Reduction of hexavalent chromium by natural iron-rich saponite

G. PARTHASARATHY[1], B.M. CHOUDARY[2], R. SRINIVASAN[1] AND A.C. KUNWAR[2]

National Geophysical Research Institute, Uppal Road, Hyderabad – 500007, India. gpngri@rediffmail.com
Indian Institute of Chemical Technology, Hyderabad – 500 007, India. choudary@iict.ap.nic.in

Hexavalent chromium in ground water is known to be environmentally hazardous. In this oxidation state, Cr (VI) is highly toxic and moblie. Treatment of hexavalent chromium bearing waters aims at reduction of Cr (VI) to Cr (III), which is non-toxic and immobile. A green coloured clay minerals occring on the walls of amygdaloidal cavities and along fractures in the Deccan Flood Basalts at Killari, Maharashtra, India, has been identified as iron-rich saponite.

The iron-rich saponite has a chemical composition $[Na_{0.60}K_{0.40}\,Ca_{0.47}]$ $\{Mg_{2.05}Fe_{3.95}\}$ $(Si_{6.45}Al_{1.55})$ $O_{20}(OH)_4$. The iron content was determined to be fully ferrous. The X-ray diffraction studies on the oriented clays sample show d_{001}= 1.70 nm and powder pattern yielded b_0= 0.9275 (0.002) nm conform to that of ferrous saponite.

Differential thermal and thermogravimetric analyses show endothermic peaks due to dehydroxylations at 120-150 and 800-860°C and a weak exothermic peak at 950°C. These are commonly observed in smectities. We have also characterised the sample by using solid state ^{29}Si and ^{27}Al- magic angle spin NMR spectroscopy. The MAS-NMR expereiemnts show a ^{27}Al chemical shift at 57.69 ppm representing tetravalent aluminum and ^{29}Si-chemical shift of –102.19 ppm revealing tetrahedral silicon. These four-fold coordinated aluminum and silican indicate that the sample is a pure trioctahedral clay. To our knowledge this is the first report on the occurrence of iron-rich saponite from India.

In order to explore the possible application of this clay mineral for environmental ground water management, we have acrried out X-ray phton spectroscopic and diffuse reflectance spectroscopic measurements on the dicromate soultions, in both unteated and treated form. The dichromate solution treated with the saponite samples show remarkable capability of not only adsorption of heaxavalent chromium but also reduction of hexavalent to trivalent chromium. These trivalent state of chromium was clearly charcterised by XPS and DRS spectra collected at room –temp[erature.

The Geochemistry of the Euroa Mafic Volcanics: Implications for small-scale mantle heterogeneities beneath Victoria, Australia

B. T. PAUL[1], J. M. HERGT[1], J. D. WOODHEAD[1] AND G. N. PHILLIPS[1,2]

[1]School of Earth Sciences, The University of Melbourne, VIC, 3010, Australia
[2]CSIRO Exploration & Mining, Clayton South, VIC, 3169, Australia b.paul@pgrad.unimelb.edu.au

Cainozoic mafic volcanism in Victoria, Australia, is represented by the tholeiitic to alkalic basaltic rocks of the Older Volcanics, Macedon-Trentham rocks, and Newer Volcanics, as well as a small leucite-bearing occurrence at Cosgrove. These provinces converge in the vicinity of Euroa, where the association between them is poorly understood.

Petrogenetic models ascribed to these rocks commonly suggest the interaction of mantle-plume derived melts with the subcontinental lithosphere (e.g. Price et al., 1997).

New bulk-rock major, trace element and Sr, Nd and Pb isotope data have been acquired for twenty samples from the four volcanic provinces in the vicinity of Euroa. On the basis of incompatible element characteristics and isotope ratios, processes such as magma mixing and crustal assimilation have been ruled out in their genesis, and mantle source heterogeneity on a scale of less than 25 km beneath the Euroa area is proposed.

Broad-scale similarities between the study samples (including the Macedon-Trentham and Cosgrove rocks) and the Newer Volcanics have been identified. The likelihood that heterogeneity on the scale now documented in the vicinity of Euroa extends to other regions of the Newer Volcanics raises questions concerning the influence of the so-called ‘Mortlake Discontinuity’ on the latter and, consequently, any requirement for the involvement of lithospheric mantle in the magmagenesis of any of these rocks. It is proposed here that all magmas may have been derived from a heterogeneous mantle source region within the asthenosphere, and that further work may record more faithfully the complexity and extent of variation within this region of the mantle.

Reference

Price, R. C., Gray, C. M. & Frey, F. A., 1997. Strontium isotopic and trace element heterogeneity in the plains basalts of the Newer Volcanics Province, Victoria, Australia. *Geochim. Cosmochim. Acta.*, **61**, pp. 171-192.