



# APPLICATION OF LINEAMENT DENSITY AND GRAVITY METHODS TO DETECTING FRACTURE AND FAULT LANE IN THE TAMPUSU VOLCANIC FIELD (NORTH SULAWESI, INDONESIA)

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## Abstract

Tampusu Mountain ( $\pm 1500$  m above sea level) is located between two famous geological tourism areas in North Sulawesi, namely Lake Linow and Lake Tondano. The position of Mount Tampusu, as well as the presence of geothermal manifestations in the surrounding area is interesting to study its geological aspects both on the surface and below the surface. This study aims to determine the existence of surface geological structures based on line density, and also to determine the presence and direction of subsurface geological structures based on gravity anomaly data in Tampusu Volcanic area. The fault and fracture density method is used to map the surface geological structure, while the gravity method is used to obtain information about the geological structure of the Tampusu volcanic area between the crater of Lake Linow and the Lake Tondano caldera. The existence of a fault is known to be west of the Lake Tondano caldera which is an extension from east to southeast of the Linow Lake crater. There is a relationship between the distribution map of the bouguer anomaly value and the map of lineament density along the Lake Linow crater to Lake Tondano caldera.

## Research Highlights

The geological structure of the surface covered by geothermal manifestations is difficult to know existed. This can be overcome by identifying the surface structure density of its through the mapping of lineament density. The results of the lineament density mapping show that the high lineament density in the east to southeast Lake Linow, and in the west area of Lake Tondano. Areas with high lineament density are discharge areas as a place where geothermal manifestations emerge.

The presence and direction of subsurface geological structures are important to know because will be provide information and recommendations on the development direction of geothermal energy exploration, especially in North Sulawesi.





## Research Objectives

This study aims to determine the existence of surface geological structures based on lineament density, and also to determine the presence and direction of subsurface geological structures based on gravity anomaly data in Tampusu Volcanic field.

## Methodology

The fracture and fracture density methods are used to map surface geological structures, while the gravity method is used to obtain information about the subsurface geological structure of the Tampusu volcanic field located between Lake Linow crater and Lake Tondano caldera.

## Results

The results of the lineament density mapping show that the high lineament density in the east to southeast Lake Linow, and in the west area of Lake Tondano. Areas with high lineament density are discharge areas as a place where geothermal manifestations emerge.

Subsurface geology shows that the area with high bouguer anomaly values is east of Lake Tondano, while for areas with low to moderate bouguer anomaly values are in the southeast part of Lake Linow. The variation in anomaly values is caused by differences in the density of rocks scattered in the surrounding area, and between the Lake Tondano caldera and the Lake Linow crater. The higher the value of rock density, the higher the bouguer and free air anomaly values that are owned by the area. Conversely, the lower the value of rock density in the area, the lower the bouguer and free air anomaly values. In addition, variations in the value of bouguer anomalies and free air are also influenced by differences in topography in the Tampusu and surrounding areas, where there are highland and lowland areas. Areas that are highlands, tend to have a bouguer anomaly and free air values greater than lowland areas.

## Findings

The surface geological structure is in the east to southeast of Lake Linow and the western part of Lake Tondano. The existence of a fault is known to extend from the east to the southeast of Lake Linow crater to the western part of the Lake Tondano caldera. There is a relationship





between the bouguer anomaly value distribution map and the lineament density map at the Tampusu volcanic field. The development trend of geothermal energy exploration extends from northwest of Lake Linow to the southeast of Lake Tondano.

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#### *Author's Biography*



**Cyrke A. N. Bujung**, the third of four children. Born in Tomohon Indonesia, March 15, 1964. Attended elementary school in 1970-1975. Continue to junior high school in 1976-1979. Completion of high school education in 1982. Then I studied at IKIP Manado college in 1982-1986. In 1987 I was appointed as a teaching staff at IKIP Manado (now Manado State University). Married in 1989 and blessed with 2 daughters. In 1993-1995 I studied S2 at UGM Yogyakarta, and in 2007-2011 attended S3 education at UNPAD Bandung. Right now I am still an active lecturer and researcher at Manado State University.