## Tantalum in cassiterite

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Tantalum is a strategic metal, which has multiple modern applications. While most of Ta is mined from Ta deposits related to rare metal pegmatites, a significant fraction of Ta is produced from the resudies of tin smelting (slag), after the extraction of tin from cassiterite concentrates.

The origin and role of Ta in cassiterite has received only a small amount of attention so far. Studies on Ta in cassiterite using newer techniques like LA-ICP-MS are especially lacking. The understanding of Ta in cassiterite is useful for the estimation of supply of the metal to the world market. It may also assist in understanding the genesis of tin deposits.

Tin deposits are associated with tin granites; intrusions characterised by an elevated Sn content. Tin granites typically have the characteristics of evolved melts, specifically elevated Ta/Nb ratios and Ta contents. An increase in Ta/Nb ratios during fractionation could occur due to the mica partitioning of Nb and Ta. Therefore, coenrichment of Sn and Ta occurs during magmatic fractionation of biotite- and muscovite-bearing granites.

Ta can occur as solid solution in cassiterite, but is also observed as Ta mineral inclusions which are sometimes interpreted as exsolution. The solid solution of Ta can occur over a wide range of concentrations, and can reach several wt.% Cassiterite from pegmatites has the highest Ta concentrations, likely due to the highest degree of fractionation of rare metal pegmatites. Cassiterite from granite-hosted vein deposits may also have elevated concentrations of Ta. Our new data on the trace element composition of cassiterite from Australias only major tin producer, Renison Bell, suggests that skarn/replacement tin deposits distal from granites have relatively low Ta values. The observations from this data are in agreement with the low mobility of Ta in hydrothermal fluids.

Elevated Ta contents in cassiterite are likely the result of the enhanced availability of Ta in highly evolved granitic melts. The deposition of tin by hydrothermal fluids away from the intrusion results however in the formation of low-Ta cassiterite.