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ESTIMATE BROAD OF NATURAL MINERAL RESOURCES AREA LATERITIC NICKEL BASED OF IMAGE ANALYSIS SATELLITE LANDSAT 7 ETM$^+$ IN DISTRICT LAONTI, KONAWE SELATAN, PROVINCE OF SOUTHEAST SULAWESI

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ABSTRACT: Mineral exploration is one of the important activities to obtain location information about where the minerals are, but this exploration process takes years and costly especially when carried out over a wide area. Therefore through this study the application of Geographic Information Systems and Remote Sensing for mapping the distribution of potential mineral deposits of lateritic nickel (Ni) is tested. The method used is the analysis of digital data Landsat 7 ETM +. Rocessed image data by performing a technique sharpening contrast, filtering, creation of a composite image and image fusion. Image data processing is for the interpretation of visual straightness, limit unit morphology and the estimation of mineral lateritic nickel. The data as well as analysis techniques NDVI in order to obtain the pattern of vegetation density on the surface. The results showed that the presence of lateritic nickel mineral formed on ultramafic rocks undergoing the process of weathering and serpentinization. Characterized with the appearance of geological structures identified as robust and fault structures. Which are also represent on the remote sensing images as rectangular flow patterns.Ultramafic rocks are located in the morphological undulating hills. Vegetation is identified growing on ultramafic rocks are categorized as dense vegetation. Vegetation that grows in the form of a single tree with an average diameter ≤30 cm. result generating estimates of mineral potential areas of lateritic nickel has an area ranging 6.3 ha.

Keywords: Remote Sensing, Morphology, Lateritic Nickel, Laonti Distric

1. INTRODUCTION

Lack of knowledge related to the information of the location of mineral reserves impacts on the economic development in developing countries. Sustainable development of mineral resources requires comprehensive information. According [1-2], one of the conclusions of the International Conference on Development and Mines in Washington DC in June 1994 stating lack of data on geology and mineral resources is a fundamental constraint to the development of many countries [3-5]. The development of technology for the identification of minerals in the early stages can be done using applications of Remote Sensing and Geographic Information System (GIS) [5-10]. Whereas lithological mapping approach could be used as a tool for mapping mineral resource, to draw conclusions from some of the main parameters obtained through remote sensing observations, such as identifying the spectral values of rock, structural appearance, weathering and formation the mainland (landform), and river flow patterns.

Identification of the distribution of lateritic nickel through remote sensing technology in this study is the geo-botanical approach, to estimate the mineral results of weathering of *ultramafic* rocks, using morphological, geological structure and lithological of the vegetation. The study area is part of Southeast Sulawesi region rich in lateritic nickel in large quantities, it is supported by geological formation consisting of pieces of the continent began to tip over East Arm. Geological structure is divided into two: Mandala-East Sulawesi and Anjungan Tukang Besi-Buton.

2. METHODS

This research was conducted in the district Laonti which have the potential lateritic mineral using data obtained from the Landsat 7 ETM$^+$.[11-12] Data collection is conducted in order to obtain information about appearance of the surface area of research in the form of streams, morphology, vegetation density, and geological structure.

The research potential of the mineral is a spatial description with land units as the unit of

analysis. A land unit obtained by overlaying several attributes that landform, land cover and geological structure. Lateritic nickel metal mineral identification through satellite imagery carried out with a spatial approach that land cover and land forms of research areas. Data or indicators obtained and analyzed through several stages: 1) pre-processing the image i.e. of the correction radiometric, the correction of geometry, sharpening, composite image, NDVI 2) the stages of analysis i.e. identification of river flow, morphology, vegetation density, and structural geology, analysis of the type of vegetation on each morphological units, and mapping [13-17].

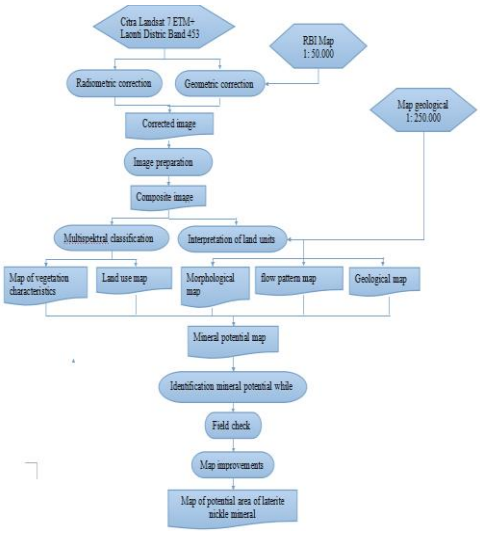

Fig 1. Flow Diagram of The Study

3. RESULTS AND DISCUSSION

3.1 Geography Condition of Research Areas

The study area is located in District Laonti of South Konawe. The layout of the area has boundaries are: in the north bordering the Banda Sea, the east by the Strait Wawonii, south by the District Kolono and to the west of Kendari Bay and District Moramo. Southeast Sulawesi arm comprised of a mandala made up of two different geological namely: Geological Mandala of East Borneo and Anjungan Tukang Besi Buton. Mandala East Sulawesi Geology is characterized by a combination of ultramafic rocks, mafic and metamorphic. Ultramafic rocks comprised of peridotite, serpentinite, diorite, wherlit, hazburgit, gabbro, basalt, altered mafic, and magnetite. Bedrock of lateritic nickel is peridotite. Peridotite weathering process will result in the saprolite, nickel-rich rock.

3.2 Geography Condition of Research Areas

a. Identification Morphology

The study area is the genesis comprised two (2) forms of land that is home fluvial landform and landform denudasional origin. Landform origin bentuk denudasional is a unit of land formed by the weathering process of degradation and soil movement and then terminated with the deposition processes such as landslides and erosion, while the origin of fluvial landform that is landform that occurs naturally as a result of river activity. Based on the rock properties and topography, shape of the land area of research can be broken down into 6 units landform is Fig 1 below.

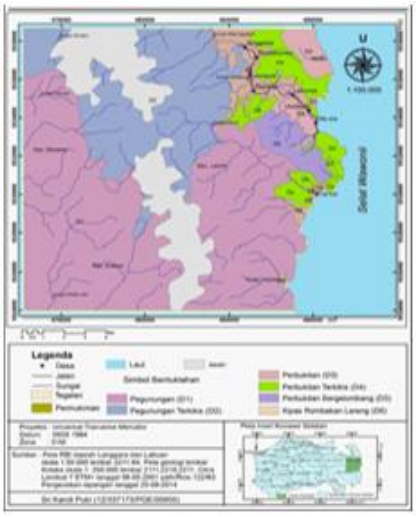

Fig 2. Map of Geomorphology

b. Pattern Identification Watershed

The flow pattern is done to identify the geological structure in the area of research. the flow pattern of the study area is divided into 2 dendritic flow patterns and the pattern of rectangular flow. *Dendritic* flow patterns shaped like a tree, with creeks and branches have an irregular way, located in the rocks resistant. Rectangular pattern where affluent forms an angle perpendicular to the main river. Usually located in areas with a fault structure or have many cracks (joint).

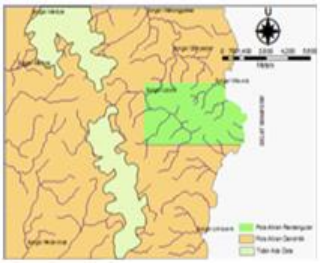

Fig 2. Spread Flow Pattern Research Area

c. Identification of the Geological Structure

Identification of rock structures filtering technique carried out on *Landsat 7 ETM*$^{+}$ bands 4, the filter used is a high pass filter for straightness scattered identification contained in each rock. The study area is divided into 3-way spread of straightness for each lithologies are rock formations that spread meluhu direction N 35^{o} E. rocks utramafik complex has the general direction N 355^{o}W, while Formation Meluhu N 315^{o}W.

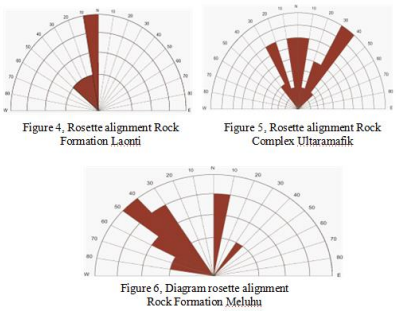

Figure 4, Rosette alignment Rock Formation Laonti

Figure 5, Rosette alignment Rock Complex Ultaramafik

Figure 6, Diagram rosette alignment Rock Formation Meluhu

Fig 3. Rosette Aligment Rock

d. Identification Characteristics/ Vegetation Density

The density of vegetation is classified into three levels of density. The highest density level is on the level with an area of heavy density of 91.2%. Dense vegetation density is more dominant in the study area with the distribution pattern found in the hills and mountains.

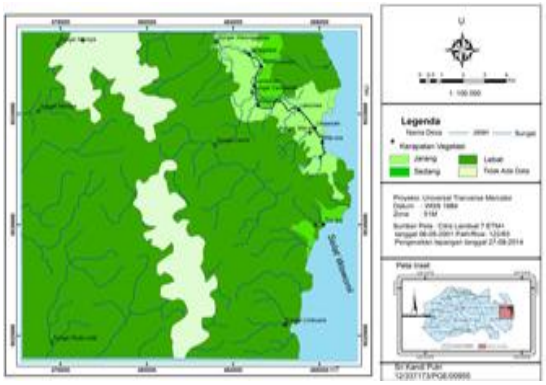

Figure 4. Map of Vegetation Density

3.3 Vegetation Type Identification Containing Mineral

The study area has a hilly forest vegetation type ultramafic. Environmental conditions characterized by (i) the parent rock in the form of ultramafic rocks containing serpentine, (ii) a very thin layer of top soil, with an orange-colored soil, (iii) it is at an altitude of 50 m to 243 m above sea level, (iv) the types of trees dominate are: a large number Ironwood (*Eusideroxylon zwager*), Sisio (*Syzygium sp.1*) Nuts (*Daemonorops draco. Syn: Calamus sp*), Resin (*Araucaria spp*), Wood kulipapo.

3.4 The Compilation of the Mineral Potential Map of Metal Lateritic Nickel

The mineral potential maps of land cover maps and land forms were made by using certain methods and techniques. The creation of mineral potential maps using assistive maps, there are a morphological map, a map of the flow pattern, geological structures maps, geological maps and vegetation density maps. Those assistive maps are overlaid. Overlaying operation coupled with defining the mineral potential as folows.

Results of the analysis of the distribution of rock area of research, ultramafic rocks which have the potential lateritic nickel metal mineral presence, is the result of weathering of rocks. Ultramafic rocks located at the northeast area of research. Morphology of ultramafic rocks in the study area is undulating hills whereas the slope ranges from 17^{o} to 27^{o}. Height ranges from 50 to 243 meters above sea level. The lithological rock types that occupy this area are ultramafic, dunite and serpentinite lies in the northeastern part of the region, which has high rates of erosion. It is an area of 632.0 ha oriented ultramafic rocks.

Geological structures of ultramafic rocks are straightness and stocky. Straightness identified by surface appearance on *Landsat* imagery. Straightness on the ultramafic rocks directional to northwest with N 355^{o} W. The fracture structure was analyzed with the flow pattern around the rectangular to ultramafic rocks. Rectangular flow pattern usually located on fault or fracture structure, distinguish from the surrounding rock.

Vegetation found in ultramafic rocks are the dominant vegetation found in the field with the characteristics of the vegetation that has a straight trunk with buttresses which grow in a circle. Further they have bark smooth, yellow or light gray and rough texture of the wood. Vegetation found are species of endemic vegetation such as Ironwood (*Eusideroxylon zwager*), Sisio (*Syzygium sp.1*), Rattan (*Daemonorops draco. Syn: Calamus sp*) and Resin (*Araucaria spp*).

The vegetation density of the morphology of undulating hills which has nickel metal mineral potency is dense vegetation. The dense vegetation is in the form of a dense forest with a single type of plant vegetation growing. Vegetation density of the image cannot be used for the assumption of the existence of nickel metal mineral because of dense vegetation that normally assumed to have fertile soil and do not contain metal. However based on the hue or the reflection of vegetation recorded by the image shows vegetation in the region of undulating hills morphology grow certain crops.

Plants are found in the field that a single tree that contains serpentine soil and nutrient-poor.

3.5 The Analysis of Potential Mineral Area

Extensive analysis performed by overlaid the mineral potential maps between parameters. Technically it is conducted by using a software application of Arc GIS 9.2. Extensive analysis of the potential result of a total area of ultramafic rocks with ultramafic hilly area using equation 3.2. Results of a preliminary investigation of the potential for the existence of lateritic nickel mineral is 632.0 ha of the area of research, which is located in the northeastern part of the study area

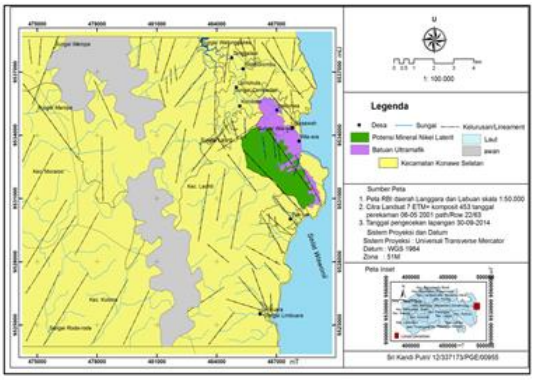

Fig 5. Map of Potential Mineral Area

4. CONCLUSION

Spatial analysis, classification, and overlaying used in the mapping of the spatial distribution in order to investigate the potential existence of lateritic nickel metal mineral. The results of analysis show that lateritic nickel mineral dispersion is on the morphology of undulating hills with geological structure that has a directional N 355º W located in ultramafic rocks and are in the Northeast of study area. Vegetation found in ultramafic rocks in the study area are mostly much Ironwood (*Eusideroxylon zwager*), Sisio (*Syzygium sp.1*), Rattan (*Daemonorops draco. Syn: Calamus sp*), Resin (*Araucaria spp*). Wide spread of potential mineral resources of lateritic nickel derived from remote sensing image processing is 632.0 ha of area study in ultramafic rocks.

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