ABSTRAK

GEOLOGI, PEMODELAN DAN ESTIMASI SUMBERDAYA ENDAPAN NIKEL LATERIT PADA BLOK 2 DAN 3, DAERAH LAMERURU DAN SEKITARNYA, KECAMATAN LANGGIKIMA, KABUPATEN KONAWE UTARA, PROVINSI SULAWESI TENGGARA

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Indonesia merupakan negara penghasil nikel terbesar kedua di dunia yang memiliki 23,7% dari total cadangan nikel dunia. Penelitian geologi dan eksplorasi endapan nikel laterit dilakukan di Blok 2 dan 3, daerah Lameruru dan sekitarnya, Kecamatan Langgikima, Kabupaten Konawe Utara, Provinsi Sulawesi Tenggara untuk mengetahui kondisi geologi, karakteristik, persebaran, hubungan, model dan jumlah sumberdaya dari endapan nikel laterit. Hasil dari penelitian menunjukkan bahwa daerah penelitian memiliki tiga pola pengaliran utama, yaitu paralel, sub-paralel, dan *mine drainage system*. Geomorfologi daerah dibagi menjadi lima bentuklahan: lereng struktural, perbukitan struktural, tubuh sungai, lereng denudasional, dan bukaan tambang. Litologi wilayah terdiri dari satuan peridotit dan serpentinit (Kompleks Ultramafik yang berumur Kapur) serta satuan batugamping (Formasi Salodik yang berumur Eosen Akhir – Miosen Awal). Hasil analisis kelurusan mengidentifikasi delapan sesar dan dua kekar gerus dengan orientasi dominan barat–timur dan utara–selatan. Hasil analisis geokimia menunjukkan bahwa batuan dasar di daerah penelitian didominasi oleh peridotit dan serpentinit yang kaya akan mineral pembawa Mg seperti Forsterit, Enstatit, Krisotil, dan Lizardit. Berdasarkan diagram *ternary* SiO_2–MgO–Fe, dominasi mineral tersebut mengindikasikan potensi substitusi Mg oleh Ni, yang kemudian dilepaskan saat proses pelapukan dan lateritisasi. Hal ini berkontribusi terhadap keterdapatan nikel yang tinggi pada endapan laterit di daerah penelitian.Data eksplorasi terdiri dari 465 titik bor dan 7.286 data assay dan litologi, serta data topografi dan densitas material 1,56 gram/cm^3. Dari hasil peta distribusi kadar Ni menghasilkan klasifikasi luas wilayah estimasi "*existing*": *Waste* (65,4%), *Very Low Grade* (21,75%), *Low Grade* (10,2%), *Medium Grade* (1,45%), dan *High Grade* (1,21%). Model geologi menunjukkan pembagian menjadi zona limonit, saprolit, dan *bedrock*. Estimasi sumberdaya menggunakan metode *Inverse Distance Weighting* (IDW) dengan *cut-off grade* 1,1% menunjukkan total tonase 2.428.848 ton dengan kadar rata-rata 1,28%. Sumberdaya diklasifikasikan menjadi tereka (687.863 ton, 1,4%), tertunjuk (1.392.788 ton, 1,41%), dan terukur (348.197 ton, 1,32%). Hubungan antara kondisi geologi dan estimasi ditunjukan pada ketebalan laterit terbesar berada di atas batuan dasar peridotit dengan topografi relatif landai, memberikan potensi volume yang lebih besar. Kadar nikel (Ni) cenderung lebih tinggi pada laterit yang tebal di daerah dengan kemiringan landai. Namun, variasi antar satuan batuan dan struktur geologi seperti sesar, rekahan, dan kekar juga memengaruhi distribusi laterit dan kadar Ni. Oleh karena itu, pemodelan dan estimasi sumber daya harus mempertimbangkan batuan dasar, struktur geologi, dan topografi untuk menghasilkan estimasi yang akurat dan representatif.

Kata kunci: Estimasi, Geologi, *Inverse Distance Weighting,* Karakteristik, Langgikima, Nikel Laterit.

ABSTRACT

GEOLOGY, MODELING AND ESTIMATION OF RESOURCES OF NICKEL LATERITE DEPOSITS IN BLOCK 2 AND 3, LAMERURU AREA AND SURROUNDINGS, LANGGIKIMA DISTRICT, NORTH KONAWE REGENCY, SOUTHEAST SULAWESI PROVINCE

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Indonesia is the world's second-largest nickel producer, holding 23.7% of global nickel reserves. Geological studies and exploration of laterite nickel deposits were conducted in Blocks 2 and 3, located in Lameruru and surrounding areas, Langgikima District, North Konawe Regency, Southeast Sulawesi Province, to investigate the geological conditions, characteristics, distribution, relationships, modeling, and resource estimation of laterite nickel deposits. The study identified three main drainage patterns: parallel, sub-parallel, and mine drainage systems. The geomorphology is divided into five landforms: structural slopes, structural hills, river bodies, denudational slopes, and mining openings. Lithology consists of peridotite and serpentinite units (Cretaceous Ultramafic Complex) and limestone units (Salodik Formation, Late Eocene–Early Miocene). Lineament analysis identified eight faults and two shear fractures with dominant west–east and north–south orientations. Geochemical analysis results indicate that the bedrock in the study area is dominated by peridotite and serpentinite, which are rich in Mg-bearing minerals such as Forsterite, Enstatite, Chrysotile, and Lizardite. Based on the SiO_2–MgO–Fe ternary diagram, the dominance of these minerals suggests the potential substitution of Mg by Ni, which is later released during the weathering and lateritization processes. This contributes to the high occurrence of nickel in the laterite deposits within the study area. Exploration data include 465 drill holes and 7,286 assay and lithology data points, along with topographic and material density 1,56 gram/cm^3. The nickel grade distribution map classifies the estimated "existing" area into Waste (65.4%), Very Low Grade (21.75%), Low Grade (10.2%), Medium Grade (1.45%), and High Grade (1.21%). The geological model defines zones of limonite, saprolite, and bedrock. Resource estimation using the Inverse Distance Weighting (IDW) method with a 1.1% cut-off grade indicates a total tonnage of 2,428,848 tons with an average grade of 1.28%. Resources are classified into inferred (687,863 tons, 1.4%), indicated (1,392,788 tons, 1.41%), and measured (348,197 tons, 1.32%). The relationship between geological conditions and estimation shows the greatest laterite thickness occurs above peridotite bedrock with relatively gentle topography, offering greater volume potential. Nickel (Ni) grades tend to be higher in thick laterite zones in gently sloping areas. However, variations among rock units and geological structures such as faults, fractures, and joints also significantly affect the distribution of laterite and Ni grades. Therefore, geological modeling and resource estimation must consider bedrock, geological structures, and topography to produce accurate and representative estimates.

Keywords: Characteristics, Estimation, Geology, Inverse Distance Weighting*, Langgikima, *Laterite Nickel.