**COLOUR SEM-CATHODOLUMINESCENCE INVESTIGATION OF THE TAGISH LAKE C2 CHONDRITE.** M. R. M. Izawa[1*], I. Barker[1], D. E. Moser[1], R. L. Flemming[1], P. J. A. McCausland[1]
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**Introduction:** A study of the Tagish Lake C2 chondrite was carried out using colour + UV (300-850 nm) cathodoluminescence (SEM-CL), whereby three types of CL-active mineral grains have been observed: Magnesioaluminate spinel occurring in an aqueously altered CAI; forsteritic olivine in chondrules, olivine aggregates, and as isolated grains; and calcite which forms small irregular nodules throughout the Tagish Lake matrix.
**Samples:** The Tagish Lake meteorite is an ungrouped C2 chondrite related to the CIs and CMs [1-3]. Six polished thin sections of Tagish Lake were investigated in this study. These sections were cut from an intact 2.9 g fragment from collection site MM-02 [3].
**Methods:** Backscattered electron (BSE), secondary electron (SE), and colour + UV SEM-CL images, were collected with the Hitachi S-2500C SEM at the University of Western Ontario Zircon and Accessory Phase Laboratory, using a Gatan ChromaCL detector. Areas of the same sections were mapped by SEM-EDX. The major and minor element compositions of the CL-active phases were measured by electron microprobe (EPMA).
**Results and Discussion:**
*Spinel*: Long-lived CL activity in the red channel has been observed in spinel associated with phyllosilicates and dolomite in an irregular, fine-grained aggregate (Fig. 1). This object is interpreted to be an aqueously altered CAI based on its composition and morphology.

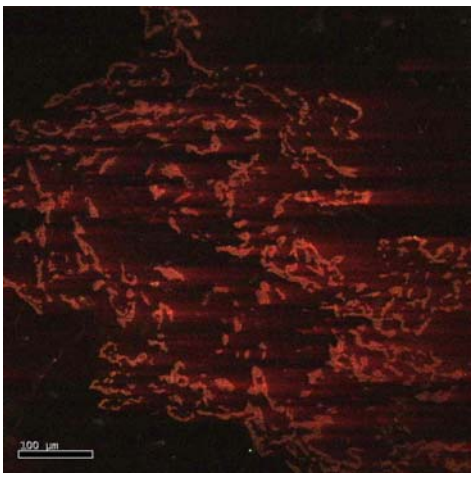


**Figure 1: Cathodoluminescent spinel, associated with dolomite and phyllosilicates.**

*Forsterite*: Forsterite shows a wide variety of behaviour (Figs. 2-5), including zonation in CL intensity and wavelength in chondrules and AOAs, purple to red zoned CL patterns in isolated euhedral grains, and intensely blue CL signal from an enigmatic irregular, flakey mass. CL zonation in forsterite does not correspond to chemical variations as detectable by SEM-EDX or EPMA (WDS). All CL active phases observed are Mg-rich and nearly Fe-free.

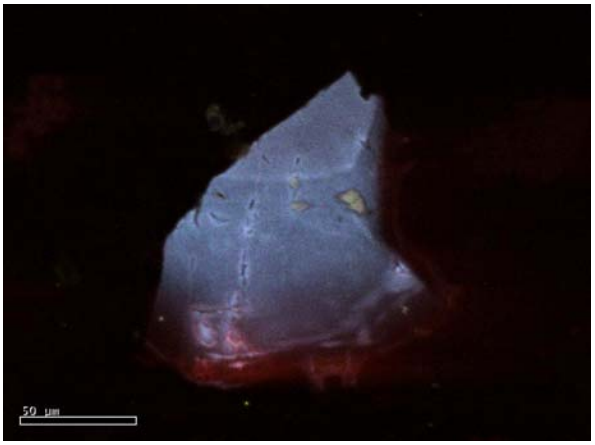


**Figure 2: Isolated olivine fragment showing core of intense blue CL activity, with domainal to gradational zoning.**

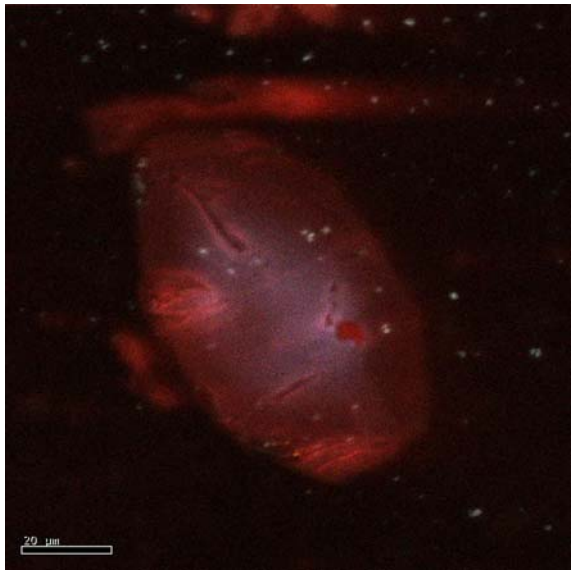


**Figure 3: Isolated euhedral olivine with gradational purple to red CL zonation.**

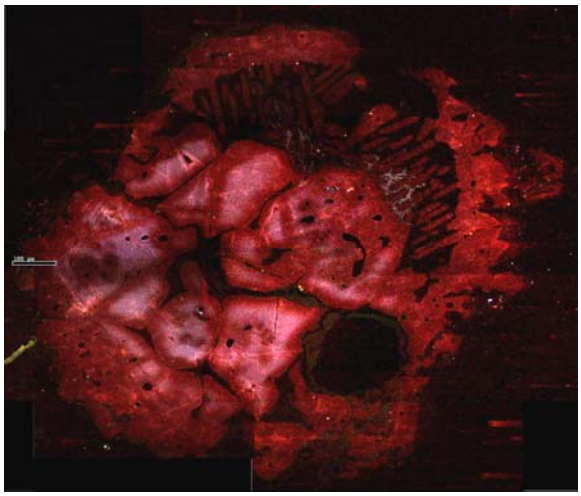

**Figure 4: SEM-CL photomosaic of chondrule containing forsterite. Scale bar at left is 100 µm.**

*'Big Blue'*: This enigmatic object is dominated by forsterite, but is very different from other forsterite-rich objects observed in this study (Fig. 5). It is an irregular aggregate of fine grained, flakey-textured forsterite microcrystals that are intensely CL-active in the blue channel. The irregular shape and forsterite-dominated mineralogy suggest that this object may be a refractory inclusion.

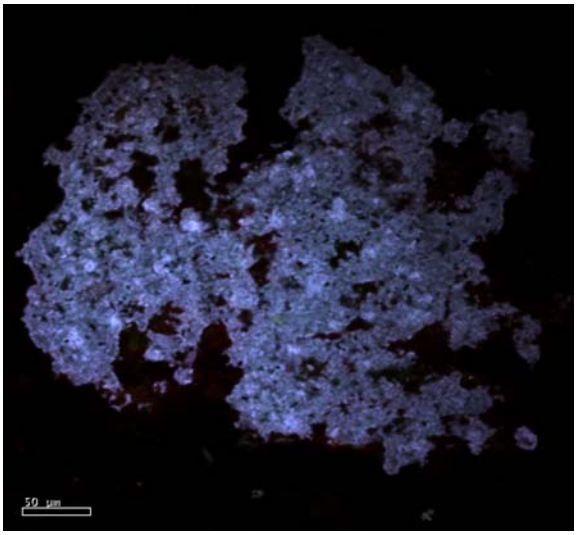


**Figure 5: 'Big Blue'. This is an irregular blue CL-active flakey-textured forsterite aggregate.**

*Calcite*: Calcite occurs throughout the Tagish Lake matrix as fine grained, irregular nodules ranging up to a few tens of microns in the longest dimension (Fig. 6). Calcite is CL-active in the red channel and is easily recognized due to its long-lived CL activity. Calcite nodules are very rare in the accretionary rims [4] surrounding many clasts in Tagish Lake, perhaps indicating that the nodules formed by "late" precipitation into pore spaces in the Tagish Lake matrix.

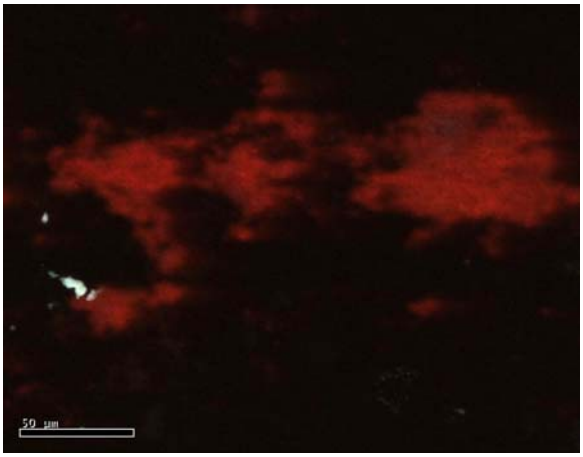


**Figure 6: Red CL activity in calcite. The pale white features at lower left may be artifacts, perhaps due to surface charging or a defect in the carbon coating of the section.**

**Conclusions and Future directions:** Colour + UV SEM-CL imaging has revealed distinct variations within at least three constituents of Tagish Lake. The intra- and inter-grain differences within mineral types so far appear to be uncorrelated with major element chemistry, but potentially identify overlooked trace element records of Tagish thermochemical evolution. This demonstrates the usefulness of colour SEM-CL imaging as a reconnaissance tool for targeting crystal domains for microbeam analysis. Additional work will be undertaken to determine the structural and chemical processes which lead to the observed CL variations.

**References:** [1] P. G. Brown et al., Science 290, 320 (2000); [2] A. R. Hildebrand et al., MAPS 41, 407 (2006); [3] M. E. Zolensky et al., MAPS 37, 737 (2002); [4] S. B. Simon & L. Grossman, MAPS 38, 813 (2003)