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Even the low-T garnet from the iconic Barrow's zone is tetragonal

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Common (anhydrous) Fe-Mg-Ca-Mn garnet, the archetypal cubic mineral, has been recently discovered to be tetragonal in metapelites and metabasites from low-temperature regional metamorphic terranes (Cesare et al., 2018).

Despite the differences in bulk rock composition and pressure conditions, such low-T tetragonal garnets share common chemical features, namely high grossular (>25 mol%) and low pyrope (<7 mol%) contents. Similar compositions are documented in other contexts worldwide, both in blueschists-eclogites and in phyllites, including the metapelites from the garnet zone of the iconic Barrovian metamorphism of the Scottish highlands (Viete et al., 2011).

We have analysed a garnet crystal from a chlorite-biotite schist collected at the Barrow's garnet zone in Glen Esk. The unit cell parameters were refined using diffraction reflections between 1.20 and 0.55 Å providing a tetragonal cell with a = 11.5731(5) Å and c = 11.5887(8) Å and volume V = 1552.15(15) Å3. Systematic absences analysis on complete intensity data collected up to 2theta = 80° indicated I41/acd space group confirming the cell parameters refinement.

Therefore, the garnet is tetragonal and not cubic, as suggested by its weak birefringence under crossed polarizers.

These results show that the tetragonal structure of common Fe-Mg-Ca-Mn garnet is verified whenever this mineral displays the Ca-rich, Mg-poor composition often observed in low-T metamorphic rocks. And support the hypothesis that the lowering of symmetry is composition-dependent.

References

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