BSE reservoirs: Insights from Nb/Ta of rutile-bearing eclogites

A. Schmidt, S. Weyer, G.P. Brey

Institut für Geowissenschaften, Facheinheit Mineralogie, JWG-Universität Frankfurt, alexander.schmidt@em.uni-frankfurt.de

High field strength elements (HFSE), in particular Nb and Ta, are commonly depleted in arc basalts and the continental crust. This implies that Nb and Ta are retained in the mantle by subduction and during formation of arc magmas usually resulting in highly variable Nb/Ta in arc basalts and andesites. Depletion of Nb and Ta and fractionation of the Nb/Ta ratios could occur because of either low and differing fluid-mobility during dehydration of subducted oceanic crust or by mineral phases containing Ti (like rutile) which retain most of the Nb and Ta. Eclogites as residues of a dehydration or melting process should be enriched in Nb and Ta. The Nb/Ta ratio of eclogites might be a monitor for this depletion process. Fractionation of Nb/Ta during subduction is supported by the low Nb/Ta ($\approx$ 12) of crustal rocks of various ages (e.g. [1], [2], [Münker et al., unpublished]) which is significantly lower than the chondritic value of 19.9 [2], but also lower than the estimated Nb/Ta of BSE ($\approx$ 14 [2]). While the difference between chondrites and BSE might be explained by Nb in the core, this model can not explain a sub-BSE Nb/Ta of the crust. Eclogites might be a reservoir for these elements balancing BSE abundances and ratios as earlier proposed by [3].

We measured trace element and HFSE concentrations of garnet, clinopyroxene, rutile and bulk rocks from several Alpine eclogites, HP/UHP samples from Dabie Shan (China) and Variscan eclogites (Spain and Bretagne) with Laser-Ablation ICPMS, in order to investigate the distribution of trace elements and their ratios. For more precise Nb/Ta ratios, rutiles were also analysed with isotope dilution [4]. The results show that the Nb-Ta budget is solely controled by rutile, while Zr and Hf are distributed between garnet, cpx, rutile and zircon (if present).

Rutiles in samples from Dabie Shan have slightly superchondritic Nb/Ta (20-26) while rutiles from Alpine and Variscan samples have Nb/Ta between crustal and chondritic values (12-20). Garnets and clinopyroxenes have lower Nb/Ta but their concentrations are not significant for the mass balance. Zr/Hf ratios of garnets are superchondritic while those of cpx and rutile are subchondritic.

The results from orogenic eclogites indicate that subducted oceanic crust might have a 'super-BSE' Nb/Ta ratio which could balance the low Nb/Ta of the continental crust but not the subchondritic Nb/Ta of BSE. Eclogite xenoliths will be analysed next to further test this hypothesis.

References

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[3] Rudnick et al., *Science* **287**, 278-281 (2000)
[4] Weyer et al., *Chemical Geology* **187**, 295-313 (2002)