Source for suprachondritic Nb/Ta and Zr/Hf values in 1.86 Ga monzogabbros in south-central Fennoscandian Shield

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The ratios of refractory element such as Nb/Ta and Zr/Hf (17,5-19.9 and 34.3-36, respectively [1,2]), in the unfractionated and in the silicate Earth are assumed to follow those of the chondrites. However, the Earth's crust and other major silicate reservoirs show subchondritic Nb/Ta values (~12-15.5) suggesting a mass imbalance for Nb and Ta in Earth which have led to so-called "Nb-Ta paradox" and searching for a suprachondritic Nb/Ta reservoir and "missing Nb" [3]. During its formation Earth's core might have fractionated Nb making it a potential reservoir for Nb [4]. The Nb/Ta fractionation, however, is an ongoing process during continent formation so other reservoirs such as refractory rutile-bearing eclogites [2], subcontinental lithospheric mantle [5] or rutile-bearing deep arc cumulates [6] could explain part of the HFSE mass inbalance.

We have studied Nb, Ta, Zr and Hf concentrations of 1.86 Ga monzogabbros from southwestern Finland. The rocks show elevated Nb/Ta (~16-38) and Zr/Hf (~ 41-48) ratios and OIB-like enriched geochemical features with low initial zircon ε_{Hf} values but high ε_{Nd} values. This is in contrast to the older 1.90-1.88 Ga magmatism within the same area [7]. Our results suggest a residence of a high Nb/Ta and Zr/Hf reservoir under the central Fennoscandian shield during the Paleoproterozoic and a link between the voluminous 1.90-1.88 Ga synorogenic magmatism with low Nb/Ta ratios and elevated Nb/Ta and Zr/Hf ratios in the 1.86 Ga gabbroic magmatism.

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