



U-Pb dating of columbite-bearing ores with a new columbite reference material

U-Pb датирание на колумбит-съдържащи руди с нов колумбитов референтен материал

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Introduction

Columbite-bearing ores are very difficult to date by conventional LA-ICP-MS U-Pb isotope technique, as there are no matrix matched standard reference materials (SRM) known. Several publications recently presented LA-ICP-MS ages of columbite, using zircon as the primary SRM (Che et al., 2015, 2019), however zircon, monazite or other usual SRMs are most often lacking in columbite-tantalite ore bearing veins and rocks (Melcher et al., 2008).

Approach

We investigated several SRMs to date columbite by the LA-ICP-MS U-Pb method, including zircon GJ-1, 91500, Plesovice and the NIST610 glass. Due to differences in laser-induced element fractionation and/or matrix effects, we observed inaccuracy of columbite U-Pb dates by up to 10% applying these non-matrix matched SRMs (Fig. 1a).

Our project therefore aims at characterizing a new homogenous columbite reference material for U-Pb dating using the LA-ICP-MS and ID-TIMS techniques.

The granitic pegmatites of the economic fields from the Pampean pegmatite province extend along a discontinuous belt that exceeds 800 km in N-S and 300 km in W-E directions, mostly in the Sierras

Pampeanas of Central and NW Argentina. They can be subdivided in orogenic and post-orogenic pegmatite fields (Galliski, Černý, 2006).

The downhole corrected Pb/U ratios demonstrate a non-matrix matched behavior between the minerals zircon and columbite (Fig. 1a). In a first attempt we select X36 and GEM-05 (both are columbites) as samples with our primary standard GJ-1. The data of X36 are scattering between 350 and 410 Ma with an average mean age of 377 Ma and GEM-05 data are plotting nicely above the Concordia. Repeating the same procedure with the columbite samples (Fig. 1b), X36 and GEM-05, using our new primary reference standard we obtained an excellent cluster data set of GEM-05 (477 Ma) and GJ-1 (563 Ma).

Conclusions

Preliminary results show that 2 to 4 homogeneous single crystals (selected out of more than 20 localities) are potentially suitable columbite SRMs. These show Pb_{rad}/Pb_{com} ratio and U content of 12.5–0.85 and 44–420 ppm respectively. The $^{206}Pb/^{238}U$ ratios and corresponding ages reveal ~1% uncertainty (SD). Our new SRM was tested on columbites from several deposits in Colombia and Argentina. The results show that using the new SRMs the columbite U-Pb dates are concordant and well defined with usual uncertainty less

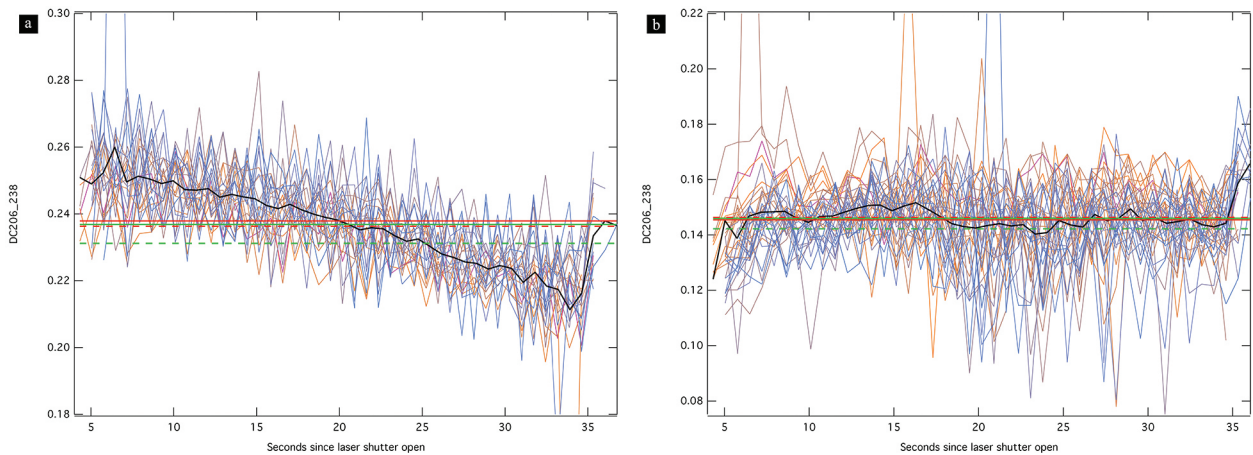


Fig. 1. Downhole corrected $^{206}\text{Pb}/^{238}\text{U}$ ratios of the columbite X36; *a*, signal $^{206}\text{Pb}/^{238}\text{U}$ ratio of columbite X36 is corrected to the zircon GJ1 standard reference material; *b*, signal of $^{206}\text{Pb}/^{238}\text{U}$ ratio of columbite X36 corrected to the new columbite standard reference material

than 2%. They encourage the potential application of this techniques and SRMs for dating of similar type of deposits over the world.

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