Survey on potential of geothermal in Lompobattang Mountains South Sulawesi by resistivity method

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Abstract. This research was conducted in Mt. Lompobattang, Pabumbungan Village, District of Ere Merasa, Bantaeng Regency, South Sulawesi using resistivity geolectric methods. The aim of this study was to determine the subsurface structure of the study area as a first step in the survey to detect geothermal potential (geothermal). Data acquisition was done by using a set of single-channel resistivity meters and in processing data using Res2DINV software to get a 2D cross-section. The measurement shows 3 lines. Based on the measurements show that the subsurface conditions in the study area there are types of rocks in the form of lava, breccia and aquifer, the resistivity value at the study site ranges from 10.8 - 1825 Ωm. With the detection of the lava layer, it can be said that there is a geothermal potential in the area.

1. Introduction
Geothermal is a renewable energy resource that is environmentally friendly (clean energy) compared to fossil energy sources. In the process of exploration and exploitation, it does not require too much surface land. Geothermal energy is not exportable, so it is suitable for meeting domestic energy needs. Indonesia has a huge geothermal potential because it is one of the countries that is crossed by the ring of fire. Currently, Indonesia ranks second largest in the capacity of Geothermal Power Plants (PLTP), beating the Philippines and the United States still ranks first in the world. Geothermal has great potential in developing low carbon energy systems in developing countries. The ability of geothermal to provide stable electricity at affordable costs makes it the right choice of energy source to replace fossil fuels in providing baseload power (operating continuously unless there are scheduled outages and damage) and to sustain electricity supply from renewable energy sources others tend to fluctuate [1]. Areas that have the potential for hot springs are usually located in volcanic or former volcanic areas. Pabumbungan Village, Bantaeng Regency is a district located at the foot of Mount Lompobattang which was once an active volcano, but currently it does not show volcanological activity. This work intends to see via an initial survey in determining the geothermal potential at that location. The preliminary survey used to determine the geothermal potential is using the resistivity geoelectric method.

2. Geophysical method in geothermal exploration
The resistivity method is one of the geo electric methods used to investigate subsurface structures based on differences in rock resistivity [2,3]. The basis of the resistivity method is the Ohm law by
flowing current into the earth through a current electrode and measuring its potential at the surface of the earth using potential electrodes [4].

The resistivity method is one of the active geoelectric methods where the required energy is obtained from the injection of currents into the earth. This method aims to identify mineral deposits, geothermal, coal and groundwater aquifer search [5].

The resistivity or resistance of a material is a quantity or parameter that indicates the level of resistance to an electric current. Material which has a greater resistivity or resistivity value, means it is increasingly difficult to pass by an electric current [6]. The value of the resistance is described as resistivity with Ohm meters. And the magnitude of this type of resistance is the amount that is the main target in geo electric measurements.

| Rock type | Resistivity Range (Ωm) |
|-----------|-----------------------|
| Lava      | $10^2 - 5 \times 10^4$ |
| Breksi    | 75 – 200               |
| Andesit   | $4.5 \times 10^4$ (Wet) |
|           | $1.7 \times 10^2$ (dry) |
| Tufa      | $2 \times 103$ (Wet)   |
|           | $3 \times 106$ (Dry)   |
| Basal     | 10 – $1.3 \times 107$  |

(Source: Tellford et al, [4])

3. Method
The type of research conducted is direct measurement in the field using the resistivity geo electric method. Data retrieval process is done by mapping the Wenner configuration. The mapping is used to determine the horizontal distribution of rock resistance. Data is collected by using a Single Chanel Resistivity meter. Measurements were made on 3 lines with lengths of 120 meters and 105 meters respectively. The data analysis process was carried out using the Res2DINV application to obtain a 2D cross section and subsurface resistivity values. Then the process of data interpretation is done by adjusting the geological conditions at the study site and the Telford table [4].

4. Results and Discussion
In this research has three tracks or lines. On the first track there are three types of resistivity values, namely, the first with a resistivity value between $422 - 10587\ \Omega m$ with a thickness of about 4 - 11.5 meters, at a depth of 1.25-12.4 meters which is predicted to be a Lava layer. The second layer has a resistivity value of 97.4 $\Omega m$ - 203 $\Omega m$ with a thickness ranging from 6 meters at a depth of 3.75 meters to 15.9 meters which is a type of breccia layer. The last layer is Aquifer with resistivity value of $10.8 - 46.8\ \Omega m$ at a depth of 9 meters and at a stretch of 40 meters to 70 meters.

The second track have three layers. In the first layer, the Lava layer with resistivity values around $1015\ \Omega m - 10587\ \Omega m$ with thicknesses ranging from 2-20 meters at depths of 2 - 24 meters. The second layer with resistivity values between 97.4 $\mu m$ to 314 $\Omega m$ at a depth of about 6 meters is predicted to be a breccia layer. The third layer with a resistivity value between 2.89 $\Omega m$ to 30.2 $\Omega m$ at a depth of 7 meters and at a stretch of the track 60 meters to infinity is an aquifer layer.

In the third track has resistivity values that are almost the same as lane 1 and 2, there are three resistivity values. The first layer is Lava with resistivity values ranging from $351 - 3473\ \Omega m$ with thicknesses ranging from 2-10 meters at a depth of 14 meters. The second layer is in the form of breccias with resistivity values ranging from $35.4 - 111\ \Omega m$ with a thickness of 2 meters to infinity at
a depth of 6 meters. The third layer is Aquifer with a resistivity value of 1.14 - 11.2 Ωm at a depth of 8 meters and on a 10-65 meter stretch.

Based on the geological map of the study area, there are lava rocks, breccias, conglomerates, lava deposits and tuffs which also show a picture that is almost the same as the results of the interpretation of the resistivity geoelectric method. Although the discovery of constituent rocks in the form of breccia is sometimes also found in volcanic rock formations in the Gorontalo region, but it is not yet a conclusion of geothermal potential. This research will continue with various other geophysical methods and geological and geochemical methods (mineral testing using XRF and XRD methods).

![Image](image.png)

**Figure 1.** (a) Track 1, (b) Track 2 and (c) Track 3

5. **Conclusion**

Based on the results of the discussion described above, it can be concluded that the subsurface conditions in the study area contained rock types such as lava, breccia and aquifer. Resistivity values
at the study site ranged from 10.8 – 1825 Ωm. With the detection of the lava layer, it can be said that there is a geothermal potential in the area.

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