

Occurrence of sursassite in the Lienne valley, Stavelot Massif, Belgian Ardennes

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In quartz veinlets crosscutting the red-purple metapelites of the Otré Formation (Salm Group) in the core of the Lienne syncline, sursassite occurs as orange-red needles associated with manganese oxide masses mostly composed of cryptomelane. Detailed petrographic observation coupled with electron microprobe analytical work reveals sursassite in close association with spessartine, manganian clinocllore (Schreyer *et al.*, 1986), hematite, and fluorapatite.

The chemical composition of sursassite shows the presence of about 2 wt % MgO, and up to 4 wt % CaO, whereas Fe₂O₃ does not exceed 1 wt %. These substitutions are interpreted in comparison with pumpellyite-(Mg). Heterogeneities have also been detected in the distribution of V and As. From a chemical point of view, these zones rich in V and As correspond to ardennite s.l., previously identified in Bierleux (Pasero *et al.*, 1994).

Sursassite constitutes a new additional phase among the minerals characteristic of the low-grade metamorphism known in the Lienne valley in the western part of the Stavelot Massif, i.e. about 300°C and 1.5 kb (Theye *et al.*, 1996). The formation of sursassite, associated with manganian clinocllore and spessartine, in relationship with quartz veinlets, shows analogies with the formation of carpholite. Due to the presence of about 0.4 Mn³⁺ per formula unit of sursassite, it seems reasonable to consider that sursassite could play the role of carpholite in the more oxidized horizons of the Otré Formation in the Lienne Valley.

References

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Onset of MORB melting: High-pressure eclogite-facies pegmatites as an example of internal fluid recycling

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Zoisite-bearing high-pressure pegmatites from the Münchberg Massif, Germany, provide an excellent example for the characteristics of the onset of metabasite melting at eclogite-facies conditions. Pegmatites were derived by partial melting of MORB-like eclogite at $T \geq 680^\circ\text{C}/2.3 \text{ GPa}$ to $750^\circ\text{C}/3.1 \text{ GPa}$, which produced small amounts of tonalitic to trondhjemitic melt. The melt concentrated locally in isolated, small melt pockets and crystallized primary zoisite as liquidus phase at $P \geq 2.3 \text{ GPa}/680^\circ\text{C}$ to $2.1 \text{ GPa}/750^\circ\text{C}$. Compositional zoning of pegmatite zoisite records an ensuing multi-stage uplift history with successive, discrete crystallization events at $1.4 \pm 0.2 \text{ GPa}/650$ to 700°C and $1.0 \pm 0.1 \text{ GPa}/620$ to 650°C . Resorption textures indicate re-heating and thermal perturbation of the whole system prior to each successive crystallization event. Final solidification of zoisite-pegmatites occurred at $0.9 \pm 0.1 \text{ GPa}/620$ to 650°C . The data suggest that isolated melt + zoisite crystal mash pockets formed an integral part of the eclogite throughout uplift from melt formation at $T \geq 680^\circ\text{C}/2.3 \text{ GPa}$ to $750^\circ\text{C}/3.1 \text{ GPa}$ to final solidification at $\sim 0.9 \text{ GPa}/620$ to 630°C ; i.e. over 45 to 60 km. The entire pegmatite-forming process was most likely fluid conserving: Any fluid present during high-pressure melt formation was trapped by fully or nearly water-saturated siliceous melts; due to the small melt fractions these melts did not migrate out of the rock but stayed in isolated pockets within the rock unit; finally, any fluid liberated during pegmatite crystallization interacted with neighbouring, dehydrated eclogite-facies assemblages to form amphibolite-facies hydrous minerals.

Based on average compositions of zoisite-pegmatite, as representative for the tonalitic to trondhjemitic high-pressure melt, and host eclogite, we calculated a set of empirical melt/eclogite partition coefficients. $D^{\text{melt/eclogite}}$ values for Ta, Zr, Hf, Tm, Yb, Lu, V, Sc, Cr, Cu, and Ni range from $D_{\text{Ni}}^{\text{melt/eclogite}} = 0.051$ to $D_{\text{Tm}}^{\text{melt/eclogite}} = 0.7$ and indicate compatibility with respect to eclogite. Rubidium, Ba, Th, K, La, Ce, Sr, Nd, Sm, Eu, Ti, and Tb are moderately incompatible with respect to eclogite and have $D^{\text{melt/eclogite}}$ values between $D_{\text{Rb}}^{\text{melt/eclogite}} = 1.11$ and $D_{\text{Th}}^{\text{melt/eclogite}} = 10.6$.