

On the origin of Li isotope signatures in magmatic rocks from the Central Bohemian Plutonic Complex

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Lithium isotopes are used to provide new constraints on the nature of mafic mantle and felsic crustal components from the Central Bohemian Plutonic Complex (CBPC) comprising several geochemically distinctive suites [1,2]. The oldest suite in the CBPC, comprising calc-alkaline (CA) gabbros to granodiorites, is the most primitive unit in terms of incompatible element contents as well as Sr and Nd isotope compositions. The younger high-K to shoshonitic monzonites and I-type granodiorites-granites (HK) are more magnesian but are also enriched in incompatible elements, and have more radiogenic Sr than the former suite. Ultrapotassic (UK) plutonic and dyke rocks comprise melasyenites to melagranites (durbachite suite) and minettes; these rocks are magnesian and Cr-rich despite variable SiO₂, elevated contents of incompatible elements and extremely radiogenic Sr and unradiogenic Nd. Subordinate S-type granodiorites to granites intruding the older members of the CBPC are of broadly similar age as the UK suite.

Li contents range from 8 to 76 ppm and are highly variable within all suites. The lowest abundances have been detected for CA rocks and increase in order from HK to UK to S-type granitoids. Within the CA and HK suites, Li contents increase from mafic to felsic members. The entire sample set exhibits a surprisingly narrow range of $\delta^7\text{Li}$ values (-2.2 to +2.9‰) with an average $\delta^7\text{Li}$ of +0.1‰ that corresponds to the average of upper continental crust [3]. $\delta^7\text{Li}$ values between -1 and +1‰ are observed even for mantle-derived mafic members in the CA, HK and UK suites. This may be explained by partial melting of an anomalous mantle source, which interacted with fluids and/or melts derived from subducted crust, followed by variable hybridization with felsic melts from metasedimentary units [1,4].

[1] Holub *et al.* (1997) *J. Geol. Sci.* **31**, 27; [2] Janoušek *et al.* (2004) *Lithos* **78**, 67; [3] Teng *et al.* (2004) *Geochim. Cosmochim. Acta* **68**, 4167; [4] Janoušek & Holub (2007) *Proc. Geol. Assoc.* **118**, 1.

Fluid controlled alteration of ilmenite to rutile

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In nature ilmenite initially undergoes weathering through oxidation and removal of Fe to form an apparently continuous series of compositions from ilmenite to pseudorutile (ideally Fe₂Ti₃O₉) as a transitional phase [1]. The Fe is assumed to diffuse out through the unaltered oxygen lattice. In the second stage, pseudorutile undergoes incongruent dissolution, resulting in the formation of rutile, hematite and goethite [2]. Here we report the results of ilmenite alteration experiments with ilmenite cubes in sulphuric and hydrochloric acid solutions at 150°C for 5 to 31 days. The resulting products are studied by electron microprobe, scanning and transmission electron microscopy. The alteration begins at the original ilmenite crystal surface and has also taken place along fractures in the ilmenite. However, the fracture pattern did not exist before the reaction and appears to have been generated by the reaction. The fracturing is possibly driven by volume changes associated with dissolution of ilmenite and reprecipitation of a product phase from the interfacial solution. Element distribution maps and chemical analyses of the reaction products within the fractures show marked depletion in Fe and Mn and a relative enrichment of Ti. However the results of these bulk chemical analyses, do not correspond to any stoichiometric composition, and may represent mixtures of TiO₂ and Fe₂O₃. This is being investigated further in the transmission electron microscopy. The chemical and structural changes induced by reactions with fluids at relatively low temperatures take place by discrete dissolution-reprecipitation mechanisms rather than by solid state diffusion. Components from both the fluid and the parent solid are incorporated in the product and therefore both the chemical and structural changes in the solid phases of the product are controlled by the fluid composition.

[1] Grey and Reid (1975) *The American Mineralogist* **60**, 898-906. [2] Schroeder *et al.* (2002) *The American Mineralogist* **87**, 1616-1625.