Behaviour of Cr in laterites and implications for Ni laterite formation

JENS C. KRÜGER[1], RACHAEL H. JAMES[1], RICHARD HERRINGTON[2], PETE BROWN[3], CHRISTOPHER R. PEARCE[4] AND STEVE ROBERTS[1]

[1]Ocean and Earth Science, National Oceanography Centre, University of Southampton Waterfront Campus, Southampton SO14 3ZH, UK
[2]Department of Mineralogy, Natural History Museum, Cromwell Road, London SW7 5BD, UK
[3]Royal School of Mines, Imperial College London, South Kensington Campus, London SW7 2AZ, UK
[4]Marine Geoscience, National Oceanography Centre, University of Southampton Waterfront Campus, Southampton SO14 3ZH, UK

Laterites form during intense tropical to semi-arid weathering and, when developed on ultramafic rocks, they can form economically important nickel deposits. Tectonic setting, climatic conditions, availability of water and redox processes are the main factors that control the evolution of a laterite deposit. During the weathering process, major and trace elements are redistributed, and may be enriched or depleted in different horizons. Oxidative weathering fractionates chromium (Cr) isotopes, producing an isotopically heavy and mobile Cr^{6+} pool which is redistributed and partly accumulated in the upper part of the weathering profile. Cr is retained in the Ni-bearing soil and saprolith horizons and has a relatively low $\delta^{53}Cr$ signature. Deciphering Cr pathways can therefore help to identify alteration and lateritisation mechanisms and may be a useful tracer for supergene ore deposits.

Here we present a geochemical and chromium isotopic characterisation of a laterite profile from Hematite Pit of the Çaldağ oxide nickel laterite deposit in the Aegean region of west Turkey. High Cr concentrations (up to 3.6 wt%) in the upper portions of the profile, in particular in clay veins in the silicified limonite horizon, indicate a high mobility of Cr during the formation of the deposit. Chromium spinel is the major source of the redistributed Cr pool, supported by observations of highly altered and partly dissolved mineral grains throughout the weathering profile. Analyses of Cr isotopes are underway. Our study contributes to the understanding of oxidative weathering processes in the critical zone and knowledge of fluid-rock interactions and the role of Cr during laterite formation.