Rapid Fingerprinting of Cassiterite Paragenesis via μXRF for Exploration of Li Pegmatites

Jason Bennett[1,2], Melvin Hartley[1], James Waldron[1], Evie Burton[1]
[1]Portable Spectral Services, Perth, Australia, [2]University of Western Australia, Perth, Australia

Cassiterite, nominally SnO_2, is often detected in the heavy mineral fraction of stream sediment surveys. Its presence could be used as an indicator for nearby Li-Ta-Nb-Cs pegmatite systems. However, cassiterite is also commonly found in other mineral systems unrelated to Li mineralisation, such as Sn-W greisen and vein-hosted deposits or polymetallic Cu-Pb-Zn-Sn skarn deposits. Recently, Bennett et al (2024) demonstrated that the minor element contents of cassiterite can be used to fingerprint the paragenetic system from which the crystals originated. Pegmatites in particular can be identified by their high Nb and Ta contents concomitant with low Nb/Ta ratios, which were acquired via costly and time consuming EPMA and LA-ICP-MS analyses.

Here we demonstrate via applied case studies that these data can be acquired rapidly via the Bruker M4+ Tornado μXRF. Following routing sample mapping and phase identification, the geochemistry of each cassiterite crystal is extracted via a custom grain segmentation algorithm. This allows for fast assessment of LCT pegmatite fertility from the presence of cassiterite in stream sediment surveys. We also demonstrate how this process can be used on loose grains without mounting in epoxy resin. This allows for select crystals to be collated with other samples along with reference materials into the same mount for subsequent trace element analysis or geochronology.

References:
Bennett, J., Kemp, A.I.S., Hagemann, S.G., Fiorentini, M.L., Roberts, M.P., 2024. Systematic trends in the substitution mechanisms of minor elements in cassiterite. Australian Journal of Earth Sciences 71, 1098–1124. doi: https://doi.org/10.1080/08120099.2024.2325396