Lithium isotope variation in waters and sediments from lake Donggi Cona and its catchment, China

M. WEYNELL[1]*, U. WIECHERT[1] AND J.A. SCHÜSSLER[2]

[1]Freie Universität Berlin; Germany (*correspondance: marc.weynell@fu-berlin.de)
[2]GFZ German Research Centre for Geosciences, Helmholtz Centre Potsdam, Potsdam, Germany

Lithium isotopes are a tracer of weathering at the Earth's surface, as documented from catchments with basaltic [e.g., 1], granitic [e.g., 2] and mixed (carbonate, volcanic and sedimentary) lithologies [e.g., 3]. In this study we examine the behaviour of lithium (Li) and its isotopes in the catchment of lake Donggi Cona, China, which is an open oligotroph freshwater lake in the northeastern part of the Tibetan Plateau. The main inflow drains an area with a high proportion of carbonate rocks and a second inflow is sourced from a catchment with a larger quantity of silicate rocks. In addition, warm springs contribute to the Li budget of the lake. Water chemistry is mainly controlled by carbonate dissolution. With the exception of spring waters, pH values are constant at ~8.8. The dissolved load (DL) of every compartment shows distinct δ^7Li values (relative to L-SVEC): main inflow +17.0 ; minor inflow +20.7 ; warm springs +11.5 and lake +16.9. Suspended loads and river sediments give δ^7Li values from -2.1 to +3.1. However, lake sediments exhibit a narrow range of -1.1 to -0.5 for distal sample locations. Detrital influenced lake sediments show positive δ^7Li values of +1.7 and +2.9. Li concentrations (DL) are 37 ng/ml in the lake, 7 to 12 ng/ml in the main inflow, 33 ng/ml in the second inflow and 125 ng/ml in warm spring waters. Li concentrations of suspended loads and sediments are in the range of 20 to 55 μg/g. Lithium concentrations and isotope ratios of the lake can be explained by mixing of waters from the 3 sources and by evaporation. High δ^7Li values (DL) in the tributaries can be explained by incorporation of light Li into secondary minerals formed in the catchments, which is consistent with low δ^7Li values of complementary sediments and suspended loads. However, compared with basaltic catchments, e.g. [1], Li concentrations in the waters are higher and δ^7Li values are lower. We suggest that this is due to a distinguished lithology and lower soil formation rates controlled by the climatic regime on the northeastern Tibetan Plateau.

[1] Vigier *et al.* (2009) EPSL 287, 434-441; [2] Lemarchand *et al.* (2010) GCA 74, 4612-4618; [3] Millot *et al.* (2010) GCA 74, 3897-3912.

Regional-scale metasomatism in the Fortescue Group volcanics, Hamersley Basin, Western Australia, constrained through phase equilibria modelling

A.J.R. WHITE*, M. LEGRAS, R.E. SMITH AND P. NADOLL

CSIRO Earth Science and Resource Engineering, Australian Resources Research Centre, 26 Dick Perry Avenue, Kensington, WA 6151, Australia (*correspondance: alistair.white@csiro.au)

Mafic to intermediate volcanic rocks of the Fortescue Group form the lowermost stratigraphic unit of the 100,000 km^2 Hamersley Basin on the southern margin of the Archaean Pilbara Craton, Western Australia. A regional burial metamorphic gradient extends across the basin from prehnite-pumpellyite facies in the north to greenschist facies in the south [1]. Superimposed on this metamorphic gradient is a heterogeneous distribution of metasomatized rocks characterized by pumpellyite±epidote+quartz assemblages.

Whole-rock geochemical data indicate metasomatism is associated with significant depletions in alkali elements, Mg and first transition series metals, with enrichments in Si and Ca. Such geochemical trends are compatible with sub-sea floor hydrothermal circulation [2].

Phase equilibria modelling with the program THERMOCALC [3], in subsets of the model system Na_2O-CaO-K_2O-FeO-MgO-Al_2O_3-SiO_2-H_2O-Fe_2O_3 (NCKFMASHO), place P-T constraints on the conditions of regional metamorphism and regional-scale metasomatism. 'Least altered', regional metamorphic rocks show a temperature gradient from <200°C in the north, to > 325°C in south, consistent with predicted burial-derived thermal gradients [1]. Highly altered, metasomatized rocks show consistent temperatures of 275 – 300°C, and pressures > 2.5 kbar, across the entire basin.

The calculated temperature for the metasomatized rocks is interpreted to represent the temperature under which hydrothermal alteration occurred. The consistent P-T estimates and geochemical data suggest a common hydrothermal event acting across the entire Hamersley Basin, covering length scales of hundreds of kilometres. This has important implications for the size of metasomatic systems in other metamorphic terranes.

[1] Smith *et al.* (1982) *J. Pet* **23**, 75-102. [2] Hannington *et al.* (2003) *Miner Deposita* **38**, 393-422. [3] Powell & Holland (1988) *J. Met. Geol.* **6**, 173-204.

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