

ABSTRAK

GEOLOGI DAN ANALISIS MOBILITAS UNSUR DENGAN METODE *MASS TRANSFER FUNCTION* PADA PROFIL NIKEL LATERIT BLOK “R” DAERAH WASILE SELATAN, HALMAHERA TIMUR, MALUKU UTARA

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Indonesia merupakan produsen bijih nikel terbesar dunia, namun kajian geokimia endapan nikel laterit komprehensif di Pulau Halmahera masih terbatas. Penelitian dilakukan pada daerah Wasile Selatan, Halmahera Timur, dengan tujuan mengidentifikasi kondisi geologi, mengkarakterisasi profil fisik dan geokimia, serta menganalisis mobilitas unsur (Ni, Fe, Mg, Si, Al, Co, Cr, Ca, Mn) menggunakan pendekatan *mass transfer function*. Metode yang digunakan meliputi pemetaan geologi permukaan, analisis petrografi, geokimia *X-Ray Fluorescence* (XRF) dengan *trenching* tiap 2 meter pada dua profil, serta perhitungan *mass transfer function* memakai elemen referensi imobil titanium ($\tau_{Ti,X}$). Hasil menunjukkan daerah penelitian tersusun atas Satuan Serpentinit berumur Jura Awal dengan pola pengaliran paralel yang dikontrol struktur sesar *oblique* baratlaut–tenggara dan timurlaut–baratdaya. Berdasarkan perhitungan *mass transfer function*, unsur di daerah penelitian terbagi menjadi tiga kategori mobilitas. Ca dan Mg bersifat sangat *mobile* dengan nilai τ mendekati -1 di zona dekat permukaan akibat pelindian intensif. Sebaliknya, Fe, Al, dan Cr bersifat *immobile*, mengalami pengayaan residual signifikan di zona limonit dengan nilai *gain* berturut-turut +3,78, +3,47, dan +3,61 karena keberadaan spinel. Sementara itu, Ni terakumulasi di saprolit hingga +3,86, Si mengendap kembali di saprolit setelah terlindi dari limonit, serta Co dan Mn terkonsentrasi di batas bawah limonit sebagai Mn-oksida bersifat *semi-mobile* dengan *gain* masing-masing +3,22 dan +3,93. Perbedaan pola mobilitas antar profil ini dikendalikan oleh kondisi perbedaan mineralogi batuan dasar dan kondisi geokimia lingkungan.

Kata kunci: *Mass transfer function*, Mobilitas Unsur, Nikel Laterit, Serpentinit, Wasile Selatan

ABSTRACT

GEOLOGY AND ELEMENTAL MOBILITY ANALYSIS USING THE MASS TRANSFER FUNCTION METHOD IN THE NICKEL LATERITE PROFILE OF BLOCK “R”, SOUTH WASILE AREA, EAST HALMAHERA REGENCY, NORTH MALUKU

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Indonesia is the world's largest producer of nickel ore, yet comprehensive geochemical studies of nickel laterite deposits on Halmahera Island remain limited. This research was conducted in the South Wasile area, East Halmahera, with the objectives of identifying geological conditions, characterizing physical and geochemical profiles, and analyzing element mobility (Ni, Fe, Mg, Si, Al, Co, Cr, Ca, Mn) using a mass transfer function approach. The methods employed include surface geological mapping, petrographic analysis, X-Ray Fluorescence (XRF) geochemical analysis with trenching at 2 meter intervals across two profiles, and mass transfer function calculations using titanium ($\tau_{Ti,X}$) as the immobile reference element. The results indicate that the study area is composed of a Serpentinite Unit of Early Jurassic age, with a parallel drainage pattern controlled by oblique fault structures oriented northwest–southeast and northeast–southwest. Based on mass transfer function calculations, elements in the study area are classified into three mobility categories. Ca and Mg are highly mobile, with values τ approaching -1 in the near-surface zone due to intensive leaching. Conversely, Fe, Al, and Cr are immobile, undergoing significant residual enrichment in the limonite zone with gain values of +3.78, +3.47, and +3.61, respectively, due to the presence of spinel. Meanwhile, Ni accumulates in the saprolite up to +3.86, Si reprecipitates in the saprolite after being leached from the limonite, and Co and Mn are concentrated at the lower boundary of the limonite as manganese oxides, exhibiting semi-mobile behavior with gains of +3.22 and +3.93, respectively. These differences in mobility patterns between profiles are controlled by variations in bedrock mineralogy and environmental geochemical conditions.

Keywords: Mass transfer function, Elemental Mobility, Nickel Laterite, Serpentinite, South Wasile