REE pattern of amphibole replacing garnet

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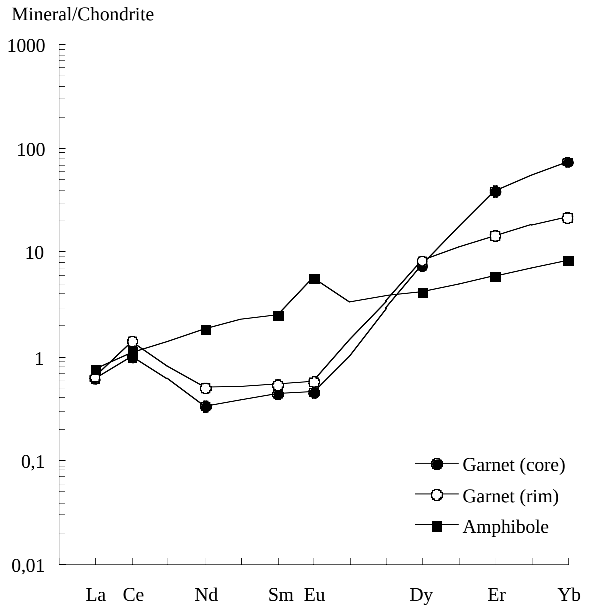
Amphibole developing after garnet in a garnet amphibolite from the Njurundukan ophiolitic complex, in the northwest Baikal region, has been analyzed by ion microprobe for REE content. REE distribution pattern in amphibole follows that of garnet with increasing REE content from LREE to HREE (Fig. 1). There is no question that formation of metasomatic amphibole after garnet with the inheritance in the REE distribution takes place here. The patterns of metamorphic amphiboles are comparatively flat or bell-shaped across the REE with low HREE/LREE ratio (Skublov, 2001).

Figure 1: REE patterns for sample 133SG91.



A similar inheritance of REE distribution pattern of a primary mineral by amphibole developing after garnet or clinopyroxene has been found in the study of superimposed metamorphism in eclogites (Rodriguez et al. 1999, Sassi et al. 2000).

References

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Sassi R., Harte B., Carswell D. A. and Yujing H., (2000), *Contrib. Mineral. Petrol.* **139**, 298-315.

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REE geochemistry of the fluorite from Yucca Mountain, USA: fingerprinting multiple sources of matter in hydrothermal fluids

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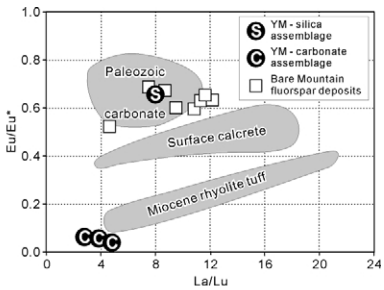
The secondary silica-calcite (+minor fluorite and zeolites) fracture and cavity-lining mineralization was studied in a 8 km-long exploratory tunnel excavated in the Miocene rhyolitic tuffs of the vadose zone of Yucca Mountain – a prospective site for a geological high-level nuclear waste disposal facility. Two mineral assemblages, the silica-dominated (opal, chalcedony, quartz) and the calcite-dominated, were distinguished. Fluorite is present as co-genetic accessory mineral in both assemblages, which were formed from fluids at T = 85 to <50-30°C. One fluorite sample yielded homogenization temperatures of 74-80°C.

Fluorite from the calcite assemblage exhibits relatively flat REE patterns with strong negative Eu- and Ce-anomalies. Fluorite from the silica assemblage shows moderate enrichment in LREE and small Eu-minimum. These contrasting properties suggest that mineral-forming fluids acquired dissolved matter from different sources.



The Figure shows that fluorite from the silica assemblage (S) has strong affinity to the Paleozoic carbonate rocks underlying Tertiary tuffs. Interaction of thermal waters with these rocks could have caused recycling of earlier fluorite mineralization (squares). The silica mineralization is most prominent in the vicinity of the major block-bounding fault, a location where the pulse of thermal waters upwelling from the deep crustal levels is most likely to have left the trace.

By contrast, REEs of fluorite from the calcite assemblage (C) exhibit affinity to the Miocene rhyolitic tuff compositions. Interpretation of this pattern is more ambiguous. It may reflect involvement of waters equilibrated with Tertiary rhyolites; alternatively, the source of REE may be deep-level Precambrian clastic rocks, from which the rhyolitic melts have derived. Importantly, neither of fluorites has REE patterns compatible with the surface calcretes, which are invoked by some researchers as a source of secondary minerals at Yucca Mountain (U.S. DOE, 2001).

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