B-isotope variations in tourmaline in the Varuträsk rare-element pegmatite: the role of mica

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The Varuträsk rare-element pegmatite in northern Sweden is a classic and typical example of highly fractionated LCT-type pegmatites, with a well-developed internal zoning pattern composed of border, wall and intermediate zones and a quartz core. Major and trace element fractionation trends of feldspars, micas, tourmaline, and columbite-tantalite correlate well with the internal zoning pattern. This pegmatite therefore forms a good basis for a case study on the use of boron isotopes in tourmaline to record processes of pegmatite internal evolution.

Early and mid-stage tourmalines from Varuträsk show a systematic increase in $\delta^{11}B$ values from -14.6 to -6.2 ‰ during crystallization of the primary pegmatite zones. This trend toward ^{11}B-enrichment in the pegmatite magma is opposite to that expected for fluid exsolution or progressive crystallization of tourmaline, and all geochemical and textural evidence suggests a closed-system crystallization without significant influx of external fluids with heavy B-isotope signature. We suggest that crystallization of abundant muscovite in the Varuträsk wall zone depleted the magma in ^{10}B, driving the residual melt toward higher $\delta^{11}B$ values. Rayleigh fractionation models based on measured B contents of 220 ppm in muscovite and 3.4 wt. % in tourmaline show that the muscovite/tourmaline mass ratio required to explain the observed shift in $\delta^{11}B$ values is about 200:1, which is consistent with the modal composition of the wall zone assemblage.

The assumption is commonly made that in rocks where tourmaline is present, it plays the dominant role in B-isotope evolution. This assumption is likely to be true for most crystalline rocks but our study shows that it may not be the case for assemblages with a high modal abundance of micas, as in many pegmatites and related rocks such as greisens.

Speleothem reconstruction of sea-level at Bermuda over the last climatic cycles

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It is now widely accepted that a sea-level rise is associated with global warming [1]. However, its rate, and the height it might reach by the end of the century remain poorly constrained. This study aims to provide better information and precision on the rates and magnitudes of past sea-level change, for periods when sea-level is close to its modern value, using speleothems from Bermudian caves. Speleothems interrupt their growth when they are submerged by sea-water, so U-Th dating periods of growth in coastal sites allows the reconstruction of past sea-level variation versus absolute time [e.g. 2,3,4]. We will present new MC-ICP-MS U-Th ages from a set of speleothems (stalagmites, stalactites, flowstones) collected from -6 to +12 m versus modern sea level from several caves in this northern Atlantic archipelago.

Relative sea-level (RSL) at Bermuda is of particular interest because it is at a distance from northern hemisphere ice sheets where the isostatic response to ice-unloading is uncertain. RSL reconstruction therefore provides both an indicates of possible rates of sea level change, and a test for glacial-isostatic-adjustment (GIA) models.

Our results provide constraint on sea level over the last climatic cycles, and in particular periods when sea level was equivalent or higher than today, at Bermuda which we place in the context of previous assessments of eustatic change, and of GIA models.

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