Correlation Between Magnetic Susceptibility And Gold (Au) Content In Bombana Gold Mine Area (BGMA), Southeast Sulawesi, Indonesia

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Abstract. The measurement of magnetic susceptibility and the content of gold (Au) on sediments in the Bombana Gold Mining Area (BGMA) has been done. The samples analyzed totaled 121 samples. The magnetic susceptibility values was measured using Low Field MS2B Bartington Susceptibility meter, while the contents of gold (Au) was measured using X-Ray Nitton. Generally, the lower the value of magnetic susceptibility, contents of gold (Au) on the sediment is higher. Based on this result, the magnetic susceptibility can be used as one of the parameters and/or the alternative methods on the exploration of gold in BGMA.

1. Introduction

Environmental magnetic methods based on the study of variations in magnetic susceptibility and rockmagnetic parameters have been successfully used over several decades to characterize and quantify the degree of pollution of air, water vegetation and land systems [1]. Geological conditions of the Wumbubangka area is reflected in the morphological, structural geology, various rock types making up to stratigrafinya types. Wumbubangka area composed by rock formations that have Langkowala flat morphology. The geology of lowland Langkowala composed by Langkowala Formation which is one of the rock formations are part of clastic sediments Sulawesi molasa. Langkowala formation contained of shale sandstones and conglomerates. These formations are widespread in areas that are Langkowala mainland tertiary sedimentary basin [2]. These formations are widespread in areas that are Langkowala mainland tertiary sedimentary basin. Stratigraphy study area is composed by lithologies of the young to the old form of schist, conglomere sandstones, limestones and alluvial. Schists consists of schist mica, schist chlorite and schist amphibolite with foliasi structure. In the metamorphic lithologies there are chunks of rocks and quartz cockade structure, vuggy and fracture-filling foliasi schist rock fractures [3]. Langkowala formation composed of shale sandstones and conglomerates. These formations are widespread in areas that are Langkowala mainland tertiary sedimentary basin [2].

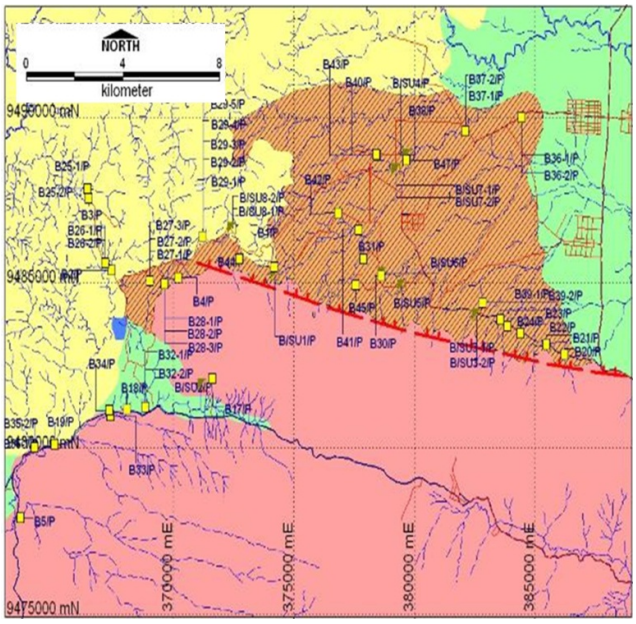

Figure 1. Regional Geology Map Bombana [4]
Note. Yellow squares are sampling point

The method most commonly used is the measurement of magnetic susceptibility. Value of magnetic susceptibility of a material can be determined either on the sample in the laboratory and in the field carried on the surface of the soil or outcrop. Pricing experimental magnetic susceptibility can be performed using a tool called Suseptibility Meter. The principle of this tool is an electromagnetic circuit that serves to detect changes in inductance when a sample is placed inside the coil [5]. Suseptibility Meter in general can work at two different frequencies, namely low frequency ordenya hundreds of hertz (465 Hz) and high-thousand hertz frequency (4650 Hz). XRF (X-Ray fluorescence) elemental analysis is a technique that forms a material with a basic X-ray interaction with the analyte material. This technique is widely used in the analysis of rock as it requires a relatively small number of samples (approximately 1 gram). This technique can be used to measure many elements contained in rocks or minerals. Mineral concerned can be ground, liquids, powders, filter material or any other form. In addition, XRF (X-Ray fluorescence) can also be used to determine the depth and composition of the coating. Detailed are the results of magnetic susceptibility measurements to correlating Between Magnetic Susceptibility And Gold (Au) Content In situ soil at Bombana Gold Mine Area (BGMA), Southeast Sulawesi, Indonesia.

2. Methods

The study, entitled "The correlation between the magnetic susceptibility and mineral content of gold in the ground at the site of gold Wumbubangka Rural District of North Rarowatu Bombana" was held in September 2015, and located in the village of Wumbubangka District of North Rarowatu Bombana Figure 1.

This research was conducted by collecting data or samples directly in the field, then measuring the magnetic susebtibilitas value and mineral content of gold at the Geophysical Laboratory. And as the supporting data or supporting data obtained from the literature. The stages of the sampling process is as follows; Soil sampling in outcrop carried around gold mining, Determining the position of the coordinates of the acquisition of land by using GPS, sampling is done vertically aims to facilitate

calculate the depth sampled in outcrop, Measuring high outcrop using the meter, taking samples at any depth, samples were taken at every interval of 20 cm, Noting the point of measurement and sampling point every point and depth in the sample bag. Detailed

The stages are performed on sample preparation is as follows; The first preparatory do is dry the sample is wet or damp, Once dry samples until finely by using a tool called mortal, samples were sieved using a sieve of 100 mesh to obtain delicate parts, samples that have been delicately inserted into the container tubular (holder) with a size of 2.5 cm diameter and 2.5 cm height also, labeling holder includes code samples and depth. Example: A(0), the sample mass measurement begins by weighing the mass of an empty holder, then the next stage is to consider holder containing the sample, run the software Multisus. By choosing MS2B later measurements with measurement devices are set to high frequency (χHF) and low frequency (χLF). Result and Discussion

The sample used in this study were taken at 5 soil profile to a depth of sampling different and positioned vertically straight down. The geographical position and the maximum depth of sampling sites for all profiles can be seen in Table 1.

Table 1. Description of Sample researchs

Profile	Position	ID	depth of sampling (cm)
1	S : $04^0$37’46.5” E : $121^0$54’38,1”	St.1	700
2	S : $04^0$39’37.3” E : $121^0$53’26,7”	St.2	400
3	S : $04^0$37’38.3” E : $121^0$54’44,5”	St.3	420
4	S : $04^0$37’39.2” E : $121^0$53’32,0”	St.4	500
5	S : $04^0$37’38.1” E : $121^0$54’46,9”	St.5	500

Figure 2, 3, 4, 5 and 6 is a graph of the value of susceptibility to elements of metallic minerals. The third profile is the exploration of mining land is still in the processing because the amount of gold that is still in large enough quantities. Type of material contained in the area is a kind of alluvial material that is composed of sandstone, mudstone, and mica schist.

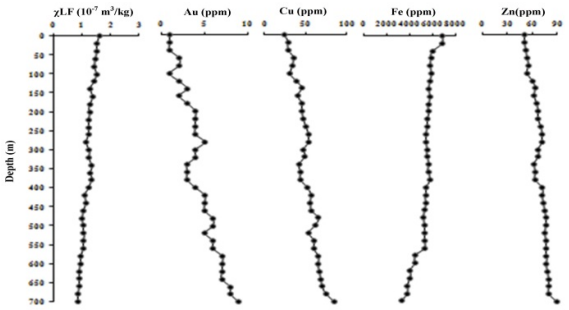

Figure 2. Relationships χLF with mineral elements Au, Cu, Fe and Zn to Profile 1,

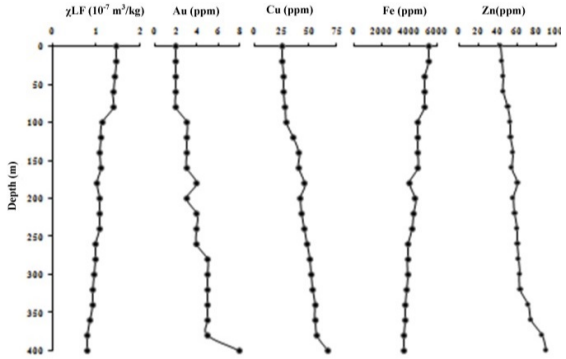

Figure 3. Relationships χLF with mineral elements Au, Cu, Fe and Zn to Profile 2

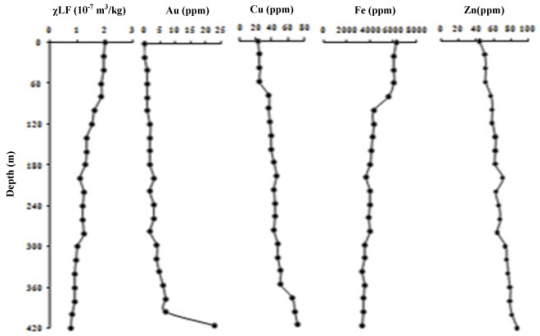

Figure 4. Relationships χLF with mineral elements Au, Cu, Fe and Zn to Profile 3

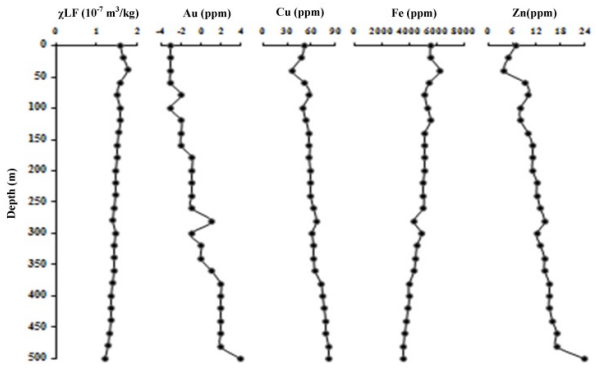

Figure 5. Relationships χLF with mineral elements Au, Cu, Fe and Zn to Profile 4

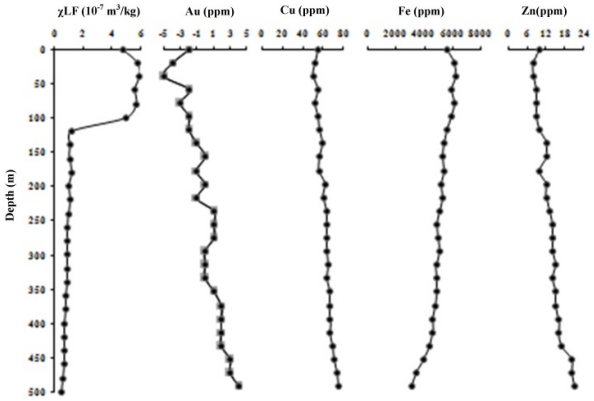

Figure 6. Relationships χLF with mineral elements Au, Cu, Fe and Zn to Profile 5

Value susceptibility maximum at profile 4 obtained at a depth of 40 cm with a value of 1.76 x $10^{-7}m^3$ / kg (susceptibility χLF) whereas the profile 5 found at a depth of 40 cm with a susceptibility value of 5.89 x 10^{-7}m3 / kg, minimum susceptibility values obtained at a depth of 500 cm with a value of 1.2 x $10^{-7}m^3$ / kg (susceptibility χLF) whereas the profile 5 found at a depth of 500 cm with a susceptibility value of 0.5 x $10^{-7}m^3$ / kg. A depth of 80 to 180 cm in 4 profiles obtained uniform susceptibility value which is about 1.5 x $10^{-7}m^3$ / kg, at a depth of 200 to 360 cm its susceptibility values also tend to be the same, namely 1.4 x $10^{-7}m^3$ / kg, and on into 380 to 460 cm susceptibility value obtained is 1.3 x $10^{-7}m^3$ / kg. While the profile 5 susceptibility values were uniformly found at depths of 120 to 220 cm with a value of approximately 1.2 x $10^{-7}m^3$ susceptibility / kg, at a depth of 240 to 340 cm with a value of approximately 0.8 x $10^{-7}m^3$ / kg, and on 360 to 440 cm depth with susceptibility value of approximately 0.7 x $10^{-7}m^3$ / kg. Similarly, in the image (1), (2) and (3) factors affecting the high, uniform, and the low value of susceptibility is influenced by the type of material, the temperature factor / temperature and grain size.

The relationship between the value of susceptibility is inversely related to the mineral content of some elements of metallic minerals such as (Au, Cu, Zn), can be seen in the above image the greater the value its susceptibility of the mineral elements Au, Cu, and Zn is getting smaller, while the mineral elements Fe if the value of susceptibility obtained the greater mineral content of Fe.

3. Conclusion

Based on the results of research and discussion, we can conclude; Type of material contained in the profile 1, 2, and 3 is a kind of alluvial material composed of sandstone, mudstone, and mica schist, while the 4 and 5 are profile-Sandstone Unit consisting of metamorphic sandstone, sandstone and claystone.

The relationship between the value of the susceptibility profile 1,2,3,4, and 5 is inversely proportional to the mineral content in the metal element (Au, Cu, and Zn) and proportional to the mineral content of Fe. Value susceptibility in five (5) that profile is influenced by several factors, including the type of material, temperature and grain size.

4. Acknowledgements

This research was supported by UNIVERSITAS HALU OLEO (UHO). We thank to The Indonesian Natural Magnetic Society for constructive comments of the manuscript.

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