

GEOLOGI DAN STUDI TINGKAT SERPENTINISASI PADA BATUAN ULTRAMAFIK TERHADAP PENGKAYAAN NIKEL PADA PROFIL LATERIT DI PULAU PAKAL, MALUKU UTARA

SARI

Secara regional, daerah penelitian terletak pada Zona Ophiolit Halmahera Utara yang merupakan bagian dari kompleks ophiolit yang tersusun atas satuan batuan ultramafik seperti dunit dan harzburgit. Persebaran batuan ultramafik di Pulau Pakal, Kabupaten Halmahera Selatan, Maluku Utara, menjadi salah satu kontrol geologi utama terhadap potensi endapan nikel laterit. Serpentinisasi yang terjadi pada batuan ultramafik ini yang akan memberikan pengaruh terhadap pengayaan Ni.

Penelitian ini bertujuan untuk mengkaji hubungan antara tingkat serpentinisasi batuan dasar terhadap pengayaan nikel dalam profil laterit. Beberapa metode digunakan dalam penelitian ini antara lain: analisis petrografi untuk mengetahui tekstur dan struktur mineral batuan dasar; analisis *X-Ray Diffraction* (XRD) untuk mengidentifikasi jenis mineral kristalin; analisis *X-Ray Fluorescence* (XRF) untuk menentukan komposisi unsur mayor dan minor; serta analisis *Scanning Electron Microscope* dengan *Energy Dispersive Spectroscopy* (SEM-EDS) untuk memetakan unsur dan identifikasi mineral alterasi secara mikroskopis.

Hasil analisis menunjukkan bahwa batuan dasar tersusun atas dunit dan harzburgit yang mengalami proses serpentinisasi dengan derajat bervariasi. Dunit memiliki kandungan olivin lebih tinggi dan menunjukkan derajat serpentinisasi yang lebih merata dibandingkan harzburgit. Proses serpentinisasi menyebabkan pembentukan mineral sekunder seperti serpentin dan magnetit, yang berperan dalam mobilisasi dan re-akumulasi unsur Ni. Berdasarkan hasil karakterisasi mineralogi dan geokimia, dapat disimpulkan bahwa tingkat serpentinisasi batuan dasar, khususnya dunit, berkontribusi besar terhadap pengayaan Ni dalam profil laterit, dengan mineral pembawa utama Ni berupa serpentin dan goetit.

Kata Kunci: Pulau Pakal, Batuan Ultramafik, Serpentinisasi, Geokimia, Nikel Laterit

**GEOLOGY AND STUDY OF SERPENTINIZATION LEVEL IN ULTRAMAFIC
ROCKS ON NICKEL ENRICHMENT IN LATERITE PROFILE IN PAKAL
ISLAND, NORTH MALUKU**

ABSTRACT

Regionally, the study area is located within the Northern Halmahera Ophiolite Zone, which is part of an ophiolite complex composed predominantly of ultramafic rock units such as dunite and harzburgite. The distribution of these ultramafic rocks in Pakal Island, South Halmahera Regency, North Maluku, acts as a primary geological control on the formation of lateritic nickel deposits. Serpentinization occurring in these ultramafic rocks will influence Ni enrichment.

This study aims to examine the relationship between the degree of serpentinization in the bedrock and the enrichment of nickel within the laterite profile. Several analytical methods were employed, including petrographic analysis to observe the texture and mineral structures of the bedrock; X-Ray Diffraction (XRD) analysis to identify crystalline mineral phases; X-Ray Fluorescence (XRF) to determine major and minor elemental compositions; and Scanning Electron Microscope with Energy Dispersive Spectroscopy (SEM-EDS) for elemental mapping and micro-mineral identification.

The results reveal that the bedrock comprises variably serpentinized dunite and harzburgite. Dunite contains a higher proportion of olivine and exhibits a more uniform degree of serpentinization compared to harzburgite. The serpentinization process facilitates the formation of secondary minerals such as serpentine and magnetite, which play a key role in nickel mobilization and re-accumulation. In the saprolite zone, nickel concentrations increase due to the leaching of Ni from olivine and its subsequent redeposition in Ni-rich serpentine. Based on the mineralogical and geochemical characterization, it can be concluded that the degree of serpentinization particularly in dunite has a significant influence on Ni enrichment within the laterite profile. The main Ni-bearing minerals identified are serpentine and goethite.

Keywords: *Pakal Island, Ultramafic Rocks, Serpentinization, Geochemistry, Nickel Laterite*