Partial melting of zoisite eclogite and its significance for trace-element cycling in subduction zones

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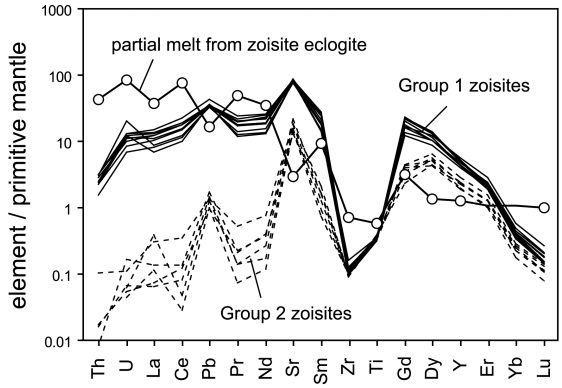
Kyanite-zoisite eclogites from an UHP terrain in the Pohorje Mts, Slovenia, can be divided in two groups: (1) zoisite-rich (7-24%) kyanite-bearing (<5%) with REE patterns similar to mid-oceanic ridge gabbros, but depleted in HFSE; (2) kyanite-rich (6-19%) zoisite-bearing (2-8%) with strongly LREE-depleted patterns and positive to no HFSE anomalies. All eclogites are rutile-bearing, despite low bulk TiO_2 contents (0.1-0.4 wt.%). *In situ* analysis of the constituent minerals shows that zoisite is the main carrier for L-MREE, Sr, Pb, Th and U, rutile for Nb, Ta and Ti, cpx for Zr and Hf, and garnet for HREE.

From trace-element signatures and modal mineralogy we infer that Group II eclogites are derived from Group I by partial melting according the reaction zo + qz = ky + gt + melt. In this particular case, partial melting was probably induced by heat from the mantle-derived ultramafic body in which Group 2 eclogites occur.



As zoisite is preferentially consumed during partial melting whereas rutile is residual, melts derived from Group 1 eclogites will be strongly enriched in LREE, Pb, Th and U, but depleted in HFSE, *i.e.*, similar to a subduction signature. Interestingly, Sr is enriched in the residue relative to REE. Hence, melts from zoisite-bearing eclogites will have lower Sr/Y than those from zoisite-free varieties, and do not resemble adakites. As even small amounts of zoisite (≥1 vol%) will dominate the rock's LREE and Sr budgets, and it is likely to be common in subducted oceanic crust, melting of zoisite eclogite may be an important contributor to mantle wedge metasomatism.