Mineralogical and Geochemical Mechanisms Concentrating Scandium in Lateritic Deposits

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Sc is one of the most valuable elements of the periodic table but the uptake of promising applications depends on a greater availability of Sc on the market [1]. Lateritic weathering over ultramafic rocks in Syerston-Flamington (NSW, Australia) has led to deposits with concentrations among the highest known in the world, which are expected to become leading sources of Sc [2]. A better knowledge of the formation of those deposits is crucial for the exploration, mining and processing of these ore deposits.

A detailed mineralogical and geochemical study of those lateritic profiles shows that the parent rock is a phlogopite-bearing pyroxenite. The Sc concentration of this parent rock is high (about 80 ppm) compared to average crust (*ca*. 22 ppm [3]). Along the lateritic profile, major- and trace-element geochemistry shows that Sc content is correlated with the content of low-solubility elements. In the saprolite, Sc concentration is still low (*ca*. 100 ppm in average) and diffuse. Sc is largely concentrated in the lateritic duricrust, with average bulk concentrations of *ca*. 400 ppm, reaching up to 700 ppm. Scanning electron microscopy and electron microprobe analysis show a correlation of Sc concentration with Fe oxides in which it can reach 1,500 ppm. X-ray diffraction shows that goethite (α-FeO(OH)) and hematite (α-Fe_2O_3) are the major phases in these Sc-rich parts of the profile.

Anomalously high Sc concentrations in the bedrock are enhanced by the dissolution of primary clinopyroxenes and trapping of Sc by secondary Fe (oxyhydr)oxides leading to the formation of a world-class deposit holding a Sc resource of 3.1 million tons at 434 ppm Sc on average.

[1] Emsley (2014) *Nat. Chem.* **6**:1025, [2] USGS (2015) *Mineral Commodity Summaries* pp. 140-141, [3] Rudnick & Gao (2003) *Treatise on Geochemistry* vol **3**, p. 46.