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Split stream bulk-rock elemental and boron isotopes analysis by LA-SF-ICPMS

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Applications of the boron isotope system expanded from the analysis of B-rich phases (e.g., tourmaline, white mica) to low-B ones (e.g., basaltic glass, carbonates). Determination of the isotopic composition by solution methods is challenging not least because of potential lab contamination. Especially for low-B samples, dedicated laboratory infrastructure is required and the accessible lower concentration limit is determined by the sample contamination during preparation.

As an alternative to solution analysis of whole-rock silicate samples, we test the analyses of nanoparticulate (Nano-ppp) and microparticulate pressed powder pellets (Micro-ppp) by Laser ablation MC-ICPMS. The aim was to optimize the procedures to achieve low detection limits that would allow analysis of samples that contain less than 3 µg/g boron.

For Nano-ppp preparation, we milled 3–5 g sample material with MilliQ water in a planetary mill (Pulverisette 5, FRITSCH) to achieve homogenous nanoparticulate powder, which we pressed to pellets of 1 cm in diameter. To control boron contamination, we analysed the B content and isotope composition in milling balls of 5 different materials and that of different MilliQ waters. Sintered corundum with boron concentration of <0.3 µg/g was selected as the ideal milling material.

To prepare Micro-ppp, we pressed approximately 0.2 g of the sample into a microparticulate pellet, which we stabilized with a resin. To address the possibility of contamination, we tested various types of resin and ultimately chose a resin with a boron concentration of approximately 0.2 µg/g.

The nano-ppp and micro-ppp procedures were both applied to a variety reference materials of known B isotope composition. Analyses for elemental and isotope composition were performed simultaneously using split-stream laser-ablation MC-ICPMS and SC-ICPMS. The advantages and disadvantages of each of the two methods will be discussed in the presentation.