volcanic rocks fragment, moderate resistivity as tuff and low resistivity as clay. This interpretation is suitable with geological survey, in the western part of line C where we found river and seepage on the surface. Meanwhile, in the southern part of line A and B, we did not find the river. So, in the west of construction site has high potential landslide hazard than in the south. It also can be seen from topography and the slope.

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