# Mineralogical hosts and speciation of As, Cr, and V in alkaline tailings during pH neutralisation

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Tailings are geochemically dynamic Earth materials hosting complex assemblages of minerals, at extremes of pH and salinity. Bauxite residue (alumina refining tailings) is a highly alkaline (pH 12), saline tailings material, containing elevated concentrations of As, Cr, and V [1]. Although remediation technologies focussing on pH neutralisation are well-developed, the speciation and mobility of trace elements such as As, Cr, and V in response to remediation is poorly understood. In general, current understanding of trace element geochemistry at highly alkaline pH is poor, and although environmentally relevant concentrations of As (100-300 ppm), Cr (400-1500 ppm), and V (200-1100 ppm) are commonly found in bauxite residue worldwide, little is known about: (a) the mineral assemblages in bauxite residue that host As, Cr, and V; (b) how these elements are hosted (e.g. surface complexation, isomorphous substitution); and (c) how their speciation and mobility may respond to changes in pH, salinity, and redox status during remediation [1,2], particularly microbially-driven pH neutralisation by fermentation of organic carbon [3].

Here, we identify mineralogical hosts for these elements in bauxite residues by analysing a suite of bauxite residue samples from ten refineries worldwide prior to remediation; and analysing bauxite residue samples at multiple pH values during remediation under various techniques to build an understanding of how speciation and mobility of As, Cr, and V responds to changes in pH, salinity, and redox status. X-ray absorption near edge spectroscopy, X-ray diffraction, and wet chemical techniques (spectrophotometry, total element digests) were used to quantify the total concentrations of elements associated with the bauxite residue matrix, their mineralogical hosts, and their speciation. These results will extend current understanding of trace element geochemistry at highly alkaline pH and provide a robust basis for analysis of potential environmental impacts associated with various tailings management approaches.

[1] Grafe & Klauber (2011) *Hydrometallurgy* **108**, 46-59. [2] Grafe *et al.* (2011) *Hydrometallurgy* **108**, 60-79. [3] Santini *et al.* (2016) *Environ. Sci. Technol.* **50**, 11164-11173.