U-Pb Geochronology of Uraninite from Mt. Douglas Granite, Canada, and Pulsifer Pegmatite, Maine, USA

NADIA MOHAMMADI, CHRIS MCFARLANE, DAVE LENTZ

Department of Earth Science, University of New Brunswick, Fredericton, NB, E3B 5A3, Canada,
nadia.mohammadi@unb.ca
crmm@unb.ca, dlentz@unb.ca

In situ laser ablation inductively coupled plasma-mass spectrometry (LA ICP-MS) measurements guided by backscattered electron imaging (BSEI) and micro-XRF imaging were applied on two uraninite-bearing rocks to test the potential applicability of uraninite U-Th-Pb geochronometers in igneous and hydrothermal settings. Rather than rely exclusively on $^{207}Pb/^{206}Pb$ ages, this new approach uses NIST610 glass for external calibration. This approach may be justified by the normally metamict nature of the uraninite matrix. One sample is from a greisen vein associated with the medium- to fine-grained porphyritic peraluminous Late Devonian Mount Douglas leucogranites, located in the southwestern New Brunswick, Canada; the other one was obtained from the Pulsifer pegmatite, Maine, USA. The microbeam imaging revealed no internal zoning and only minor local recrystallization along grain boundaries. Measurement of ^{31}P, ^{44}Ca, ^{56}Fe, ^{89}Y, and ^{90}Zr was used to screen inclusions and to gauge trace element variations whereas ^{202}Hg, ^{204}Pb, ^{206}Pb, ^{207}Pb, and ^{208}Pb, ^{232}Th, and ^{238}U were analyzed for U-Th-Pb geochronology. Because of the high actinide and Pb* concentrations, a crater size of 17 µm, low laser pulse rate (2.5 Hz), and low laser fluence (<2 J/cm^2) were used in these initial experiments. Uraninite from both settings produced concordant clusters of data, with weighted mean ages of 366.4 ± 4.3 (2σ; n = 5) Ma for the Mt. Douglas greisen vein which overlaps with existing U-Pb monazite and zircon geochronology (364 ± 10 Ma) for the same sample. Uraninite from the Pulsifer pegmatite yielded a concordant age of 271 ± 2 Ma which is in excellent agreement with U-Pb and Sm-Nd geochronology for other pegmatite suites in south-central Maine. Treating the Pulsifer uraninite as external standard assuming and age of 271 Ma yielded an age of 364.3 ± 6.6 Ma.

This preliminary dataset suggests that precise and accurate uraninite geochronology is possible using NIST610 for external calibration whereas the chemical and isotopic homogeneity of the Pulsifer uraninite makes it useable as an excellent secondary standard. Significantly better precision is expected after further ablation optimization.