

Crystal chemistry of vanadium-rich garnet from the Sør Rondane Mountains, east Antarctica

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X-ray single-crystal and infra-red spectral studies of vanadium-bearing garnets from the Menipa mountain mass, central part of the Sør Rondane Mountains, East Antarctica (Osanai *et al.* 1990) were carried to determine crystal structures and examine existence of OH-group.

Occurrences of V-bearing garnet are 1) large porphyroblast (type-1); 2) fine crystal (type-2) in kelyphite rim around type-1 garnet; 3) fine-grained porphyroblast (type-3) in matrix.

Chemical compositions of garnets studied in this study are as follows: type-1 $(\text{Ca}_{2.90}\text{Mg}_{0.05}\text{Mn}_{0.02})(\text{Fe}_{0.01}\text{V}_{0.08}\text{Cr}_{0.02}\text{Ti}_{0.03}\text{Al}_{1.86})\text{Si}_{3.02}\text{O}_{12}$; type-2 $(\text{Ca}_{2.65}\text{Mg}_{0.12}\text{Mn}_{0.05})(\text{Fe}_{0.21}\text{V}_{0.69}\text{Cr}_{0.18}\text{Ti}_{0.03}\text{Al}_{0.99})\text{Si}_{3.01}\text{O}_{12}$; and type-3 $(\text{Ca}_{2.65}\text{Mg}_{0.18}\text{Mn}_{0.07})(\text{Fe}_{0.20}\text{V}_{0.96}\text{Cr}_{0.23}\text{Ti}_{0.03}\text{Al}_{0.68})\text{Si}_{2.98}\text{O}_{12}$.

The structure refinements of type-1 and type-3 garnets with the space group of *Ia-3d* were reduced with *R1* of 0.0278 and 0.0689, respectively. The site occupancies determined using both X-ray diffraction data and electron microprobe analysis data are: ^{VIII}[Ca0.976Mg0.017Mn0.007] and ^{VI}[Al0.930V0.040 Cr0.01Ti0.015 Fe0.005] for type-1 garnet, and ^{VIII}[Ca0.885 Mg0.027Mn0.057Fe0.030] and ^{VI}[Al0.315V0.520Cr0.10 Ti0.015Fe0.05] for type-3 garnet.

Mean interatomic distances are: type-1 $\langle X-O \rangle = 2.407(1)$ Å, $\langle Y-O \rangle = 1.931(1)$ Å, $\langle T-O \rangle = 1.651(1)$ Å, and type-3 $\langle X-O \rangle = 2.426(2)$ Å, $\langle Y-O \rangle = 1.989(2)$ Å, $\langle T-O \rangle = 1.655(2)$ Å. The increase of $\langle Y-O \rangle$ distances is caused by the substitution of V^{3+} for Al^{3+} . By the expansion of the octahedral site with this substitution, the unit-cell parameters increase from $a = 11.8686(8)$ Å of type-1 garnet to $a = 11.9694(6)$ Å of type-3 garnet. The mean $\langle T-O \rangle$ distances of 1.651-1.655 Å are longer than ordinary Si-O distances in silicates.

OH absorptions in the wave number region 3500-3700 cm^{-1} were confirmed in the infrared spectra of type-1, -2 and -3 garnets.