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Coltan U-Pb ID-TIMS Dating: Where is U-Pb found? How does coltan respond to chemical abrasion?

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Columbite and tantalite, often referred to as coltan, are important phases for dating pegmatites rich in several critical metals (e.g., Li, Ta, Nb, Cs, REEs). These dates are commonly used to link pegmatites to regional tectonic and/or magmatic events, allowing for mineral systems models to be created to enhance the success rate in exploration. Coltan is an attractive mineral to date due to its abundance as an accessory phase in lithium-bearing pegmatites, and its ability to incorporate suitable levels of uranium for dating (100s of ppm). However, coltan may show complex U-Pb systematics and growth histories that can lead to discordance [1,2] or potentially mixing ages [3]. Identifying when and how this occurs will improve the interpretability of coltan age data, help with screening of suitable ID-TIMS crystals, and assist in the development of reference materials.

Coltan grains from four distinct pegmatite systems in Canada were investigated here, ranging from Neoarchean to Eocene in age. These include pegmatites from: (1) Mount Begbie (southern British Columbia), (2) Dryden (western Ontario), (3) Pakeagama Lake (northwest Ontario), and (4) Brazil Lake (Nova Scotia).

Coltan grains were first mapped using LA-ICP-MS to determine the distribution of U, Pb, and other major and trace elements. A key observation is that the grains are often extensively fractured and often contain high levels of U and/or Pb within them (Fig. 1). This may be evidence of U-Pb mobility that could impact the concordance of coltan during ID-TIMS analysis if left untreated. To determine if it is possible to eliminate these domains, several chemical abrasion experiments were undertaken, using HCl, HNO_3, and HF acids. Preliminary observations show that common lead is leached out using HF at the cost of physical integrity of the crystal.

[1] Romer and Smeds, Precambrian Research 76, p. 15-30

[2] Smith et al., 2004, Contributions to Mineralogy and Petrology 147, p. 549-564

[3] Kontak et al. 2005, Atlantic Geology 41, p. 17-29

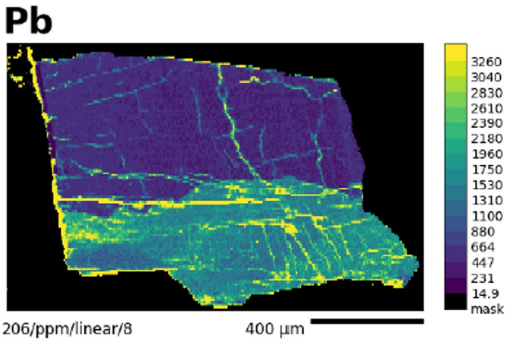


Figure 1: LA-ICP-MS ^{206}Pb map of coltan from the Dryden pegmatite field showing elevated Pb in the fractures.