UNIVERSITAS
GADJAH MADA
Geologi dan Karakteristik Endapan Nikel Laterit di PIT 'X', Kecamatan Obi, Kabupaten Halmahera Selatan, Provinsi Maluku Utara
Bajra Anugrah Semesta, Prof. Dr.rer.nat. Ir. Arifudin Idrus, S.T., M.T., IPU.; Ir. Anastasia Dewi Titisari, M.T., Ph.D.IPU
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

INTISARI

Daerah penelitian di Pulau Obi, Maluku Utara, merupakan salah satu wilayah prospektif endapan nikel laterit yang berkembang akibat proses pelapukan intensif batuan ultramafik. Potensi sumber daya nikel laterit di daerah ini menjadikan wilayah penelitian penting untuk dikaji sebagai dasar dalam mendukung kegiatan eksplorasi lanjutan, khususnya terkait karakteristik geologi, distribusi kadar nikel, dan kontrol pembentukan endapan laterit. Penelitian ini bertujuan untuk menjelaskan kondisi geologi daerah penelitian, mengidentifikasi karakteristik mineralogi, geokimia, dan distribusi endapan nikel laterit, serta menginterpretasi kontrol geologi terhadap pembentukan dan karakteristik endapan nikel laterit. Metode penelitian yang digunakan meliputi pemetaan geologi, analisis petrografi, analisis geokimia *X-Ray Fluorescence* (XRF), serta pengolahan dan interpretasi data 614 *borehole* dengan 13.451 data geokimia yang didukung analisis statistik dan profil geokimia vertikal laterit. Daerah penelitian tersusun atas dua satuan geomorfologi, yaitu perbukitan bergelombang curam dan perbukitan bergelombang agak curam, dengan litologi berupa harsburgit dan serpentinit serta struktur geologi berupa kekar gerus berarah utama baratlaut–Tenggara (NW-SE). Endapan nikel laterit berkembang dalam zonasi limonit, saprolit, dan *bedrock* dengan karakteristik geokimia yang berbeda. Zona limonit dicirikan oleh pengayaan Fe dengan kadar Fe sebesar 26,0–58,0%, Ni 0,56–1,64%, SiO_2 0,15–21,22%, dan MgO 0,2–19,19%, sedangkan zona saprolit merupakan horizon utama pengayaan Ni dengan kadar Ni sebesar 0,27–2,75%, Fe 5,27–36,8%, SiO_2 8,13–42,3%, dan MgO 8,11–37,3%. Zona *bedrock* menunjukkan karakteristik batuan ultramafik segar dengan kadar Ni 0,13–1,06%, Fe 3,31–11,7%, SiO_2 19,77–46,8%, dan MgO 18,13–48,63%. Hasil analisis menunjukkan bahwa litologi dan geomorfologi berperan sebagai faktor pengontrol perkembangan profil laterit, distribusi unsur mayor dan minor, serta pengayaan nikel. Litologi harsburgit cenderung menghasilkan profil laterit yang lebih berkembang dan kadar Ni yang relatif lebih tinggi dibandingkan serpentinit akibat penambahan silika oleh proses serpentinisasi yang lebih tinggi. Kontrol geomorfologi ditunjukkan oleh perkembangan zona laterit yang lebih tebal pada morfologi relatif landai hingga bergelombang, karena kondisi lereng yang lebih stabil mendukung akumulasi material pelapukan dan infiltrasi air sehingga proses lateritisasi dan pengayaan Ni berlangsung lebih intensif, sedangkan pada lereng curam proses erosi lebih dominan sehingga profil laterit berkembang lebih tipis. Berdasarkan hasil penelitian, pembentukan dan karakteristik endapan nikel laterit di daerah penelitian dikontrol oleh interaksi antara litologi batuan induk, geomorfologi, dan proses geokimia supergen yang memengaruhi diferensiasi zonasi laterit serta pengayaan nikel terutama pada zona saprolit.

Kata kunci: endapan nikel laterit, geokimia laterit, kontrol geologi, Pulau Obi.

UNIVERSITAS
GADJAH MADA
Geologi dan Karakteristik Endapan Nikel Laterit di PIT 'X', Kecamatan Obi, Kabupaten Halmahera Selatan, Provinsi Maluku Utara
Bajra Anugrah Semesta, Prof. Dr.rer.nat. Ir. Arifudin Idrus, S.T., M.T., IPU.; Ir. Anastasia Dewi Titisari, M.T., Ph.D.IPU
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

ABSTRACT

The study area on Obi Island, North Maluku, is one of the prospective lateritic nickel deposit regions formed due to intensive weathering processes of ultramafic rocks. The lateritic nickel resource potential in this area makes it important to be studied as a basis for supporting further exploration activities, particularly related to geological characteristics, nickel grade distribution, and the controlling factors of laterite formation. This study aims to explain the geological conditions of the study area, identify the mineralogical, geochemical, and distribution characteristics of lateritic nickel deposits, and interpret the geological controls on the formation and characteristics of lateritic nickel deposits. The research methods include geological mapping, petrographic analysis, geochemical analysis using X-Ray Fluorescence (XRF), and the processing and interpretation of 614 borehole data consisting of 13,451 geochemical datasets supported by statistical analysis and vertical laterite geochemical profiles. The study area is composed of two geomorphological units, namely steep undulating hills and moderately steep undulating hills, with lithologies consisting of harzburgite and serpentinite, as well as geological structures in the form of shear joints trending northwest–southeast (NW–SE). Lateritic nickel deposits develop into limonite, saprolite, and bedrock zones with distinct geochemical characteristics. The limonite zone is characterized by Fe enrichment with Fe contents ranging from 26.0–58.0%, Ni 0.56–1.64%, SiO_2 0.15–21.22%, and MgO 0.2–19.19%, whereas the saprolite zone represents the main horizon of Ni enrichment with Ni contents ranging from 0.27–2.75%, Fe 5.27–36.8%, SiO_2 8.13–42.3%, and MgO 8.11–37.3%. The bedrock zone reflects fresh ultramafic rock characteristics with Ni contents of 0.13–1.06%, Fe 3.31–11.7%, SiO_2 19.77–46.8%, and MgO 18.13–48.63%. The results indicate that lithology and geomorphology play important roles as controlling factors in laterite profile development, major and minor element distribution, and nickel enrichment. Harzburgite lithology tends to produce more developed laterite profiles and relatively higher Ni grades compared to serpentinite due to silica enrichment associated with higher serpentinization processes. Geomorphological control is indicated by thicker laterite profile development in relatively gentle to undulating morphologies, where more stable slope conditions support the accumulation of weathered materials and water infiltration, resulting in more intensive lateritization and Ni enrichment processes, whereas steeper slopes are dominated by erosion processes that produce thinner laterite profiles. Based on the study results, the formation and characteristics of lateritic nickel deposits in the study area are controlled by the interaction between parent rock lithology, geomorphology, and supergene geochemical processes, which influence laterite zonation differentiation and nickel enrichment, particularly within the saprolite zone.

Keywords: *lateritic nickel deposits, laterite geochemistry, geological control, Obi Island.*