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The Effect of Slope on the Distribution of Nickel Laterite at PT Sentratama Karya Cemerlang, South Konawe Regency, Southeast Sulawesi Province

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ABSTRACTS

Host rock and topography are factors that greatly influence the formation of nickel laterite deposits. Local topography will greatly affect the circulation of water and other reagents. For sloping areas, the water will move slowly so that it will have the opportunity to penetrate deeper through fractures or rock pores. This study aims to determine the effect of slope on the distribution of nickel laterite, namely to determine the slope of the slope on nickel laterite at PT Sentratama Karya Cemerlang, Laeya District, South Konawe Regency, Southeast Sulawesi Province. All data obtained in the field were processed and analyzed using Arcgis software application to determine the slope while Microsoft excel application was used to calculate the average nickel content. The results showed that the distribution of nickel laterite is strongly influenced by the amount of slope of the study area, the greater the degree of slope, the smaller the area and distribution of Ni content.

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INTRODUCTION

Nickel laterite is the residual product of chemical weathering of ultramafic rocks. This process takes place over millions of years starting when ultramafic rocks are exposed on the earth's surface, laterization is a chemical weathering that results in secondary enrichment of certain elements and produces economically valuable deposits, such as nickel deposits, (Fadli, 2021; Ilham et al., 2021). Host rock and topography are factors that greatly influence the formation of laterite nickel deposits, (Program et al., 2013; Waluyo, 2021).

Local topography will greatly affect the circulation of water and other reagents. For sloping areas, the water will move slowly so that it will have the opportunity to penetrate deeper through rock fractures or pores. The accumulation of deposits is generally found in areas that are sloping to moderate slopes, this explains that the thickness of weathering follows the shape of the topography. In steep areas, theoretically the amount of water that slides is more than the water that permeates this can cause less intensive weathering, (Firdaus et al., 2022; Kadri, 2022; Yanto Sudiyanto, 2020).

The morphology that develops in the study area consists of undulating hills. Based on the results of the slope analysis, the research area is divided into several slope classes, namely flat slopes, gentle slopes, sloping slopes and steep slopes. The process of forming laterite nickel deposits will be greatly influenced by the slope conditions, (Kadarusman, 2009; Novaldi Yahya Arif Guntara* 1, 2021; Thamsi et al., 2021).

In the research area, slopes that have a high percent slope, the thickness of the deposits that will be formed will be thinner, ranging from 6-12 meters, on the other hand, slopes that have a low percent slope, the thickness of the deposits that will be formed will be thicker, ranging from 18-30 meters, (Astuti et al., 2023; Fitrian, 2021; Harahap & Novitasari, 2022). Therefore, this study aims to determine the effect of slope on the distribution of nickel laterite, namely to determine the slope of the slope on nickel laterite at PT Sentratama Karya Cemerlang, Laeya District, South Konawe Regency, Southeast Sulawesi Province.

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METHODS

The research method is divided into starting from the preparation stage, the data collection stage, the data processing and analysis stage, and the withdrawal stage of report writing. The preparation stage is a stage where researchers must prepare everything needed before research activities are carried out in the laboratory in order to facilitate the next stages of research.

The research data collection stage was obtained directly from the field, precisely at Block B1 PT Sentratama Karya Cemerlang, the location of PT Sentratama Karya Cemerlang, Laeya District, South Konawe Regency, Southeast Sulawesi Province. The data taken were collar, assay, and topographic data (primary data) and regional geology (secondary data).

All data obtained in the field were processed and analyzed using Arcgis software application to determine the slope, while Microsoft excel application was used to calculate the average nickel content as a reference material to determine the effect of slope on the distribution of nickel laterite in the study area. A map of the drilling points can be seen in Figure 1 below.

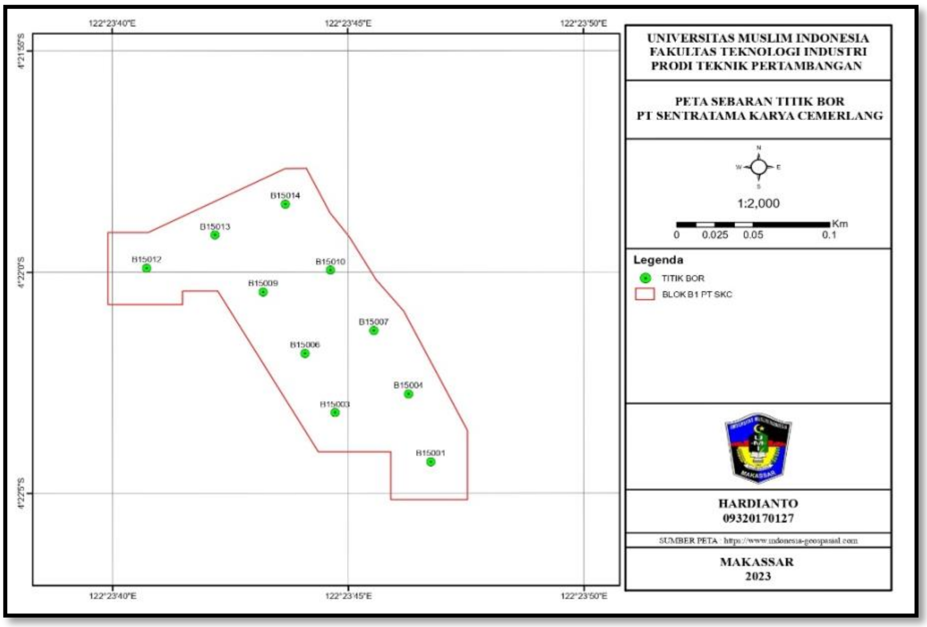

Figure 1. Map of drill points of the study area

RESULTS AND DISCUSSION

Slope Analysis of the Study Area

Analysis of the slope of the research area based on direct observation in the research area was carried out by morphometric analysis or slope analysis with remote sensing methods. Geological analysis in this area is done using Arcgis and Microsoft excel, where in the research area there are seven different slope classes.

Based on the classification, the slope of the study area consists of flat (0 - 2°), gentle (2 - 4°), very gentle (4 - 8°), rather steep (8 - 16°), steep (16 - 35°) very steep (35 - 55°) and steep (>55°). The distribution of drill points is found on four slopes, namely flat, gentle, rather steep, and steep so that it is modified by the author into four parts. The exploration drilling data used in this study were ten drill points processed using Microsoft excel. Then the ten drill points are divided into four slopes, namely flat, gentle, rather steep, and steep slopes.

Based on the observation of the slope in the research area, it can be divided into four classes, namely the slope class 0 - 2°, slope 4 - 8°, slope 8 - 16°, and slope >55°. Slope class map of the research area, can be seen in Figure 2 below.

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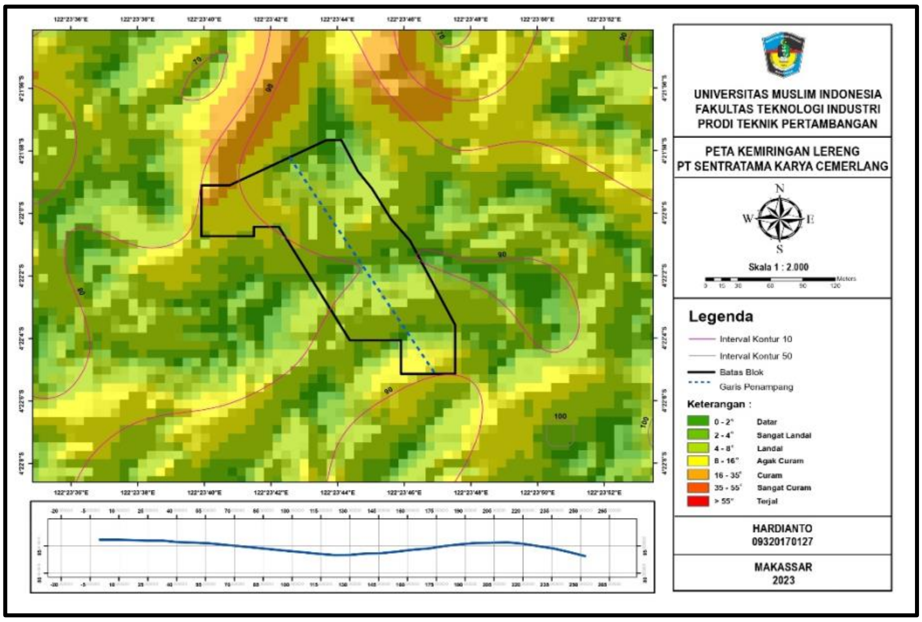

Figure 2. Map of slope classes of the study area

Effect of Slope of the Research Area on Nickel Distribution

Based on the results of processing in the form of drilling data and the help of satellite imagery (landsat), the author sees that of the several conditions for the formation of nickel laterite levels, one of which has an appropriate morphology. The research area does present a suitable morphology in the formation of nickel laterite as referred to the clarification of slope.

The results of the slope analysis, in general, the research area is the IUP area of PT Sentratama Karya Cemerlang which consists of several morphological units, including land morphological units, gentle hills and steep hills units. The research area shows that the morphology in block B1 can be divided into four parts, namely flat areas 0 - 2°, sloping 4 - 8°, rather steep 8 - 16°, and steep > 55° in Block B1.

The division of the slope of the area can be seen in the following tables 1 - 4, this data is then associated with local morphology and the following data is obtained.

Table 1. Areas with slope class 0 - 2°

No	Hole Id	Average grade of Nickel (%)
1	B15007	0.46
Average		0.46

The analysis of the peridotite zone shows the lowest Ni content of 0.21% and the highest content of 0.68%. The thickness of the saprolite and limonite zones from the drill data is between 7 - 10 meters with an average nickel content thickness of 7 - 11 meters with an average grade of 0.46%. The morphological unit in this area is a flat hilly morphological unit with a slope percentage of 0 - 2°, in the western and northern parts of the study area.

Table 2. Areas with slope class 4 - 8°

No	Hole Id	Average grade of Nickel (%)
1	B15006	0.18
2	B15014	1.00
Average		1.09

Based on table 2 above, the analysis results in the peridotite zone show the lowest Ni content of 0.21% and the highest content of 2.75%. The thickness of the saprolite and limonite zones from the drill data ranges from 3 - 10 meters and 3 - 9 meters respectively with an average grade of 1.09%. This morphology is scattered in the south to the north of the study area.

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Table 3. Areas with slope class 8 - 16°

No	Hole Id	Average grade of Nickel (%)
1	B15001	0.53
2	B15003	1.01
3	B15004	0.41
4	B15009	0.04
5	B15010	1.00
6	B15013	0.22
Average		1.09

Based on table 3 above, the analysis results in the peridotite zone show the lowest Ni content of 0.10% and the highest level of 2.89%. The thickness of the saprolite and limonite zones from the drill data ranges from 1 - 11 meters with an average nickel content thickness of 2 - 10 meters with an average grade of 0.81%. This morphology is spread in the eastern part of the study area.

Table 4. Areas with slope class >55°

No	Hole Id	Average grade of Nickel (%)
1	B15012	0.33
Average		0.33

Based on table 4 above, the analysis results in the peridotite zone show the lowest Ni content of 0.02% and the highest level of 0.61%. Then the thickness of the saprolite and limonite zones from the drill data ranges from 1- 2 meters with an average nickel content thickness of 1- 2 meters with an average grade of 0.33%. This morphology is scattered in the eastern part of the study area.

The local topography will greatly affect the circulation of water and other reagents. In sloping areas, the water will move slowly so that it will have the opportunity to penetrate deeper through rock fractures or pores. Accumulation is generally found in areas with gentle to moderate slopes, explaining that the thickness of weathering follows the shape of the topography, (Ilyas et al., 2016; Irfan et al., 2019) . In steep areas, theoretically, the amount of water that slides off is more than the water that seeps in, which can cause less intensive weathering.

The influence in this area has a lot of peridotite rocks because the elevation location is sloping so that ultrabasic rocks in the upstream area go downstream in various ways such as weather, climate, temperature and earth structure so that in that area many pyroxene and olivine minerals precipitate into peridotite minerals. And as for the sandstone in block B1, it is small because the field conditions are not sloping due to minerals that go down to the bottom not settling in that area.

Distribution of Laterite Nickel in the Study Area

The distribution of nickel laterite follows the topography of the local area, the more gentle the topography, the better the distribution. A good nickel laterite distribution area also has a high Ni content, the nickel laterite distribution and Ni content distribution can be seen in Figure 3 below.

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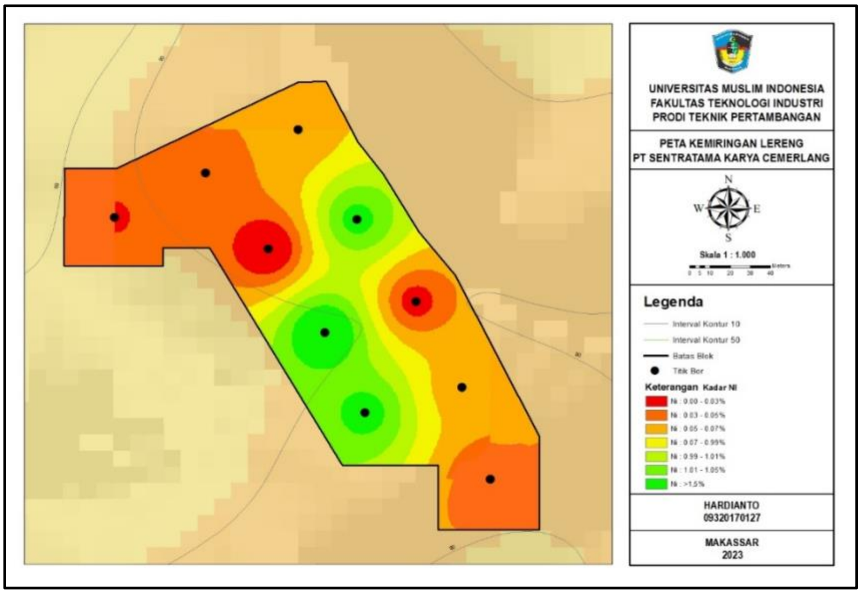

Figure 3. Map of nickel laterite distribution and Ni content distribution of the study area

The map of nickel distribution in the saprolite zone is made based on analytical data with a cut of grade of 1.52% Ni and drill data with a minimum thickness of 4 meters. The grade distribution map shows that the distribution of nickel grades ≥ 2.27% is concentrated in the northern, central, and southern parts of the study area, the distribution of nickel ore ≥ 2.27% develops in several places. The distribution of nickel grades ≥ 2.27% generally follows hilly ridges to gentle slopes, with hilly reliefs in the range of 21° - 30° slopes found in the southern to northern parts of the study area, then in the central and southern parts of the study area with flat-hilly reliefs in the range of 0° - 20° slopes. Likewise, the distribution map of nickel ore thickness in the saprolite zone with thickness ≥ 3 - 7 meters is concentrated in the northern, central and southern parts of the study area. Distribution of nickel thickness > 7 meters develops in several places.

The distribution of nickel thickness generally follows hilly ridges-sloping slopes with choppy-hills relief in the range of 21° - 30° slopes found in the northern part of the study area, then in the central and southern parts of the study area with almost flat-hills relief in the range of 0° - 20° slopes. These conditions indicate that the zone of nickel enrichment and thickness in the saprolite zone in the study area is influenced by morphological conditions, where nickel enrichment and thickness are concentrated in morphology, steep hilly-slope ridges with a slope relief of 55°.

CONCLUSION

Based on the research that has been done, it can be concluded that the morphology of the study area consists of flat morphology with a slope of 0 - 2º which has an average Ni content of 0.46% spread in the western and northern parts of the study area, sloping morphology with a slope of 4 - 8° which has an average Ni content of 1, 09% spread south to north, rather steep morphology with a slope of 8 - 16° has an average Ni content of 0.81% spread in the east and steep morphology with a slope >55° has an average Ni content of 0.33% spread in the eastern part of the study area. The distribution of nickel laterite is influenced by the degree of slope of the study area, the greater the degree of slope, the smaller the area and distribution of Ni content.

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