MERCURY AND SOIL CARBON DIOXIDE ANALYSIS TO DETERMINE GEOTHERMAL POTENTIAL IN MT. TELOMOYO, CENTRAL JAVA. INDONESIA

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SUMMARY

Mercury and soil carbon dioxide are two of many elements that can be used to determine geothermal source potential. The simple concept is that these elements are commonly present in geothermal fluids and usually reside on rocks or soil along its migration path while going onto the surface through porosities. The research is located at Mt.Telomoyo, Central Java Province, located approximately 400 kilometers east-southeast of Jakarta. Around the mountain, four hot springs and four cold springs were found, as well as 144 soil samples. This study aims to determine the geothermal source by using soil geochemical analysis which uses mercury and carbon dioxide as analysed elements. Methods of mercury and carbon dioxide analysis were also aided by Fault-and-Fracture analysis in the study area. The anomaly map of both elements and the fracture density shows anomalies in the same location thas is at the north side of Mt. Telomoyo. This anomaly zone is indicated as a geothermal prospect area in the study area.

Key words: Mercury Analysis, Soil Carbon Dioxide, Soil Geochemistry, FFD, Mt. Telomoyo

INTRODUCTION

Mount Telomoyo is a volcano that is no longer active since quarter period. This mountain has a height of 1,894 m above sea level and is a strato-shaped volcano but has never recorded erupted. This mountain is flanked by Mount Merbabu, Mount Andong, Mount Sumbing, and Mount Ungaran. Mount Telomoyo appears to the south of this depression as high as 600 m from the base of the basin. In this area, there are other volcanoes older than it namely Kendapi Volcano and Gilipetung Volcano (Ramadhan, et al, 2014).

Previous research conducted by Pertamina from 1988-1993 in the form of geological, geochemical, geophysical data collection and gradient thermal temperature data. In 2010 Indonesian Geological Resource Center (PSDG) has conducted an integrated survey of geology and geochemistry as well as magnetotelluric survey in this area. The results of previous research shows that this geothermal area Telomoyo has excellent geothermal potential to be developed. As for the purpose of this research is to know the prospect zones of Telomoyo geothermal mainly using mercury and carbondioxide analysis in study area soil samples.

Figure 1: Mt. Telomoyo and its surrounding. The mountain itself marked with red marker, approx. 400 kilometers from Jakarta, capital city of Indonesia. (Google Maps)

METHOD

Mercury and soil carbondioxide anomalous distribution maps were used and map of fracture density anomaly which later compiled to see potential of geothermal prospect area of research area. Both anomalies map will also be compiled with Fault-and-Fracture Density (FFD) map. Those three maps will result an overlayed area that shows the highest potential of geothermal at Mt. Telomoyo.

RESULTS

Fault-and-Fracture Density Map

Four azimuths of illumination used to extract all of lineaments in research area i.e. 0°, 45°, 90°, and 315°. All of lineaments compiled into one map and the research area converted into grids. The lineaments converted into a map based on the length of lineaments in each grid. The resulted map shows even distribution of lineament density in the research area. As for the highest density of lineament are located around Mt. Telomoyo itself, at the northern side of the mount for the exact. High density of lineament showed with orange to red zones.

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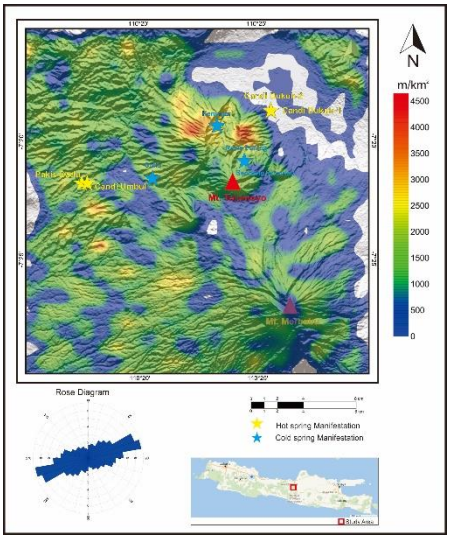

Figure 2: Fault and Fracture Density Map as The Result of Fault and Fracture Density Analysis

Mercury Anomaly Map

The mercury anomaly distribution map is used to determine the geothermal potential area. Mercury consentration in soil influenced by atmospheric parameter. Most soils retain mercury by formation of chelates, by absorption on clays, or by ion exchange. Soil characteristics like pH, clay content and organic content influence the Hg distribution in soils, but geothermal activity introduces Hg in sufficient amounts to overwhelm local background variations (Varekamp and Buseck, 1983). The distribution map of mercury anomaly is made from ploting mercury content value of soil samples. Based on the mercury anomaly distribution map it was found that mercury anomaly was at the northern side of Mt. Telomoyo showed as yellow to red color.

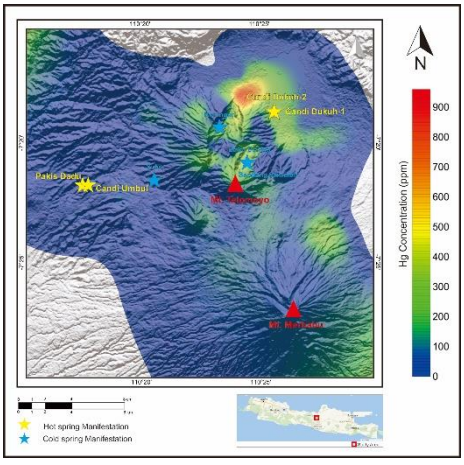

Figure 3: Mercury Distribution Map on Research Area

CO^2 Anomaly Map

The carbondioxide anomaly distribution map is also used to determine the geothermal potential area. Volcanoes release gases also on their flanks by diffuse degassing of gaseous species such as carbon dioxide (CO^2). Whereas the high-temperature gases in craters tend to be reactive, CO^2 does not react with country rocks. The distributions and quantities of the gases provides information on the overall permeability of a volcanic edifice, the potential for lateral degassing from areas other than the active crater and the ability of a volcano to diffusely release large quantities of CO^2 and the other gases (Malimo, 2012).

The resulted map of CO^2 distribution shows an evenly distributed CO^2 gas in research area based on the soil samples. The CO2 anomalies were found near Candi Dukuh hotspring at the northern side of Mt. Telomoyo, and Candi Umbul hotspring which located at western side of the mount.

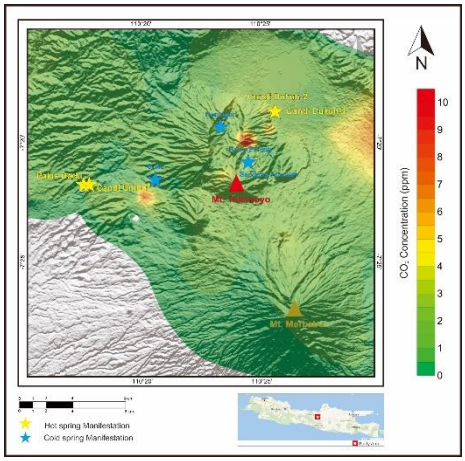

Figure 4: CO^2 Distribution Map on Research Area

CONCLUSIONS

The result of this study shows that the geothermal prospect zone in the Bayah region is located at the northern side of Mt. Telomoyo. This conclusion resulted from compiling each resulted maps above and interpret the zone that shows positive geothermal occurences of each maps i.e. Fault and Fracture Density, mercury anomaly, and CO^2 anomaly.

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