

## Li and B isotopes as tracers for crust/mantle vs. slab influences in western Mexico

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While both B and Li are enriched in sediments and altered ocean crust reaching trenches, their signatures in continental arcs often reflect diverse source and process effects. In the western Trans-Mexican volcanic belt (TMVB), a young, hot downgoing plate minimizes inputs of low- $T^\circ$  slab components, permitting the study of mantle and crustal contributions to the Li and B signatures of erupted lavas.

B contents and B/Be ratios are low (<10 ppm; B/Be < 10) in mafic TMVB lavas, while evolved lavas reach values  $\geq 50$  ppm, indicating B-rich crustal inputs [1].  $\delta^{11}\text{B}$  in TMVB lavas are surprisingly high, with values up to +10.6 ‰ in some Colima Graben minettes. This heavy  $\delta^{11}\text{B}$  signature, observed primarily in rift-related alkaline lavas, may reflect relict slab B remobilized during extension, as the low  $P/T^\circ$  conditions under which high  $\delta^{11}\text{B}$  boron can be transferred from slab to mantle are unlikely to occur during TMVB subduction. Evolved lavas have markedly lower  $\delta^{11}\text{B}$  (-1.6 to -9.9‰), indicating that high B crustal rocks can have very low  $\delta^{11}\text{B}$  signatures, so crustal assimilation can result in lowered  $\delta^{11}\text{B}$ . All TMVB lavas thus far examined seem to reflect mixing between high  $\delta^{11}\text{B}$  alkaline lava (old slab?) and low  $\delta^{11}\text{B}$  crustal end-members.

In contrast, Li and  $\delta^7\text{Li}$  are insensitive to either present or older slab influences in the western TMVB. Li contents are similar in mafic lavas from across the arc, and while Li/Yb ratios are elevated in western TMVB centers, this appears to reflect Yb depletions due to residual amphibole  $\pm$  garnet during melting.  $\delta^7\text{Li}$  in the western TMVB, at +3 to +5‰, is similar to arcs globally [2], and likely indicates that here, as elsewhere, the upper mantle Li reservoir dominates, and/or the signature for slab-derived Li is not markedly different [3,4]. Evolved TMVB lavas move to somewhat lower  $\delta^7\text{Li}$ , reaching values similar to those measured in entrained crustal xenoliths, and approaching average crustal  $\delta^7\text{Li}$  [5].

[1] Hochstaedter *et al.* (1996) *GCA*. [2] Tomascak *et al.* (2002) *EPSL*. [3] Tomascak *et al.* (2000) *Geology*. [4] Benton *et al.* (2004) *G<sup>3</sup>*. [5] Teng *et al.* (2005) *Chem Geol*.

## Chemical weathering of carbonates and silicates in the Han River basin, South Korea

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A detailed investigation of the fluvial geochemistry of the Han River system allows us to estimate the rates of chemical weathering and the consumption of  $\text{CO}_2$ . The Han River drains approximately 26,000  $\text{km}^2$  and is the largest river system in South Korea in terms of both water discharge and total river length. It consists of two major tributaries: the North Han River (NHR) and the South Han River (SHR). Distinct differences in basin lithology (silicate vs. carbonate) between the NHR and SHR provide a good natural laboratory in which to examine weathering processes and the influence of basin geology on water quality. The concentrations of major elements and the Sr isotopic compositions were obtained from 58 samples collected in both summer and winter along the Han River system in both 2000 and 2006. The concentrations of dissolved loads differed considerably between the NHR and SHR; compared with the SHR, the NHR had much lower total dissolved solids (TDS), Sr, and major ion concentrations but a higher Si concentration and  $^{87}\text{Sr}/^{86}\text{Sr}$  ratio. A forward model showed that the dissolved loads in the NHR came primarily from silicate weathering ( $55 \pm 11\%$ ), with a relatively small portion from carbonates ( $30 \pm 14\%$ ), whereas the main contribution to the dissolved loads in the SHR was carbonate weathering ( $82 \pm 3\%$ ), with only  $11 \pm 4\%$  from silicates. These results are consistent with the different lithologies of the two drainage basins: silicate rocks in the NHR versus carbonate rocks in the SHR. Sulfuric acid derived from sulfide dissolution in coal-containing sedimentary strata has played an important role in carbonate weathering in the SHR basin, unlike in the NHR basin. The silicate weathering rate (SWR) was similar between the NHR and SHR basins, but the rate of  $\text{CO}_2$  consumption in the SHR basin was lower than in the NHR basin due to an important role of sulfuric acid derived from pyrite oxidation.

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