3.3

Origin of gem corundum in calcite marble: The Revelstoke occurrence in the Canadian Cordillera of British Columbia

Tashia J. Dzikowski [a], Jan Cempírek [b], Lee A. Groat [c], Gregory M. Dipple [c], Gaston Giuliani [d]

[a] *SSEF Swiss Gemmological Institute, Aeschengraben 26, CH-4051 Basel*
[b] *Department of Geological Sciences, Masaryk University, Kotlarska 2, 65937 Brno, Czech Republic*
[c] *Department of Earth, Ocean and Atmospheric Sciences, University of British Columbia, 2207 Main Mall, Vancouver, BC V6T1Z4, Canada*
[d] *IRD et CRPG/CNRS, Centre de Recherches Pétrographiques et Géochimiques, 15 rue Notre Dame des Pauvres, Vandoeure-lés-Nancy 54501, France*

The calcite marble-hosted gem corundum (ruby, sapphire) occurrence near Revelstoke, British Columbia, Canada, occurs in the Monashee Complex of the Omineca Belt of the Canadian Cordillera. Corundum occurs in thin, folded and stretched layers with green muscovite + Ba-bearing K-feldspar + anorthite ($An_{0.85–1}$) ± phlogopite ± Na- poor scapolite. Other silicate layers within the marble are composed of: (1) diopside + tremolite ± quartz and (2) garnet ($Alm_{0.7–0.5}Grs_{0.2–0.4}$) + Na-rich scapolite + diopside + tremolite + Na,K-amphiboles. Non-silicate layers in the marble are either magnetite- or graphite-bearing.

Predominantly pink (locally red or purple) opaque to transparent corundum crystals have elevated Cr_2O_3 (≤0.21 wt.%) and variable amounts of TiO_2; rare blue rims on the corundum crystals contain higher amounts of TiO2 (≤0.53 wt.%) and Fe_2O_3 (≤0.07 wt.%). The associated micas have elevated Cr, V, Ti, and Ba contents. Petrography of the silicate layers show that corundum formed from muscovite at the peak of metamorphism (~650–700 °C at 8.5–9 kbar). Because the marble is almost pure calcite (dolomite is very rare), the corundum was preserved because it did not react with dolomite to spinel + calcite during decompression. The scapolite-bearing assemblages formed during or after decompression of the rock at ~650 °C and 4–6 kbar. Gem-quality corundum crystals formed especially on borders of the mica-feldspar layers in an assemblage with calcite.

Whole rock geochemistry data show that the corundum-bearing silicate (mica-feldspar) layers formed by mechanical mixing of carbonate with the host gneiss protolith; the bulk composition of the silicate layers was modified by Si and Fe depletion during prograde metamorphism. High element mobility is supported by the homogenization of $\delta^{18}O$ and $\delta^{13}C$ values in carbonates and silicates for the marble and silicate layers. The silicate layers and the gneiss contain elevated contents of Cr and V due to the volcanoclastic component of their protolith.