A petrogenetic link between high-MgO and garnet-bearing andesites — A Setouchi analogue from the Eastern volcanic belt in Northland, New Zealand?

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An unusual island arc suite from the Miocene Eastern volcanic belt (EVB) in Northland, New Zealand, comprises high-MgO pyroxene and hornblende-pyroxene andesites (HMA) as well as garnet-bearing low-MgO hornblende and biotite-hornblende andesites (LMA). They carry gabbroic xenoliths of high-MgO pyroxenites, hornblendites, and pyroxene-hornblende gabbros (HMG) as well as high-Al_2O_3 hornblende gabbros, garnet-hornblende gabbros, garnetite lenses and anorthosites (HAG). HMG and HAG xenoliths formed by isobaric crystal fractionation from a common parental hydrous high-Mg basalt at T=1000-700ºC and P=10 kbar during underplating at the base of the arc.

EVB HMAs show striking similarities in their compositions to major-element, trace-element and isotope compositions of the HMAs from the Setouchi volcanic belt (SVB) in SW Japan (Tatsumi, 2001) which are also associated with low-MgO calcalkaline and garnet-bearing andesites (Tatsumi et al., 2002).

Detailed major- and trace-element studies on EVB garnets, xenoliths and andesites identify 4 garnet types as xenocrysts in the andesites. They are derived by disintegration from the garnet-bearing HAG xenoliths. Oscillatory zoned garnets and hybrid xenoliths record a sediment-derived slab-melt interaction with the underplated gabbroic sequence at P=10 kbar causing a Th and LREE enrichment. The andesites are hybrid products of mixing between the sediment-slab-melt, the underplated and fractionated high-P gabbroic sequence and low-P magmas which evolved from the high-P gabbroic precursor.

Tectonic models for both the generation of the SVB and EVB andesites, include short-lived fore-arc magmatism during subduction of a hot and young lithosphere slab, a strong sediment-slab-melt contribution to a hydrous mantle wedge and andesite eruption in an extensional tectonic zone. In contrast to the experimentally derived SVB model, the empirical data on lower arc crustal EVB xenoliths show that the sediment slab-melt did not interact with mantle peridotite or primary magmas, but with fractionated products from such mantle melts during a period of underplating.

References:

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Lanthanide distribution and the tetrad effect in bulk rocks and fluorite of the Khangilay granitic complex (Russia)

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The Khangilay complex in Eastern Transbaikalia (Russia) is composed of biotite granites accompanied by two smaller satellite intrusions: Orlovka and Spokoinoe. Although the intrusions likely formed from a single parental magma, the main Khangilay body and the satellites are geochemically distinct. Orlovka is a strongly differentiated intrusion of Li-F granites hosting Nb-Ta ore deposits. Spokoinoye is composed of muscovite-albite granite with W-Sn mineralisation. Here we present new results on REE distribution in bulk rock samples and fluorite mineral separates which further reveal the complexity of evolution trends in the adjacent intrusions.

All the samples were analysed by ICP-MS. The REE abundances in the most primitive rocks of the three intrusions are similar, but differ in the evolved rock types. The greatest diversity of the distribution patterns is found in Li-F granites of the Orlovka intrusion and best revealed by chondrite-normalised REE characteristics of accessory fluorite (Fig. 1). The patterns of magmatic fluorite (*solid symbols*) are similar to those of the rocks themselves and show deepening Eu anomaly and more pronounced tetrad pattern with fractionation. No such features are observed in the hydrothermal fluorite (*open symbols*). In Spokoinoe the evolved bulk rocks and magmatic fluorite show much weaker tetrad patterns and the REE distribution is affected by crystallisation of accessory garnet.

This example of the Khangilay complex suggests that the development of the lanthanide tetrad pattern in granitic systems is strongly related to F enrichment and the formation of fluoride species in melts and fluids.