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Analysis of Clay Silt Reserve Using Geoelectricity in the Village of Dulohupa District of Gorontalo

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Abstract

This research aims to investigate clay silt reserve in brick farmer area. This research applies geoelectricity by using Schlumberger configuration conducted by doing injection of electric current with low frequency to surface of earth. Value of resistance will bring information about structure and materials across by it.

Research site is in four stations and based on the geographical location in the station I at coordinate N 00 ˚35'43.7 ", E 123 ˚ 03'41.6" directed to east west, station 2 in coordinate N 00 ˚ 35'43.8 ", E 123 º 03'41.4 "directed to north south, station 3 in coordinate N 00 ˚ 35'42.4", E 123 ˚ 03'41.5 "directed to north south and station 4 in coordinate N 00 ˚ 35'45.4", E 123 ˚ 03 '42 .1 "directed to south north. Research finding reveals that depth or density of clay silt ie in S1 is 8 m, in S2 is 2.5 m, in S3 is 7 m while in S4 is 8,5 m. Density in S2 is the thinnest is the river thinnest gravel and sand are found there. Then, based on the four points after straight line is drawn, it shapes geometry which makes the volume of clay silt reserve can be calculated. And based on finding of measurement and calculation, it obtains volume of clay silt reserve in the village of Dulohupa for 15000 m3.

***Keywords**: Geoelectricity, Schlumberger, Silt, Clay*

1. Preliminary

Information that the surface is one important component in doing activities related to the earth. This information includes geological structures, lipata, fractures, fractures, rock types and properties, rock formations below the surface, depth, thickness, and distribution (Lubis *et al.,* 2017; Lubis and Wenang, 2017). One way to be able to know the condition below ground level is to conduct geophysical measurement by geo-electric method (Nartyanto, 2008)

Geo-electric is one method of measuring resistivity value that studies the nature of electric current in the earth, by injecting the electric current into the earth, by measuring the potential difference and the current that occurs and associated with the type of electrode configuration used ultimately obtained the resistivity value of rock layers below surface (Wahid, 2007).

Geo-electric is one of the geophysical methods to know the change of resistance of rock layer type under the surface of the soil by passing a DC current (Direct Current) that has high voltage into the ground. This electric current injection uses 2 A and B current electrodes that are plugged into the ground at a certain distance. The longer the electrode distance AB will cause the flow of electric current can penetrate the deeper layers of rock. With the flow of electric current it will cause electrical voltage in the ground. The voltage that occurs at ground level using a multimeter measured connected through two pieces of "electrode voltage" M and N are the distance is shorter than the electrode distance AB.

Method appliance geo-electric resistivity (Schlumberger method). The resistivity method is basically a measurement of the resistivity price (resistance type) rock. The working principle of this method is to inject the current down the earth's surface so that the potential difference is obtained, which then will get information about the resistance of rock types. This can be done using four in-line electrodes, one of two different charge electrodes used to drain the current into the ground, and two other electrodes are used to measure the voltage generated by the current flow, so that the subsurface resistivity can be known. Rock resistivity is a function of electrode configuration and electrical parameters of rocks. Flow that flowed in the ground can be a direct current (DC) or alternating current (AC) low frequency. To avoid spontaneous potential, the polarization effect and avoid the effect of soil capacitance ie the tendency of soil to store the charge is usually used low frequency alternating current (Bhattacharya and Patra, 1968 in Rohim, 2010).

Lanau is a material that is a transition between clay and fine sand. Less *plastic* and more permeable than clay and water show dilatant properties that are not on clay. Dilatant is a trait that showed symptoms of silt content changes if it changed its shape. To declare the properties and classification of land use trial Atterberg limits. From this experiment can be known the plastic limit and liquid limit, which gives better clues about the properties of silt and clay. When it is clear that certain grains of soil are entirely finer than 0.06 mm then there is no need to further measure the size of the granules, to determine whether the soil is silt or clay. It is determined on the basis of experimental results *Atterberg limits.*

The difference in terms between "silt" and "silt fraction" is important to know. Clay is the term used to express the fine-grained soil that has a *cohesive* properties, *plasticity,* not show dilatant properties and do not contain any significant amount of coarse material. The clay fraction is the weight portion of the soil whose granules are finer than 0.002 mm. While silt is a term used to declare soil that is like silt. The silt fraction is the weight portion of the soil whose granules are between 0.002 mm-0.06 mm.

If most of the soil is finer than the size of the sand and silt boundary then the soil belongs to the silt or clay group, but the determination of whether the silt or clay is not done on the basis of the grain size. The best way to distinguish between silt and clay is the experiment of dilatancy. A bit of soft soil (wet enough so that it is almost sticky) is placed in open arms and shaken horizontally. On the silt, water will appear on the surface and will be lost when the soil sample is pressed between the fingers. In clay this will not happen.

In some respects, the reaction to the dilatancy experiment is not so assertive, whether the soil should be classified as a clay or silt-clay.

2. Method

2.1 Location and Time of Study

2.1.1 Research sites

The research location is in the village of Telaga sub-district Dulohupa Gorontalo district.

2.1.2 Research time

The research was carried out for 3 months in the current year (in May s / d in July 2017) which include the following stages:

1) The preparatory phase includes the preparation of research instruments, in the form of geo-electric observation sheets and geo-electric calibration tests.
2) Phase field orientation and the collection of measurement data for 2 months.
3) The data collection stage is a field measurement stage that includes geo-electric measurements at the sample site.
4) Phase analysis covering the *true* analysis of *resistivity*.

2.2 Tools and materials

2.2.1 Tool

Equipment used in this research are:

1) Resistivity meter Model IPMGEO-4100
2) Laptop
3) IP2WIN software.
4) Printer
5) Global Positioning System (GPS) type Garmin Oregon 300
6) Battery
7) Electrode (current and potential)
8) Meter
9) Stationery
10) Roll wires for current and potential connectors Camera Canon 1100 for documentation.

2.3 Variables

Variable in this research is 4 sample point at station 1 at coordinates N 00 ° 35'43.7 "E 123 ° 03'41.6" west east direction, station 2 at coordinates N 00 ° 35'43.8 "; E 123 ° 03'41.4 "north of south direction, station 3 at coordinates N 00 ° 35'42.4" E 123 ° 03'41.5 "north-south direction, station 4 N 00 ° 35'45.4" E 123 ° 03'42.1 "north-south direction of village Dulohupa, Telaga District, Gorontalo District, determined by geo-electric type resistance method.

2.4 Data collection technique

The data in this study is the value of *resistivity* in the village Dulohupa. For estimate of the field's boundary beneath the surface silt and clay silt reserves, geoelectric measurements were taken using imaging techniques resistivity measurements at four locations that were found in the study site measurement path. Measurements were made using a schlumberger electrode configuration with a stretch length of 170 m to 180 m for a depth target of about 20 m to 30 m. Acquisition or acquisition of resistivity imaging measurements using the schlumberger configuration.

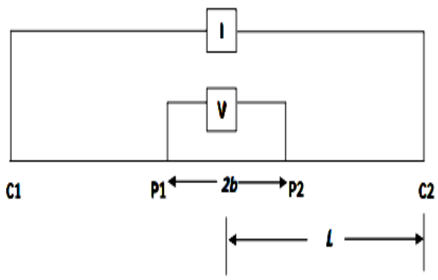

Figure 1. Structure Schlumberger electrode configuration (Dobrin & SAVIT,) in Winarti, (2013)

2.5 Data analysis technique

Data analysis techniques are the means used to investigate, examine and study existing data and make interpretations as necessary. Data analysis technique used in this research is the 1D inversion.

The 1D inversion method is used to generate vertical cross-sectional section (1D cross), so using computer programming aid, used IP2WIN application. At this stage it tries to display the 1D medal to get the type resistance value and the actual depth. The IP2WIN program will automatically determine the 1D resistivity model for subsurface geo-electric data measurements. The data in question consists of the accumulation electrode distance from the first electrode, the penetration depth and resivility actual value of subsurface materials.

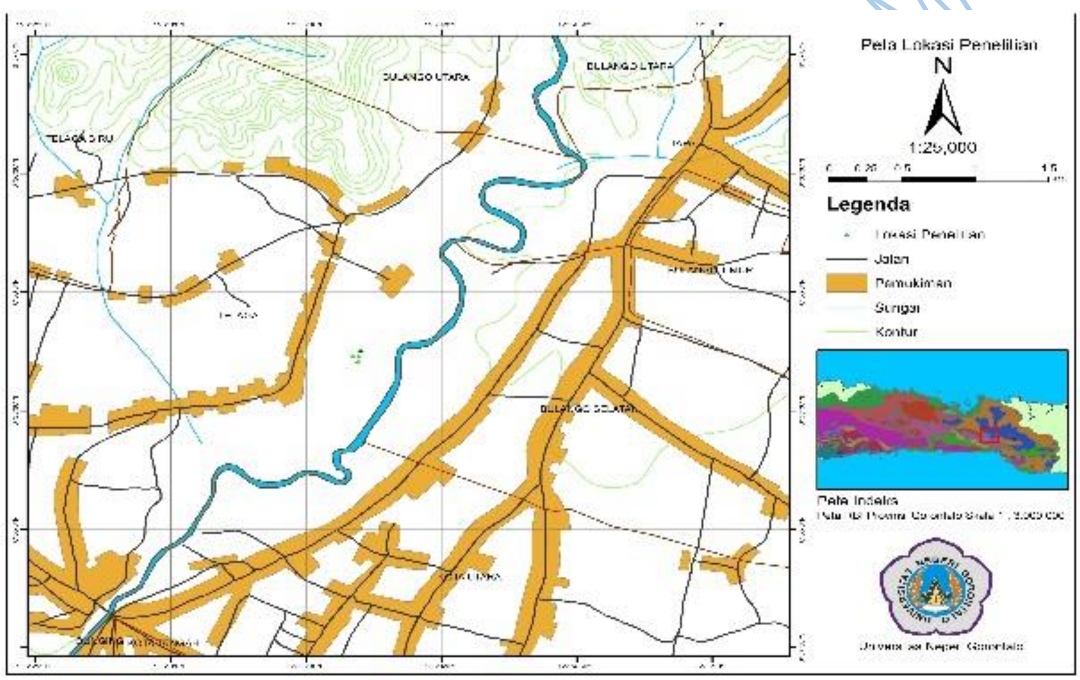

Figure 2. Map of research location Map Administration

The resulting data is then interpreted by looking at the resistivity price range of several types of rocks, soils, and minerals. Interpretation conducted to determine the type and depth of the composition and thickness of the material or based mainly silt loam resistivity values to determine the reserve volume of silt loam.

3. Results and Discussion

Based on location map from 4 point of fetch sample *(sample point)* is close to the river water area (DAS) so the chances of getting a larger clay in this area. Based on the geological map 4 *sample point* is in the region Tmb (diorite Bone).

From measurements at four locations *sample point* resistivity values obtained at each sample point. With data processing using IP2WIN software obtained the size of the thickness or depth as follows.

Geological cross-section contour of the results above, for the S2-S1 obtained silt loam backup depth trend increasingly towards the east (towards S1 thickness of 8 m) up silt loam deeper and deeper to the west (towards S2 thickness of 2.5 m) clay reserves silt shallower. This corresponds to the structure of the subsurface geological map. As for the contour cross-section of the geology of the S4-S1-S3 obtained trend depths of up silt loam to the north (towards S1 towards S3 thickness of 7 m) is getting shallower otherwise reserves clay silt deeper to the south (towards S1 toward S4 with a thickness of 8 , 5 m). If it is linked to the geological map and the southern administrative map of the measurement in the direction of the stream line, it can be estimated that the southern part had once been streamed. So the southern part of the point of measurement will find more shallow sand and silt loam at this point is a little thin.

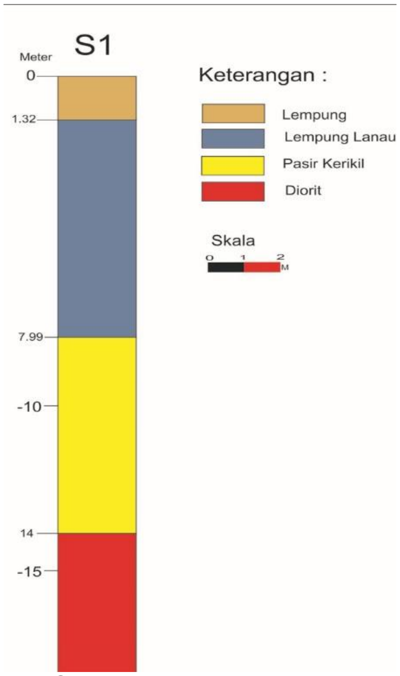

Figure 3. Cross-section lithology at station 1

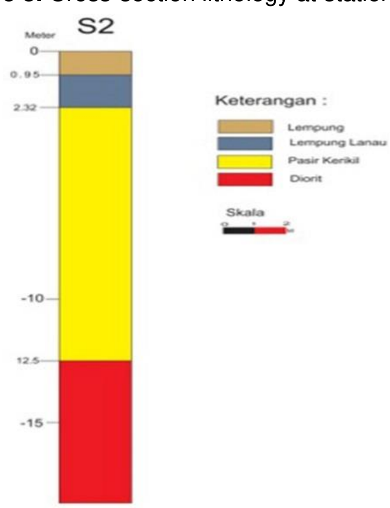

Figure 4. Cross-section lithology at Station 2

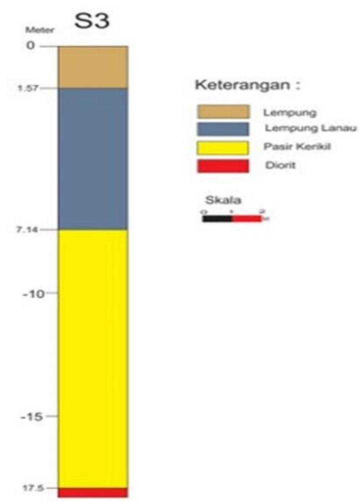

Figure 5. Cross-section 3 lithology station

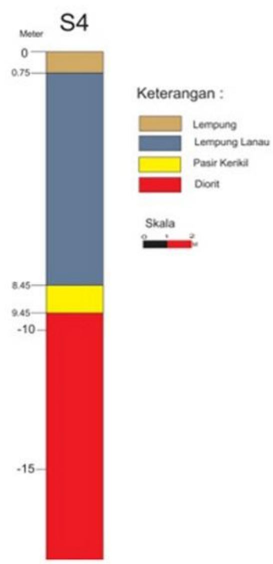

Figure 6. Sectional lithology at station 4

From the analysis of geoelectric measurements on location-based study by the Geological Map Apandi and Bachry (1997), from this point if the fourth straight line to form a triangular prism wake irregular space as in **Figure 7.**

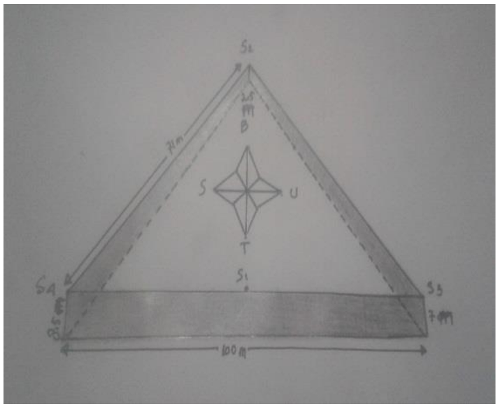

Figure 7. Illustration of clay silt thickness in the form of untitled triangle prism

To be able to calculate and determine the volume of silt-clay reserves in this area used mathematical techniques geometrical calculations by dividing an irregular triangular prism based on variations in the depth or thickness of silt loam reserves, thus becoming irregular triangular prism with a prism height of 2.5 m which is a component depth, d an irregular quadrilateral pyramid.

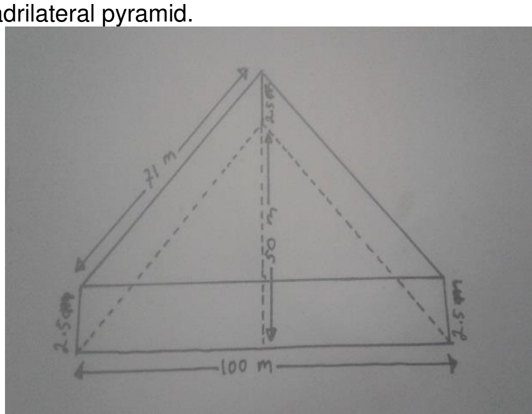

Figure 8. Triangular prism

In a triangular prism like the **Figure** 8 to determine the volume of the prism be calculated with mathematical geometrical KNIK. By multiplying the distance point-S3 S4 with a distance of S1-S2. Then the result of the multiplication is multiplied by the thickness or depth of silt loam reserves at S4, S3 and S2. The results of all these multiplications must be subdivided in order to satisfy the equations of the regular triangular prisms. From all this arithmetic operation obtained the value of 6250 m^{3,} this value is the backup volume lane clay to wake up the first room that an irregular triangular prism.

Then to determine the volume of pyramid facets Uran heavy four-stroke in the same way that the mathematical techniques by multiplying the value of the building area of the base with a distance of S1-S2 and then divided by three to satisfy the equation irregular quadrilateral pyramid. Values area of the base can be obtained by multiplying the thickness of the distance S3 S3-S4 obtained the value of 450 m $^{2.}$ Then added with half the value of the multiplication value of the distance S3-S4 with a thickness of silt loam backup at point S4 is silt 1.5 m with the value obtained is 75 m $^{2.}$ So the area of the base value of 525 m ^{2} values obtained this value is the sum of 450 m ^{2} to 75 m ^{2}.

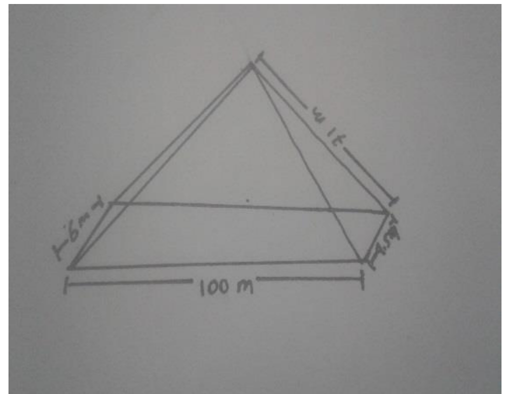

Figure 9. Illustration of the thickness of clay silt in the form of a rectangular square pyramid

So to know the volume of the irregular quadrilateral pyramid by dividing the value of the multiplication of the comprehensive value three pedestals 525 m^{2} and the distance from S1-S2 with a value of 50 m$^{2.}$ The calculation of the value obtained irregular quadrilateral prism volume is 8750 m$^{3.}$

Once it is known the volume value of two wake up space that was once a wake up space. Then divided into two forms of space to be able to calculate the value of the volume. So to determine the total volume value of the clay silt volume reserves of the two wake-ups of this space. Waking up the first room that an irregular triangular prism volume of 6250 m^{3} with waking second space is irregular rectangular prism volume value of 8750 m $^{3.}$

Then from these results obtained total volume value is 15000 m $^{3.}$ So reserve silt loam research area is 15000 m$^{3.}$

4. Conclusion

From the results of the research that can be concluded that there are reserves of Silt loam in the village Dulohupa precisely around 4 sample point. Through Geo-listric method, resistivity can sounding clay silt thickness or depth at all four points scattered in villages Dulohupa. By using the configuration Schlumberger resistivity interpretation of the results obtained by the surface structure and the results of geological information. Where at S1 the thickness of silt-clay 8 m at S2 thickness of silt-clay 2.5 m. And on S3 the thickness of silt-clay 7 m and at the S4 thickness of clay silver 8.5 m. Of silt loam at this point can be calculated the fourth volume of silt loam reserves amounting to 15 000 m$^{3.}$

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