Zr/Hf fractionation and REE in subcratonic magnesian eclogite and pyroxenite

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Subcratonic mantle includes magnesian eclogite (Koidu, W Africa) and garnet pyroxenite (WGR, W Norway) that share similar mineral chemical trends (Fig. 1a). We investigated ten pyroxenites whose whole-rock trace element concentrations subdivide the sample suite. Group I samples have average values that are low for HREE (1.3–1.5 × PM), HFSE (largely sub-PM) and Zr/Hf (22). Whereas those of group II samples are high for HREE (3.1–4.5 × PM), HFSE (super-PM) and Zr/Hf (31). Both groups are enriched in LREE. One sample has an intermediate chemistry. Batch melt modelling using standard equations and partition coefficients typical for pressures up to 3 GPa weakly fractionates Zr/Hf in N-MORB eclogite residues and spinel peridotite melts. In addition, we used partition coefficients from 5-7 GPa experiments and chemically equilibrated mantle compositions of peridotite mixed with 0-3% N-MORB eclogite. Results show that sequential melting effectively lowers Zr together with Zr/Hf in the melt batches (Fig. 1b). Ensuing crystallisation of individual melt batches, first of olivine + orthopyroxene followed by garnet websterite, can form HREE abundances in the latter as observed in the sample averages. Late metasomatism appears to have altered primary LREE abundances and Zr/Hf. Correlation between HREE, Zr and Zr/Hf suggests samples of group I to have formed from melts late in the sequence of mantle melting, after ~50% total melt extraction, whereas group II samples formed about half way. A pulsed melt release is inferred. Trace element chemical similarity of group II pyroxenite and Koidu high MgO eclogite suggests a similar origin for the two.

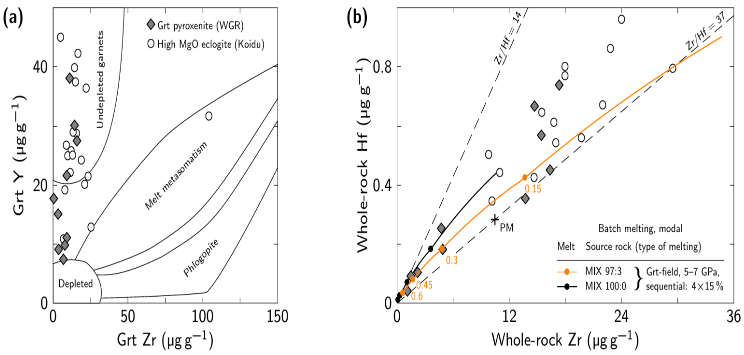

Figure 1- Bivariate plots showing compositional overlap between WGR garnet pyroxenite (this study) and Koidu high MgO eclogite (Barth et al.*, 2002; Aulbach* et al.*, 2019). Sequential batch model melts of MIX (peridotite + N-MORB in %) vary in Zr/Hf.*

This work is financially supported by the Norwegian Financial Mechanism 2014-2021 and the Polish National Science Centre, project no. 2020/37/K/ST10/02784.

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