

Radiohaloes in cordierite: Radiochemical transformation of channel constituents

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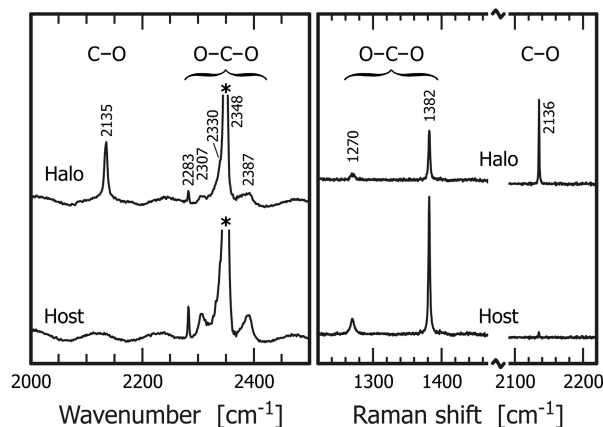
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Yellow pleochroic radiohaloes are frequently observed in cordierite. Their formation is caused by the impact of alpha particles originating from actinoid-bearing inclusions, which create scattered point defects in the cordierite structure. This process may result in a significant disturbance of the short-range order of this mineral (Nasdala *et al.*, 2006).

Cordierite is well known to contain hydrous species and CO₂ in structural channels that are oriented parallel to the *c* axis (Aines and Rossman, 1984). Our micro-spectroscopic investigations yield evidence for radiochemical changes of such molecules. Raman and infrared (IR) spectra of radiohaloes are characterized by less intense OH stretching and CO₂ bands when compared to the host cordierite, whilst concurrently an extra band appears at ~2135cm⁻¹ (Fig.1). This band is assigned to CO stretching vibrations (Khomenko and Langer, 2005). Our observations suggest that carbon monoxide (observed only in radiohaloes) must have formed from CO₂ caused by the impact of alpha radiation.

Figure 1: Polarised IR absorption (left) and Raman spectra (right) taken inside a radiohalo and in the unaltered host cordierite, indicating irradiation-induced CO₂ → CO transformation.



References

- Aines R.D. and Rossman G.R., (1984), *Am. Mineral.* **69**, 319-327.
 Khomenko V.M. and Langer K., (2005), *Am. Mineral.* **90**, 1913-1917.
 Nasdala L., Wildner M., Wirth R., Groschopf N., Pal D.C. and Möller A., (2006), *Mineral. Petrol.* **86**, 1-27.

Boron isotopic compositions of tourmaline from a hydrothermal gold deposit – Constraints on fluid sources

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The ultimate sources of ore forming fluids still remain a key question in orogenic gold research. In this regard the boron isotope and chemical compositions of tourmaline provide important constraints on the source compositions of the mineralizing fluids because tourmaline (a) is a common gangue mineral in many Archaean lode gold deposits and is often closely associated with gold mineralization, (b) is stable over a wide p/T range and is resistant to alteration and weathering, (c) is indicative of source lithology as reflected by its compositional variability, and (d) is the main host for boron in most rocks, where the boron isotopic composition in tourmaline is controlled by the composition of boron in the source, the p/T conditions of crystallization, and by fractionation effects related to phase changes.

We investigated tourmalines from the Hira Buddini Gold Deposit within the Archaean Hutti-Maski Greenstone Belt in southern India. The tourmalines belong to the dravite-schorl series with major element variations being related to their host lithology. SIMS determined $\delta^{11}\text{B}$ values vary in a wide range from -13‰ to +9‰ with 95% of the values are between -4‰ and +9‰. The bimodal distribution with peak $\delta^{11}\text{B}$ values at about -2‰ and +6‰ is consistent with the presence of at least two isotopically distinct fluids which penetrated the hydrothermal system along different access-pathways and were subsequently mixed. The calculated $\delta^{11}\text{B}$ values of the fluids being about 0‰ and +10‰, respectively, rule out a crustal origin for the source fluids, suggesting an involvement of metamorphic and/or magmatic sources. The isotopically lighter fluid may have been generated during metamorphic devolatilization reactions, whereas the heavier fluid is attributed to degassing of I-type granitic magmas that provided heat and fluids to the hydrothermal system.