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Comparison of Laterite Nickel Deposit Levels on the Mining Front with Stockpile at PT Ceria Nugraha Indotama, Kolaka Regency

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Abstract

PT Ceria Nugraha Indotama is a company engaged in mining laterite nickel ore in Wolo sub-district, Kolaka district, Southeast Sulawesi province. In lateritic nickel ore mining activities, there is often a difference in levels of laterite nickel ore when it is still in the mining front and after being transferred to the stockpile. This research is to determine the proportion of differences in the levels of Ni, Fe, MgO and SiO2 on the mining front with the stockpile and to determine the factors that influence changes in nickel content. The method used in this study is the grab sampling method in front mining and stockpile. The results of this study are based on the results of the analysis, obtained data on the levels of Ni, Fe, MgO and SiO2 on the mining front with a stockpile, the Ni content has a difference of 0.05% and the Fe content has a difference of 0.34%, the two minerals have the highest grades on the mining front. mining and MgO content has a difference of 2.68% and SiO2 content has a difference of 8.87%, the two minerals have the highest grade in the stockpile. Factors that influence changes in nickel content are the heterogeneous distribution of ore, the position of the waste above the ore and the rainy weather that occurs in the field, operator and sampling skills.

Keywords: Grade, Nickel Laterite, Front, Stockpile, Grab Sampling

1 Introduction

Indonesia is a country that has many special resources in eastern Indonesia [1].[2]. On the island of Sulawesi there is the Sulawesi Ofiolite Complex, which is the third largest Ofiolite Complex in the world [3]. In foreign languages, the Sulawesi Ofiolite

Complex is considered the East Sulawesi Ophiolite Belt (ESOB) or East Sulawesi Ofiolite lane. The formation of nickel deposits in the tropics occurs due to the weathering process of ultraalkaline rocks whose Ni content reaches 0.25% [4]. Currently, the mining industry is faced with a problem where its mining reserves are getting thinner and even depleted, causing companies to stop mining activities in an area. Mineral resources that have special properties are *Non Reneable Resources* which is if the mineral material will not be renewed or in other words, the mining industry means a large industry without recycling [5]. Topography is one of the factors that affect the availability of laterite nickel resources. The surrounding topography can affect water movement which can help the formation of laterite nickel deposits [6], [7]. Laterite nickel deposits are products derived from the advanced weathering process in Ni-Silicate-carrying ultramafic rocks, generally found in areas with tropical to subtropical climates. Indonesia is known to be one of the countries that produces mineral materials in the world, including nickel [8], [9]. Nickel laterite is a type of metallic mineral obtained through the chemical weathering process of ultraalkaline rocks, which makes residue enrichment and secondary origins of the elements Ni, Mn, Fe, and Co. Nickel laterite is characterized by containing metal oxides using a reddish-brown color and containing Ni and Fe [10]. There are two groups of laterite nickel ores, namely limonite zone nickel with low nickel content and saprolite zone nickel with high nickel content. The disparity that exists in these two types of ore zones is that the ore in the saprolite zone has a low Fe content and high Mg while the limonite zone has a high Fe content and low Mg [11]. Laterite nickel deposits are deposits due to the lateritic weathering process of ultramafic host rocks (perittite, dunit, and serpentinite) containing Ni using high levels, the weathering agents are in the form of rainwater, temperature, humidity, topography, and others. Generally, the formation of laterite nickel deposits occurs in tropical or sub-tropical areas [12], [13].

Changes in levels that occur on the mining and stockpile fronts must be identified as various possible causes so that with the knowledge of the causes of these changes in levels can be overcome to minimize their occurrence, because if not done this will continue so that the quality of the excavated material may decrease to not meet the specifications of the demand level for shipping needs and will have the potential to cause losses for the Ceria Nugraha company Indotama. The formulation of the problem in this study is how much is the percentage difference in Ni, Fe, MgO and SiO2 levels on the mining front with the stockpile and what are the factors that affect the change in nickel levels. The purpose of this study is to find out the percentage difference in Ni, Fe, MgO and SiO2 levels on the mining front with the stockpile and to find out the factors that affect the change in nickel levels.

2 Material and Methods

The type of data used in this study consists of primary data and secondary data. Primary data is data collected by making direct observations in the field. The data that will be used in this study are documentation data, level data on the mining front, content data on the *stockpile* and the level analysis process using XRF equipment in the company's laboratory [14], [15]. Secondary data is data obtained from the company/agency based on the results of previous observations or research such as company archives, journals and reference books. Secondary data in this study are the map of the research location and the company's SOP (standard operating *procedure*). The data processing used in this study is quantitative data processing. General conclusion based on the results of the data analysis method In this study, the data analysis technique used is descriptive quantitative analysis. The author uses a descriptive method to obtain an overview of the results of data processing in the Excel application [16].

3 Results and Discussions

The levels of laterite nickel deposits often experience differences between *the mining front* and *the stockpile*, so the author analyzed the data on the levels of laterite nickel deposits on samples on the *mining front* with *the stockpile*. The samples used amounted to 300 samples on the *mining front* with stockpiles. Every 20 samples were analyzed using XRF equipment so that the author obtained 15 values of laterite nickel deposits in Ni, Fe, MgO and SiO2 minerals in the *mining front* with *a stockpile* while the factors that affect the change in nickel content are the distribution of heterogeneous ore, the position of impurities to *ore*, weather and operator and *sampling skills*.

Difference in Laterite Nickel Deposit Levels in *Mining Fornt* with *Stockpile*

To find out the difference in the levels of laterite nickel deposits, it is necessary to compare the levels in the *mining front* area with *the stockpile*. The values of nickel precipitation rates compared are Ni, Fe, MgO and SiO2 (shown in Table 1).

Based on Table 1, the author has data on the level of laterite nickel deposits on the *mining front* . The minerals compared by the author are nickel, iron, magnesium oxide and silica. The value obtained from the author comes from the award pit at PT Ceria Nugraha Indotama. The total level owned by the author is 15 levels.

Table 2 shows the value of laterite nickel deposits in the *stockpile*. The data owned by the author comes from *Dome* 172, *Dome* 174, *Dome* 176, *Dome179 and Dome* 182. The total levels owned by the author are 15 levels equal to the data on the level of laterite nickel deposits on the *mining front*.

Table 1. Data on Laterite Nickel Deposit Levels on *the Mining* Front

It	*Assay*				Qty	Location
	Ni	Fe	MgO	SiO2		
1	1.82	15.44	13.46	37.96	1	Pit Anugrah
2	1.74	15.25	13.31	38.40	1	Pit Anugrah
3	1.63	13.28	13.47	40.39	1	Pit Anugrah
4	1.68	22.57	7.56	27.71	1	Pit Anugrah
5	1.82	17.91	9.84	37.72	1	Pit Anugrah
6	1.68	14.50	12.23	42.65	1	Pit Anugrah
7	1.64	13.78	11.80	40.41	1	Pit Anugrah
8	2.03	15.43	12.31	37.89	1	Pit Anugrah
9	1.90	11.16	13.99	43.05	1	Pit Anugrah
10	1.84	13.28	11.90	41.10	1	Pit Anugrah
11	1.98	13.94	13.27	39.32	1	Pit Anugrah
12	1.56	13.52	11.47	47.32	1	Pit Anugrah
13	1.36	14.17	10.53	44.62	1	Pit Anugrah
14	1.34	12.80	11.95	44.56	1	Pit Anugrah
15	1.36	14.31	11.45	44.99	1	Pit Anugrah

Table 2. Data on Nickel Laterite Deposits on *Stockpile*

It	*Assay*				Qty	Location
	Ni	Fe	MgO	SiO2		
1	1.61	13.36	19.26	45.84	1	*Dome* 172
2	1.86	14.34	16.52	45.97	1	*Dome* 172
3	1.63	13.45	17.77	48.19	1	*Dome* 172
4	1.59	13.59	11.58	54.26	1	*Dome* 174
5	1.55	14.79	13.39	52.05	1	*Dome* 174
6	1.71	14.83	13.61	49.68	1	*Dome* 174
7	1.72	13.41	14.45	48.14	1	*Dome* 174
8	1.71	19.63	14.14	37.35	1	*Dome* 176
9	1.63	17.13	14.37	39.79	1	*Dome* 176
10	2.24	16.31	15.67	44.71	1	*Dome* 179
11	1.75	16.22	15.78	48.02	1	*Dome* 179
12	1.50	12.43	16.95	53.52	1	*Dome* 182
13	1.63	13.02	13.36	56.39	1	*Dome* 182
14	1.27	10.84	11.46	59.56	1	*Dome* 182
15	1.30	12.90	10.41	57.70	1	*Dome* 182

Fig. 1 shows the average rate value of laterite nickel deposits made in the form of a graph. In the graph there are 2 lines where the blue line is the rate value on the stockpile and the red line is the rate value on the mining front. At the nickel (Ni) level, the author obtained a difference in the value of 0.04% with the highest level on the mining front. At the iron content (Fe), the author obtained a difference in the value of 0.34% with the highest rate on the mining front. At the magnesium oxide (MgO) level, the author obtained a difference in the value of 2.68% with the highest level in the stockpile. at silica (SiO_2) level, the author obtained a difference of 8.87% with the highest value in the stockpile.

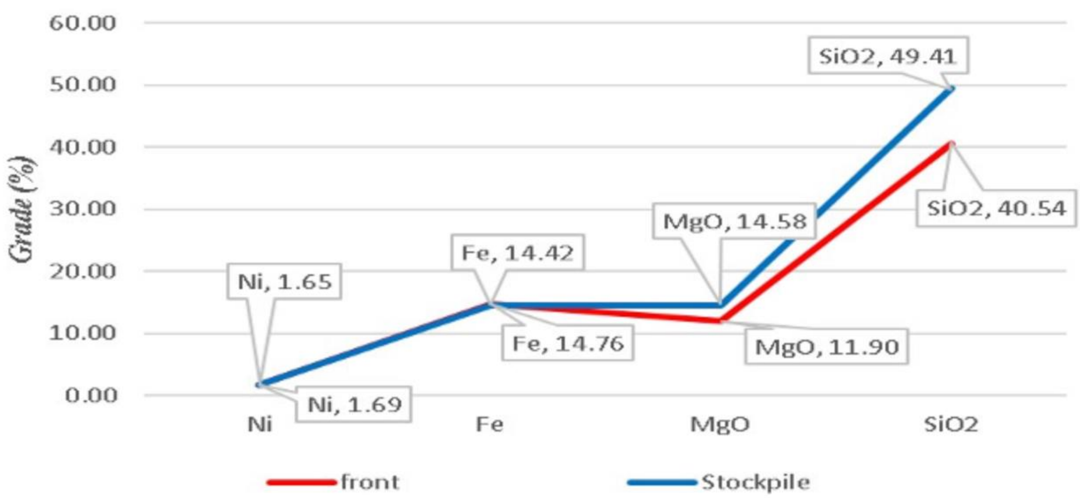

Figure 1. Comparison graph of the average levels of Laterite Nickel Deposits (Ni, Fe, MgO and SiO2).

Difference in Laterite Nickel Deposit Levels on *Mining Fronts* with *Stockpile*

Nickel has several factors that can cause the value of the rate to decrease. Based on Fig. 2*, non-homogeneous ore can cause changes in nickel levels because during* ore getting *activities, impurities* (waste) *can be included in the ore* product (Pranata et al., 2017). So that in carrying out *ore getting* activities, it is necessary to pay attention to grade *control* which functions to petrify operators in the implementation of *ore getting activities*.

In Fig. 3, it can be seen that in the *mining front* area, the *position of waste* and *ore* is always close together. This can cause changes in nickel levels. Nickel levels can be affected by rainy weather with rain can cause the *moisture content* content in ore products *to* increase so that this can cause *ore* products to be damaged or not meet *the needs of buyers.*

As shown in Fig. 4, *ore getting* is a very important activity. At the ore *getting* stage, impurities (*waste*) often occur in the *ore* product so that the presence of *waste* in *the ore* product can cause the nickel level to decrease. Therefore, it is necessary to carry out supervision at this stage which aims to maintain the stability of the rate on the *mining front*.

Figure 2. The distribution of *ore* is heterogeneous.

Figure 3. Waste position *relative* to *ore* and weather

Figure 4. Heterogeneous Ore Distribution

4 Conclusions

Based on the results of the analysis, data on Ni, Fe, MgO and Sio2 rates on the *mining front* with *stockpiles* were obtained, the Ni rate had a difference of 0.05% and the Fe rate had a difference of 0.34%, the two minerals had the highest rates on the *mining front* and the MgO rate had a difference of 2.68% and the SiO2 rate had a difference of 8.87%. Factors that affect changes in nickel levels are heterogeneous ore distribution, the position of *waste* above the *ore* and rainy weather that occurs in the field, operator and sampling skills.

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