CALDERITE–SPESSARTINE GARNETS IN ECLOGITIC METACHERTS

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The nature of the compositional gap(s) between aluminous and ferric garnets is a pending problem, which was repeatedly addressed for the Ca-rich members grossular and andradite (e.g. POLLOCK et al., 2001). The finding of coexisting spessartine, ideally $Mn_3Al_2(SiO_4)_3$, and calderite, ideally $Mn_3Fe^{3+}_2(SiO_4)_3$, raises the question for the Mn-rich members as well.
We found them in eclogite-facies manganese concentrations hosted in metaradiolarite and siliceous strata interlayered in the 'Schistes lustrés' Mesozoic sequence associated to the ophiolites of the Western Alps. The localities studied, the Praborna mine near Saint-Marcel, Val d'Aoste, Italy (MARTIN & KIENAST, 1987), and the upper end of the Maurienne Valley, France (CHOPIN, 1978), belong to the eclogite-facies ophiolitic Zermatt Unit, which locally reaches coesite-eclogite conditions (REINECKE, 1991). The presence of eclogitic metabasite (with paragonite and glaucophane stable) and of the talc–chloritoid–garnet (± phengite) assemblage in metapelite (CHOPIN, 1981) is characteristic in both places.
The coexistence of the two garnets was observed both in the oxidised quartzite with hematite and braunite (+ minor Mn-pyroxenoid and tirodite; with ardennite or piemontite in distinct layers), and in reduced, carbonate-rich boudins included in it. The co-occurrence takes a variety of textural aspects, from coexisting euhedral garnets (10 to 100 μm in size for the calderite to mm-size for spessartine) to sharp overgrowths of yellow calderitic garnet on colourless spessartine, to cauliflower-like masses (a few hundreds of μm in size) overgrowing spessartine and showing evidence of oscillatory zoning, resorption stages and resumed growth. Sector zoning and anisotropy are common, although not consistent features.
Compositions can be expressed to 95% in the quadrilateral system $Ca–Mn^{2+}–Al–Fe^{3+}$ and coexisting pairs define two gaps, bounded by values of the $Fe^{3+}/(Al + Fe^{3+})$ ratio of 10 and 15 % for the first one, of 40 and 65 % for the other. Interestingly, the optically obvious discontinuity (colour change and Becke's line) corresponds to the narrower gap, whereas the broad compositional gap occurs within yellow garnet, only revealed by SEM. Only the latter can be candidate for a miscibility gap, if any. This point will be discussed on the basis of textural, paragenetic and experimental (LATTARD & SCHREYER, 1983) evidence.

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