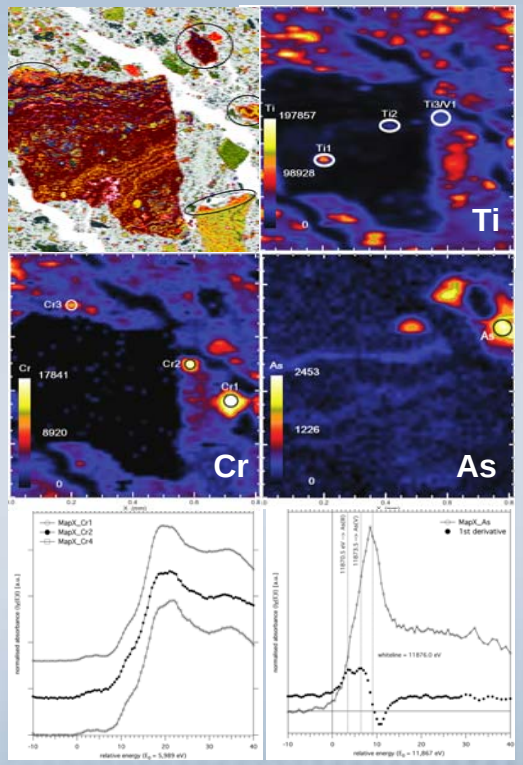
Red Mud- Assessment of Bauxite Residue for Reuse in the Environment

M. Gräfe[1], M. Landers[1], R. Tappero[2], P. Austin[1], B. Gan[1], A. Grabsch[1], and C. Klauber[1]
[1]CSIRO; [2]NSLS-BNL

- Bauxite residues (BR) – solid remnants that remain after treating bauxite (Aluminum ore) with caustic solutions at elevated temperature to extract AlOx (i.e., Bayer Process) – have been accumulating for over 120 years, and global production has reached 120 million tons per annum (Mtpa) making BR the most voluminous mineral residue on the planet (~ 2 billion tons) and the potential for its reuse an attractive option.

- By applying a suite of hard X-ray microprobe techniques such as X-ray fluorescence imaging (XRF), X-ray absorption spectroscopy (XAS), and X-ray diffraction (XRD), the CSIRO/BNL team determined the mineralogical associations and chemical speciation of toxic metals (e.g., As and Cr) in untreated BR at the micron scale. Chromium was present in the non-toxic Cr(III) form and incorporated with stable iron oxides. Arsenic was detected in both As(III) and As(V) oxidation states, but these were not occluded in stable mineral assemblages.

- If bauxite residues are to be applied outside their impoundments both short and long term ramifications of such applications with respect to the fate of trace metals must be understood. These measurements are important to help industry assess the reuse of untreated BR in secondary industrial streams or as soil amendments.



A petrographic section of an untreated bauxite residue from a western Australian alumina refinery; XRF images show the elemental distributions for As, Cr, and Ti, and complimentary XRD and XAS measurements reveal their mineralogical associations and molecular speciation.

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