

1. Data reporting table for LA-ICP-MS U-Pb analyses

Laboratory & Sample Preparation	
Laboratory name	Geotop, University of Quebec in Montreal
Sample type/mineral	Magmatic and detrital zircons
Sample preparation	Conventional mineral separation, 1 inch resin mount, 1µm polish to finish
Imaging	Centaurus, Hitachi S-3400N SEM
Laser ablation system	
Make, Model & type	Photon-machines G2
Ablation cell & volume	Helix, 2-volume cells
Laser wavelength (nm)	193 nm
Pulse width (ns)	4 ns
Fluence (J.cm ⁻²)	3.18 J.cm ⁻²
Repetition rate (Hz)	6 Hz
Ablation duration (secs)	30 secs
Ablation pit depth / ablation rate	Not available
Spot diameter (µm)	30 µm
Sampling mode / pattern	Static spot ablation n
Carrier gas	100% He in the cell
Cell carrier gas flow (l/min)	0.7 l/min He in the 1 st volume cell 0.5/min He in the 2 nd volume cell
ICP-MS Instrument	
Make, Model & type	ICP-MS (Attom, Nu Instruments)
Sample introduction	Ablation aerosol from laser to torch
RF power (W)	1300W
Make-up gas flow (l/min)	0.3 L/min Ar mixed along the sample transport line to the torch 3 ml/min N2 also added before torch
Detection system	single ion counter
Masses measured	202, 204, 206, 207, 208, 232, 235, 238.
Integration time per peak/dwell times (ms)	500ms for each isotope
Total integration time per output datapoint (secs)	~0.9secs
'Sensitivity' as useful yield (% , element)	0.4% U (NIST610 = 500ppm, #atoms sampled: 500ppm*85um*3Hz*3J/cm ² , #ions detected: >25 mcps)
IC Dead time (ns)	25 ns
Data Processing	
Gas blank	15 second on-peak zero subtracted
Calibration strategy	91500 used as primary reference material
Reference Material info	91500 (Wiedenbeck et al. 1995)
Data processing package used / Correction for LIEF	Iolite4 and IsoplotR softwares. laser-induced elemental fractionation correction assumes reference material and samples behave identically.
Mass discrimination	N/A - Down-hole effect with iolite.
Common-Pb correction, composition and uncertainty	No common-Pb correction applied to the data.

Analytical Procedures For LA-ICP-MS U-Pb Analyses

Uncertainty level & propagation	Ages are quoted at 1 σ absolute, propagation is by quadratic addition. Reproducibility and age uncertainty of reference material are propagated where appropriate.
Quality control / Validation	Plesovice, OG1, R33

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2. Analytical procedures for LA-ICP-MS U-Pb geochronology

Hand-picked zircons were annealed in a muffle furnace at 1000 degrees for 48 hours before being mounted in a 1 inch epoxy puck and polished to expose the center of the grains. Zircon grains have then been imaged on a Hitachi S-3400 Variable Pressure SEM using a Centaurus cathodoluminescence (CL) detector at an accelerating voltage of 20 kV to guide the laser spot location. U-Pb analysis was conducted using a Nu Atom single collector mass spectrometer coupled with a Photon Machines G2 193nm excimer laser. The analytical procedures generally followed those outlined in Perrot et al. (2017), with some modifications. Notably, 3 ml/min of N₂ was introduced before the torch to reduce oxide formation in the plasma. Additionally, the mass spectrometer's sensitivity was optimized using U from a NIST610 glass, and gas flows were adjusted to achieve a U/Th ratio of 1 and a Th/ThO ratio of 1.10⁻³ for the NIST glass.

We used 91500 (Wiedenbeck et al., 1995) as the primary reference material for the correction of all the U-Pb ratios, while Plesovice (Sláma et al., 2008; Widmann et al., 2019), OG1 (Stern et al., 2009), R33 (Black et al., 2004) were analyzed as a secondary reference material for quality control and validation purposes. Iolite 4 software was used to process the data and for down-hole fractionation correction. Measurements were conducted using a sample-reference material bracketing approach, with packages of 15 unknowns bracketed by 2 primary reference analysis and at least one analysis of the secondary reference grains. Analyses were conducted over 2 sessions, for each of the sessions, the repeated analyses of the secondary reference materials produced ages within 2 σ of their respective published ages. All data were processed in Iolite v4 using the laser log file and the U-Pb Geochronology data reduction scheme (DRS) (Paton et al., 2011; Petrus and Kamber, 2012) using an exponential equation to correct for downhole fractionation. Analyses containing detectable 204Pb were removed before data reduction, and no common Pb correction has been applied to the data. After processing the raw data in Iolite v4, Isoplot R (Vermeesch, 2018) was used to generate concordia diagrams and weighted mean ages for samples Zg-106, and Zg-119. Plus, concordia diagram and KDE were generated for sample Zg-132. Ages calculated from the secondary reference material are summarized in Supplementary table 5.

3. References for section

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