

## **Variations in the composition of elbaite and elbaite-hosted fluid inclusions from the Greenbushes Pegmatite, southwestern Australia: insights into Ta-transport**

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The Greenbushes pegmatite in southwestern Australia is one of the largest Lithium-Cesium-Tantalum (LCT) type pegmatites in the world. The pegmatite consists of many linear dikes ranging from 2–3 km in length and 10–300 m in thickness. It is located in the Western Gneiss terrain of the Yilgarn Block in Western Australia and was emplaced in the Donnybrook-Bridgetown shear zone where it underwent syntectonic crystallization. The pegmatite is an important resource of Sn, Ta, and Li and has been economically mined since 1888. Petrographic observations of thin sections show that tourmaline grains are host to complex crystal-rich and aqueous carbonic fluid inclusions and also show evidence of zoning. The inclusions vary greatly in their solid-vapour-liquid ratios. Various microanalytical techniques used to determine the major and trace element variation within tourmaline growth zones and of the inclusions show the tourmalines have gone through a diverse growth history and the inclusions are heterogeneous in their chemical make-up. Varying proportions of Sn, Pb, Sr, Ta, and different transition metals (Ti, V, Ni) are associated with the changing colour zones throughout the elbaite. The inclusion chemistry is highly variable, with elements like Cs, As, Sb, and Rb commonly detected as well as trace amounts of Ta, Bi, and W. Ta was also present in late-stage fractures within the tourmaline crystals. Trapping temperatures of inclusions, determined in a separate study, suggest entrapment at a temperature of about 700°C and pressures of about 500 MPa. Major and trace element chemistry variations within tourmaline grains and inclusions indicate that the Ta-bearing fluids were enriched in Cs, As, and Sb. The presence of Ta within inclusions and the anomalous concentrations of Ta in microfractures indicate that Ta is being transported by an aqueous fluid, a process that is not well understood or seriously considered in mineralized pegmatite.