Fate of Cr in a Ni Laterite Mine Catchment, Palawan, Philippines

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The Philippines remain as one of the world's leading producer of nickel (Ni) ore. These ores are derived from Ni laterites formed through prolonged and pervasive weathering of ultramafic rocks under tropical to subtropical conditions. Since these deposits result from surficial processes, the ores are extracted through strip mining resulting to large opencast areas which affect the quality of the surrounding aqueous environments. With the high chromium (Cr) concentrations of ultramafic rocks (~2,200 mg/kg Cr) and derived Ni laterite deposits (up to 10,500 mg/kg Cr) [1], the present work investigated on the fate of Cr, whose hexavalent species is a known toxic pollutant and carcinogen, in surface waters draining a Ni mine in Palawan, Philippines. To understand the controls on Cr cycling, X-ray diffraction (XRD), X-ray fluorescence spectroscopy (XRF), and sequential extraction of ores and tailings, UV-Vis spectrophotometry, ion chromatography (IC), and inductively coupled plasma mass spectrometry (ICP-MS) of surface waters combined with reaction path modelling via the Geochemist's Workbench have been conducted. Results show that Cr in the laterites (up to 33,000 mg/kg) is mostly associated with the residual fraction followed by amorphous Fe-oxides, organic matter, and least in the exchangeable fraction. Exchangeable Cr is mainly under the hexavalent form as detected in the surface waters where dissolved Cr is dominantly Cr(VI) with concentrations up to 0.18 mg/L. Mine waters have significantly higher Cr(VI) concentrations than the control stations (0.008 mg/L) and the average dissolved Cr in surface waters (0.001 mg/L) [2]. This suggests that ores and tailings in the mine area are potential sources of Cr whose concentration is magnified during the rainy season. The present study is an important contribution to the understanding of water-rock interactions in Ni laterites, helpful to the management of Ni mining catchments.

[1] Chrysochoou et al. (2016), *Curr. Poll. Rep.* 2, 224-235.
[2] Martin & Whitfield (1983), *Tr. Met. Se. Wat.* 9, 265-296.