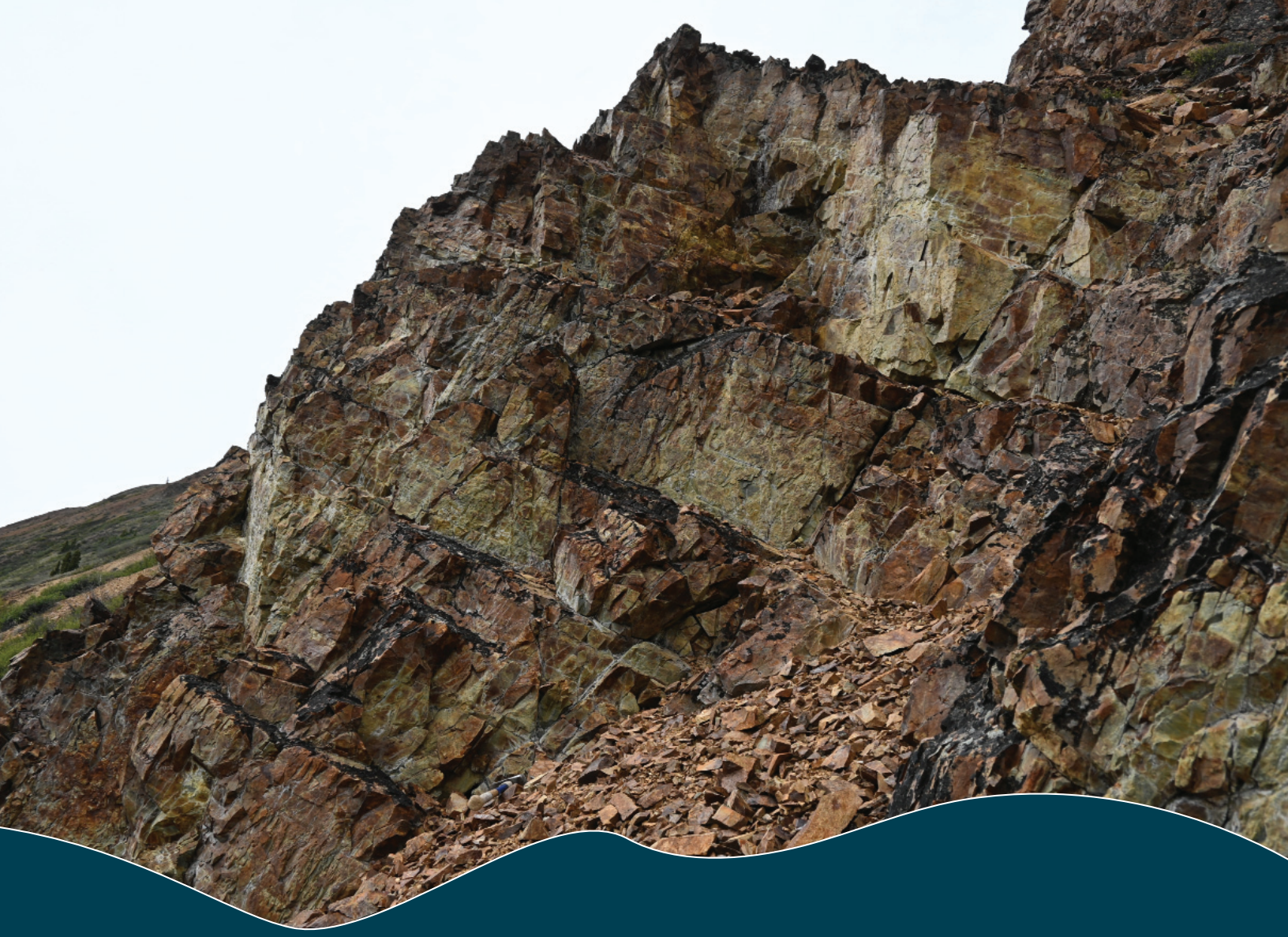

YGS Open File 2025-9

U-Pb zircon geochronological data for Paleocene to Eocene magmatic rocks in southwest Yukon

Israel, S.[1], Murphy, D.[2], Sack, P.J.[2] and Crowley, J.L.[3]

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Yukon

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Yukon Geological Survey
102-300 Main Street
Box 2703 (K-102)
Whitehorse, Yukon, Canada Y1A 2C6

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Front cover: Paleocene Rhyolite Creek subvolcanic ring dike cross-cutting Late Cretaceous volcanic rocks on Red Ridge, southern Yukon, locality 21PS017. Photo credit: Patrick Sack, Yukon Geological Survey.

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Table of Contents

Abstract

U-Pb zircon ages are reported for 28 samples of Paleogene magmatic rocks from the Ruby Range of southwestern Yukon. Rock units sampled include the Ruby Range plutonic suite, the Rhyolite Creek volcano-plutonic complex and the Hayden Lake plutonic suite. Twenty-five samples have chemical abrasion-isotope dilution-thermal ionization mass spectrometry (CA-TIMS) ages, and three samples have laser ablation-inductively coupled plasma mass spectrometry (LA-ICPMS) ages. Ages range from 63.76 ± 0.05 Ma to 45.777 ± 0.057 Ma.

Plain language summary

This publication includes data for 28 new ages of igneous rocks in the Ruby Range of southwest Yukon. These samples are between 64 million years old and 46 million years old.

Introduction

This publication provides basic geologic information and high-quality geochronologic data for 28 legacy samples from the Ruby Range of southwest Yukon. The samples in this publication are from the Ruby Range plutonic suite, the overlying Rhyolite Creek volcano-plutonic complex and the younger Hayden Lake plutonic suite (Fig. 1). The ages of these rocks were determined by analysing U-Pb radiogenic isotopes in igneous zircon, the results of which are summarized in Table 1. Twenty-two samples have chemical abrasion-isotope dilution-thermal ionization mass spectrometry (CA-ID-TIMS; shortened hereafter to CA-TIMS) crystallization ages and three samples have laser ablation-inductively coupled plasma mass spectrometry (LA-ICPMS) crystallization ages. In three samples CA-TIMS dates do not overlap and a maximum crystallization age is interpreted based on the age of the youngest grain.

Table 1. *Summary of the analytical techniques used and the geochronological results. Note errors on the weighted mean ages are 2σ and include all uncertainties; errors quoted in results section include analytical uncertainties only. See CA-TIMS method for full description of error propagation.*

Sample number	Unit	Latitude	Longitude	CL images	LA-ICPMS	CA-TIMS	LA-ICPMS age (Ma)	LA-ICPMS 2σ error (Ma)	CA-TIMS age (Ma)	CA-TIMS 2σ error (Ma)	Interpretation
09DM010B	Ruby Range suite	61.542	-139.222	N/A	N/A	x			63.760	0.050	maximum crystallization age
09EW057	Ruby Range suite	61.444	-138.794	x	N/A	x			60.800	0.050	maximum crystallization age
09EW186	Ruby Range suite	61.933	-138.860	x	N/A	x			57.263	0.066	crystallization age
10EW024-1	Ruby Range suite	61.293	-138.274	x	N/A	x			57.311	0.067	crystallization age
10EW130-1	Ruby Range suite	61.076	-137.617	x	x	N/A	50.9	1.6			crystallization age
10EW176-3	Ruby Range suite	61.543	-138.399	N/A	N/A	x			58.323	0.068	crystallization age
10EW232-1	Ruby Range suite	61.081	-137.307	x	N/A	x			55.409	0.065	crystallization age
10MC042A	Ruby Range suite	60.624	-134.164	N/A	N/A	x			55.295	0.068	crystallization age
10RC131-1	Ruby Range suite	61.861	-138.239	x	N/A	x			61.198	0.020	crystallization age
10RC171-2	Ruby Range suite	61.489	-137.812	x	N/A	x			57.186	0.066	crystallization age
10RC197-1	Ruby Range suite	61.266	-137.294	x	x	N/A	61	1.7			crystallization age
10SI003-1	Hayden Lake suite	61.031	-138.110	x	N/A	x			48.150	0.058	crystallization age

Sample number	Unit	Latitude	Longitude	CL images	LA-ICPMS	CA-TIMS	LA-ICPMS age (Ma)	LA-ICPMS 2σ error (Ma)	CA-TIMS age (Ma)	CA-TIMS 2σ error (Ma)	Interpretation
10SI035-1	Ruby Range suite	61.467	-138.556	x	x	N/A	55.2	1.3			crystallization age
10VLS141-2	Ruby Range suite	61.212	-138.253	N/A	N/A	x			52.187	0.061	crystallization age
11EW025-1	Ruby Range suite	61.690	-137.964	N/A	N/A	x			57.587	0.070	crystallization age
11EW049-1	Rhyolite Creek	61.685	-137.738	x	N/A	x			57.841	0.070	crystallization age
11SI075-1	Rhyolite Creek	61.742	-137.814	x	N/A	x			57.649	0.067	crystallization age
13SI018-1	Hayden Lake suite	60.963	-138.038	x	x	x	46.4	1.2	45.777	0.057	crystallization age
13SI029-1	Ruby Range suite	60.731	-136.696	x	x	x	57.4	1.5	56.100	0.130	crystallization age
13SI045-1	Ruby Range suite	60.698	-136.795	x	x	x	56.4	1.5	57.377	0.042	maximum crystallization age
13SI183-1	Ruby Range suite	60.712	-137.044	x	N/A	x			55.749	0.065	crystallization age
13SI206-1	Ruby Range suite	60.601	-137.005	x	N/A	x			54.622	0.067	crystallization age
15SI142	Ruby Range suite	61.354	-136.988	x	x	x	57.5	1.5	57.301	0.070	crystallization age
16SI166	Ruby Range suite	60.884	-136.903	x	x	x	51.8	1.3	50.901	0.060	crystallization age
16SILK001	Rhyolite Creek	61.594	-136.537	x	x	x	56.6	1.6	56.530	0.066	crystallization age
19MY002-1	Ruby Range suite	61.485	-138.186	x	x	x	51.9	1.1	52.384	0.061	crystallization age
19TF002	Ruby Range suite	60.893	-135.409	x	x	x	54.9	1.2	56.270	0.065	crystallization age
21PS017-2	Rhyolite Creek	60.355	-135.162	x	x	x	56.3	1.3	56.998	0.068	crystallization age

*includes all uncertainties

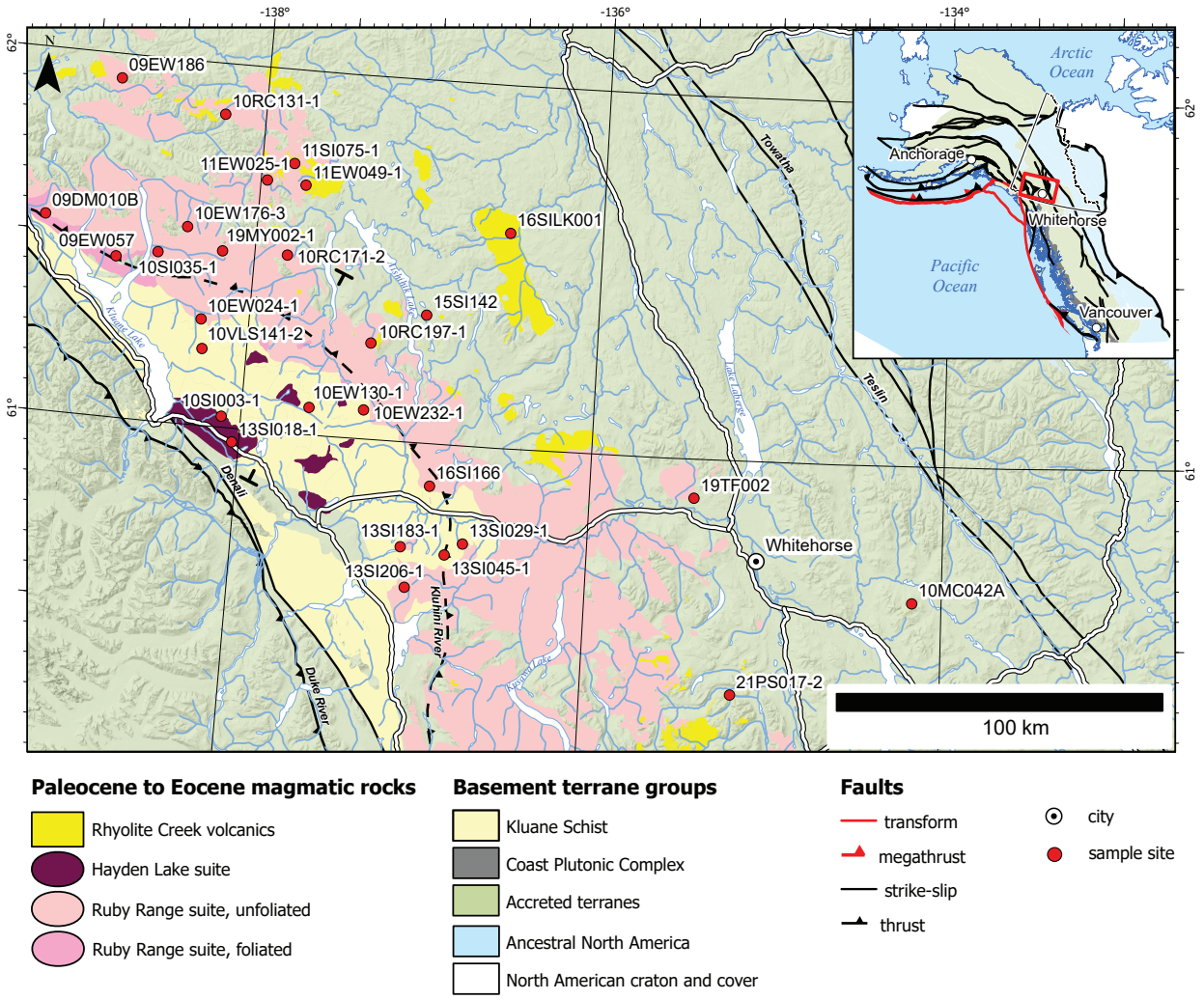

Figure 1. *Simplified regional geology of southwest Yukon (modified from Yukon Geological Survey, 2020, 2025). Trace of the Kluhini River thrust is approximate, portions of the thrust are intruded by younger phases of the Ruby Range suite. Paleocene magmatic rocks in the main map are shown with bold colours whereas older basement terrane rocks are shown with subdued colours that are the same in both the main and inset maps.*

Geology of the Ruby Range

Lying northeast of the Denali fault, the Ruby Range is underlain by a northeast-dipping structural stack of ~40 km structural thickness (Johnston and Canil, 2007) with the metamorphic basement of Paleozoic Yukon-Tanana terrane thrust over Cretaceous Kluane Schist metasedimentary rocks via the Kluhini River thrust (Israel et al., 2011; Vice et al., 2020). These rocks are intruded, and overlain, by Paleogene plutonic and volcanic rocks of the Ruby Range and Rhyolite Creek units and the younger Hayden Lake plutonic suite (Yukon Geological Survey, 2025). Ruby Range plutonism is syn- to post-deformation as seen by variably foliated sections of the Ruby Range batholith along the Kluhini River thrust; Hayden Lake plutonism is inferred to be post ductile deformation (Israel et al., 2011).

The Ruby Range batholith (ca. 64–57 Ma; Israel et al., 2011; Colpron et al., 2016) forms the core of the Coast plutonic complex in the Yukon (Fig. 1). It comprises mainly granodiorite to tonalite and has potential for copper-molybdenum porphyry and epithermal styles of mineralization (Israel et al., 2011). The Rhyolite Creek volcanoplutonic complex refers to the youngest, porphyritic phase of the Ruby Range batholith and its volcanic equivalents. Volcanic

rocks consist of intermediate volcanic flows, breccia and tuff, flow-banded rhyolite and felsic tuff, and rare mafic flows, breccia and tuff (Israel et al., 2011). They are coeval with felsic volcanic rocks near the Mount Skukum gold mine, in the Sifton Range west of Whitehorse, and in the southern Dawson Range. The slightly younger Hayden Lake plutonic suite (ca. 48–45 Ma; Colpron et al., 2016) comprises peraluminous granites found southwest of the Kluhini thrust (Fig. 1) and locally host molybdenum veins.

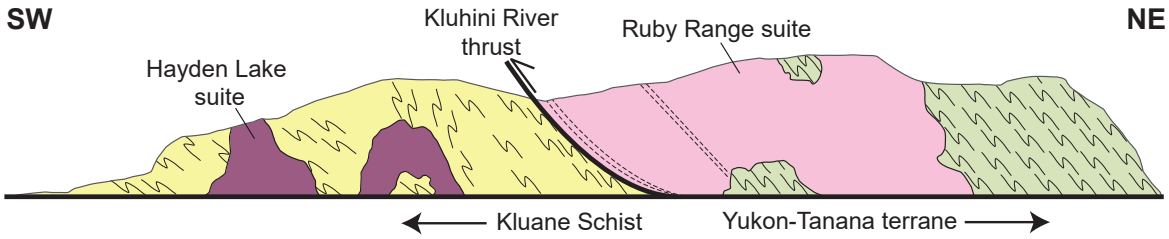

Figure 2. *Schematic cross section drawn from southwest to northeast (modified from Israel et al., 2011), approximate location shown on Figure 1.*

U-Pb geochronology

CA-TIMS method

U-Pb dates were obtained by the chemical abrasion-isotope dilution-thermal ionization mass spectrometry (CA-TIMS) method from analyses composed of single zircon grains (Table 2), modified after Mattinson (2005). Zircon was separated from rocks using standard techniques, placed in a muffle furnace at 900°C for 60 hours in quartz beakers, mounted in epoxy, and polished until the centres of the grains were exposed. Cathodoluminescence (CL) images were obtained with a JEOL JSM-300 scanning electron microscope and Gatan MiniCL. Zircon was removed from the epoxy mounts for dating based on CL images and LA-ICPMS data.

Zircon was loaded into 300 µl Teflon PFA microcapsules, placed in a large-capacity Parr vessel, and partially dissolved in 120 µl of 29 M HF for 12 hours at 190°C. Contents of the microcapsules were then put in 3 ml Teflon PFA beakers, the HF was removed, and zircon was then immersed in 3.5 M HNO_3, ultrasonically cleaned for 30 minutes, and fluxed on a hotplate at 80°C for an hour. The HNO_3 was removed, and zircon was rinsed twice in ultrapure H_2O before being reloaded into the 300 µl Teflon PFA microcapsules (rinsed and fluxed in 6 M HCl for several hours) and spiked with the Boise State University mixed ^{233}U-^{235}U-^{205}Pb tracer solution (BSU-1B). Zircon was dissolved in Parr vessels in 120 µl of 29 M HF at 220°C for 48 hours, dried to fluorides, and re-dissolved in 6 M HCl at 180°C overnight. Uranium and Pb were separated from the zircon matrix using an HCl-based anion-exchange chromatographic procedure (Krogh, 1973), eluted together and dried with 2 µl of 0.05 N H_3PO_4.

Uranium and Pb were loaded on a single outgassed Re filament in 5 µl of a silica-gel/phosphoric acid mixture (Gerstenberger and Haase, 1997), and U and Pb isotopic measurements made on a GV Isoprobe-T multicollector thermal ionization mass spectrometer equipped with an ion-counting Daly detector. Lead isotopes were measured by peak-jumping all isotopes on the Daly detector for 160–220 cycles and corrected for 0.16 ± 0.03%/a.m.u. (1σ) mass fractionation. Transitory isobaric interferences due to high-molecular weight organics, particularly on ^{204}Pb and ^{207}Pb, disappeared within approximately 60 cycles, while ionization efficiency averaged 104 cps/pg of each Pb isotope. Linearity (to ≥1.4 x 106 cps) and the associated deadtime correction of the Daly detector were determined by analysis of NBS982. Uranium was analyzed as UO2+ ions in static Faraday mode on 1012-ohm resistors

for 300 cycles and corrected for isobaric interference of $^{233}U^{18}O^{16}O$ on $^{235}U^{16}O^{16}O$ with an $^{18}O/^{16}O$ of 0.00206. Ionization efficiency averaged 20 mV/ng of each U isotope. The U mass fractionation was corrected using the known $^{233}U/^{235}U$ ratio of the BSU-1B tracer solution.

Dates and uncertainties were calculated using the algorithms of Schmitz and Schoene (2007), calibration of BSU-1B tracer solution of $^{235}U/^{205}Pb$ of 77.93, $^{233}U/^{235}U$ of 1.007066, and $^{205}Pb/^{204}Pb$ = 3491, U decay constants recommended by Jaffey et al. (1971), and $^{238}U/^{235}U$ of 137.818 (Hiess et al., 2012). The $^{206}Pb/^{238}U$ ratios and dates were corrected for initial ^{230}Th disequilibrium using $D_{Th/U}$ = 0.20 ± 0.05 (1σ) and the algorithms of Crowley et al. (2007), resulting in an increase in the $^{206}Pb/^{238}U$ dates of ~0.09 Ma. All common Pb in analyses was attributed to laboratory blanks and subtracted based on the measured laboratory Pb isotopic composition and associated uncertainty. The U blanks are estimated at 0.013 pg.

Weighted mean $^{206}Pb/^{238}U$ dates are calculated from equivalent dates (probability of fit [pof]>0.05) using Isoplot 3.0 (Ludwig, 2003). Errors on the weighted mean dates are 2σ and given as ± x / y / z, where x is the internal error based on analytical uncertainties only, including counting statistics, subtraction of tracer solution, and blank Pb subtraction, y includes the tracer calibration uncertainty propagated in quadrature, and z includes the ^{238}U decay constant uncertainty (Jaffey et al., 1971) propagated in quadrature. Internal errors should be considered when comparing our dates with $^{206}Pb/^{238}U$ dates from other laboratories that used the same tracer solution or a tracer solution that was cross calibrated using EARTHTIME gravimetric standards. Errors including the uncertainty in the tracer calibration should be considered when comparing our dates with those derived from other geochronological methods using the U-Pb decay scheme (e.g., laser ablation ICPMS). Errors including uncertainties in the tracer calibration and 238U decay constant should be considered when comparing our dates with those derived from other decay schemes (e.g., $^{40}Ar/^{39}Ar$, ^{187}Re-^{187}Os). Errors on dates from individual analyses are 2σ.

LA-ICPMS method

Zircon from nine samples was analyzed by laser ablation-inductively coupled plasma mass spectrometry (LA-ICPMS) using a ThermoElectron X-Series II quadrupole ICPMS and New Wave Research UP-213 Nd:YAG UV (213 nm) laser ablation system. In-house analytical protocols, standard materials, and data reduction software were used to acquire and calibrate U–Pb dates, as well as a suite of high field strength elements (HFSE) and rare earth elements (REE). Zircon was ablated with a laser spot of 25 µm wide using fluence and pulse rates of 5 J/cm² and 5 Hz, respectively, during a 45 second analysis (15 sec gas blank, 30 sec ablation) that excavated a pit ~15 µm deep. Ablated material was carried by a 1.2 L/min He gas stream to the nebulizer flow of the plasma. Dwell times and other instrumental data are given in tab S1 for each sample in Appendix B. Zircon from one sample was analyzed using an iCAP RQ Quadrupole ICP-MS and Teledyne Photon Machines Analyte Excite+ 193 nm excimer laser ablation system with HelEx II Active two-volume ablation cell. In-house analytical protocols, standard materials and data reduction software were used for acquisition and calibration of U-Pb dates and a suite of HFSE and REE. Zircon was ablated with a laser spot of 20 µm wide using fluence and pulse rates of 2.5 J/cm² and 10 Hz, respectively, during a 25 second analysis (15 sec gas blank, 10 sec ablation) that excavated a pit ~8 µm deep. Ablated material was carried by a 0.25 L/min He gas stream in the inner cell and a 1.25 L/min He gas stream in the outer cell. Dwell times and other instrumental data are given in supplementary Table S1 Instrumental data for each sample in Appendix B.

Background count rates for each analyte were obtained prior to each spot analysis and

subtracted from the raw count rate for each analyte. Ablation pits that appear to have intersected glass or mineral inclusions were identified based on Ti and P. U-Pb dates from these analyses are considered valid if the U-Pb ratios appear to have been unaffected by the inclusions. Analyses that appear contaminated by common Pb were rejected based on mass 204 being above baseline. For concentration calculations, background-subtracted count rates for each analyte were internally normalized to 29Si and calibrated with respect to NIST SRM-610 and -612 glasses as the primary standards. Temperature was calculated from the Ti-in-zircon thermometer (Watson et al., 2006). Because there are no constraints on the activity of TiO_2, an average value in crustal rocks of 0.8 was used.

For U-Pb and $^{207}Pb/^{206}Pb$ dates, instrumental fractionation of the background-subtracted ratios was corrected, and dates were calibrated with respect to interspersed measurements of zircon standards and reference materials. The primary standard Plešovice zircon (Sláma et al., 2008) was used to monitor time-dependent instrumental fractionation based on two analyses for every 10–12 analyses of unknown zircon. A secondary correction to the $^{206}Pb/^{238}U$ dates was made based on results from a combination of the zircon standards Seiland (531 Ma; Kuiper et al., 2022), FC1 (Swanson-Hysell et al., 2020), and Zirconia (327 Ma, unpublished data, Boise State University), which were treated as unknowns and measured once for every 10–12 analyses of unknown zircon. Data from the standards are shown in supplementary Table S3 Standard data for each sample in Appendix B. These results showed a linear age bias of several percent that is related to the ^{206}Pb count rate. The secondary correction is thought to mitigate matrix-dependent variations due to contrasting compositions and ablation characteristics between the Plešovice zircon and other standards (and unknowns).

Radiogenic isotope ratio and age error propagation for all analyses includes uncertainty contributions from counting statistics and background subtraction. For groups of analyses that are collectively interpreted from a weighted mean date (i.e., igneous zircon analyses), a weighted mean date is first calculated from equivalent dates (pof >0.05) using Isoplot 3.0 (Ludwig, 2003) with errors on individual dates that do not include a standard calibration uncertainty. A standard calibration uncertainty is then propagated into the error on the date. This uncertainty is the local standard deviation of the polynomial fit to the interspersed primary standard measurements versus time for the time-dependent, relatively larger U/Pb fractionation factor, and the standard error of the mean of the consistently time-invariant and smaller $^{207}Pb/^{206}Pb$ fractionation factor. These uncertainties are shown in supplementary Table S1 Instrumental data for each sample in Appendix B. An additional 2% uncertainty based on long term variance in the secondary reference materials was propagated into the weighted mean error; this is the error given and used in age interpretations. Age interpretations are based on $^{206}Pb/^{238}U$ dates. Discordance, defined as the relative difference between the $^{207}Pb/^{235}U$ and $^{206}Pb/^{238}U$ dates, outside of uncertainty of 5% is flagged with strikethrough font in supplementary Table S2 Sample data for each sample in Appendix B and should not be interpreted for age. Errors are at 2σ.

Results

These data summaries include sample descriptions, representative CL images, weighted mean plots using LA-ICPMS and CA-TIMS data and Concordia plots using CA-TIMS data, as well as an interpretation of the geochronological data. Basic sample details, including the location of the field station, and a summary of geochronological results, can be found in Table 1. The data for CA-TIMS analyses are in Table 2. Figures 3 to 30 are data summaries for each sample. Cathodoluminescence images for all zircon grains with LA-ICPMS ablation spot locations are in Appendix A. The data for LA-ICPMS analyses are in Appendix B.

Table 2. *CA-TIMS zircon U-Pb isotopic data.*

									Radiogenic isotope ratios								Isotopic dates					
		Th	^{206}Pb*	mol %	Pb*	Pb_c	Pb*	^{208}Pb	^{208}Pb	^{207}Pb		^{207}Pb		^{206}Pb		corr.	^{207}Pb		^{207}Pb		^{206}Pb	
Sample	LA-ICPMS	U	x10-13 mol	^{206}Pb*	(pg)	(pg)	Pbc	^{204}Pb	^{206}Pb	^{206}Pb	% err	^{235}U	% err	^{238}U	% err	coef.	^{206}Pb	±	^{235}U	±	^{238}U	±
(a)	label	(b)	(c)	(c)	(c)	(c)	(c)	(d)	(e)	(e)	(f)	(e)	(f)	(e)	(f)		(g)	(f)	(g)	(f)	(g)	(f)
09DM010B																						
z5d	N/A	0.211	0.519	99.29%	11.9	0.31	39	2531	0.068	0.047	0.253	0.066	0.301	0.010	0.074	0.727	74.25	6.00	65.26	0.19	65.01	0.05
z3	N/A	0.176	12.788	99.98%	290.9	0.26	1112	73214	0.056	0.047	0.063	0.066	0.132	0.010	0.080	0.949	66.86	1.50	64.73	0.08	64.67	0.05
z5c	N/A	0.160	1.779	99.74%	40.3	0.39	103	6808	0.051	0.047	0.123	0.066	0.174	0.010	0.072	0.827	68.27	2.91	64.75	0.11	64.65	0.05
z2	N/A	0.191	7.551	99.95%	172.6	0.31	563	36904	0.061	0.047	0.064	0.066	0.130	0.010	0.073	0.965	67.84	1.51	64.69	0.08	64.61	0.05
z5b	N/A	0.174	1.591	99.65%	36.2	0.47	77	5091	0.056	0.047	0.125	0.066	0.178	0.010	0.072	0.847	68.24	2.96	64.65	0.11	64.56	0.05
z4	N/A	0.131	18.502	99.93%	415.4	1.07	389	25976	0.042	0.047	0.067	0.066	0.133	0.010	0.077	0.945	66.32	1.59	64.43	0.08	64.38	0.05
z5a	N/A	0.199	2.269	99.59%	52.0	0.78	67	4388	0.064	0.047	0.124	0.065	0.177	0.010	0.072	0.838	66.20	2.96	64.31	0.11	64.26	0.05
z1	N/A	0.137	12.246	99.96%	275.4	0.39	704	46895	0.044	0.047	0.061	0.065	0.130	0.010	0.077	0.964	68.46	1.45	63.88	0.08	63.76	0.05
09EW057																						
z2	N/A	0.109	0.446	98.67%	9.9	0.50	20	1353	0.035	0.047	0.401	0.064	0.451	0.010	0.082	0.672	70.94	9.54	63.42	0.28	63.22	0.05
z1	N/A	0.058	2.159	99.67%	47.4	0.59	81	5532	0.019	0.047	0.118	0.064	0.171	0.010	0.072	0.845	65.54	2.80	63.10	0.10	63.03	0.05
z5	N/A	0.108	0.365	98.92%	8.1	0.33	25	1670	0.035	0.047	0.444	0.064	0.494	0.010	0.083	0.658	74.11	10.56	62.82	0.30	62.52	0.05
z4	N/A	0.066	0.634	99.21%	14.0	0.42	33	2294	0.021	0.047	0.255	0.063	0.302	0.010	0.076	0.716	63.47	6.06	62.42	0.18	62.39	0.05
z6	N/A	0.126	0.204	98.02%	4.6	0.34	13	911	0.040	0.047	0.595	0.063	0.656	0.010	0.091	0.728	70.36	14.13	61.87	0.39	61.65	0.06
z3	N/A	0.174	0.377	98.55%	8.6	0.46	19	1241	0.056	0.047	0.430	0.062	0.484	0.009	0.081	0.722	62.32	10.25	60.84	0.29	60.80	0.05
09EW186																						
z6	N/A	0.368	1.648	99.66%	39.6	0.46	86	5363	0.118	0.047	0.132	0.058	0.185	0.009	0.073	0.837	60.99	3.15	57.401	0.103	**57.315**	**0.041**
z5	N/A	0.323	1.175	99.48%	27.9	0.51	55	3468	0.103	0.047	0.164	0.058	0.214	0.009	0.074	0.793	59.29	3.90	57.321	0.120	**57.274**	**0.042**
z1	N/A	0.641	2.546	99.85%	65.8	0.31	214	12432	0.206	0.047	0.075	0.058	0.140	0.009	0.072	0.963	58.71	1.78	57.303	0.078	**57.269**	**0.041**
z2	N/A	0.439	6.000	99.94%	147.0	0.32	464	28347	0.141	0.047	0.072	0.058	0.135	0.009	0.073	0.937	60.09	1.73	57.316	0.075	**57.250**	**0.042**
z3	N/A	0.757	2.299	99.72%	61.2	0.53	116	6557	0.243	0.047	0.106	0.058	0.163	0.009	0.072	0.891	57.75	2.52	57.250	0.091	**57.238**	**0.041**
z4	N/A	0.412	1.782	99.70%	43.3	0.44	98	6061	0.132	0.047	0.112	0.058	0.167	0.009	0.072	0.864	58.25	2.67	57.258	0.093	**57.234**	**0.041**
									Weighted mean from dates in bold (2 sigma error): 57.263 ± 0.017 (0.024) [0.066] MSWD = 2.1, pof = 0.07, n = 6[h]													
10EW024-1																						
z4	N/A	0.235	0.974	99.71%	22.5	0.24	96	6202	0.075	0.047	0.167	0.058	0.216	0.009	0.074	0.767	54.61	3.98	57.267	0.120	**57.330**	**0.042**
z5	N/A	0.384	0.407	99.44%	9.8	0.19	52	3240	0.123	0.047	0.203	0.058	0.257	0.009	0.075	0.803	62.96	4.84	57.452	0.144	**57.320**	**0.043**
z6	N/A	0.212	0.388	98.58%	8.9	0.46	19	1269	0.068	0.047	0.456	0.058	0.509	0.009	0.083	0.699	55.67	10.86	57.274	0.283	**57.313**	**0.048**
z2	N/A	0.252	1.125	99.80%	26.2	0.19	139	8999	0.081	0.047	0.117	0.058	0.177	0.009	0.072	0.907	55.98	2.80	57.280	0.098	**57.312**	**0.041**
z3	N/A	0.278	0.629	99.54%	14.7	0.24	61	3937	0.089	0.047	0.196	0.058	0.248	0.009	0.075	0.782	52.65	4.69	57.199	0.138	**57.308**	**0.043**
z1	N/A	0.245	0.460	99.49%	10.7	0.20	55	3542	0.079	0.047	0.320	0.058	0.357	0.009	0.089	0.523	49.96	7.64	57.105	0.198	**57.275**	**0.051**
									Weighted mean from dates in bold (2 sigma error): 57.311 ± 0.018 (0.025) [0.067] MSWD = 0.6, pof = 0.70, n = 6[h]													
10EW176-3																						
z2	N/A	0.399	2.084	99.87%	50.5	0.23	224	13835	0.128	0.047	0.086	0.059	0.147	0.009	0.072	0.935	56.24	2.04	58.298	0.083	**58.348**	**0.042**
z1	N/A	0.239	1.278	99.82%	29.6	0.19	154	9942	0.077	0.047	0.153	0.059	0.199	0.009	0.075	0.738	62.88	3.65	58.440	0.113	**58.331**	**0.043**
z5	N/A	0.287	0.806	99.68%	18.9	0.21	89	5676	0.092	0.047	0.132	0.059	0.187	0.009	0.072	0.856	56.73	3.14	58.293	0.106	**58.331**	**0.042**
z4	N/A	0.291	1.093	99.80%	25.7	0.18	145	9234	0.093	0.047	0.105	0.059	0.163	0.009	0.072	0.898	57.72	2.50	58.312	0.092	**58.326**	**0.042**
z6	N/A	0.305	0.629	99.64%	14.8	0.19	78	4966	0.098	0.047	0.172	0.059	0.225	0.009	0.075	0.805	60.22	4.10	58.355	0.128	**58.310**	**0.043**
z3	N/A	0.298	1.334	99.84%	31.4	0.18	176	11181	0.095	0.047	0.103	0.059	0.160	0.009	0.072	0.898	57.95	2.45	58.286	0.091	**58.294**	**0.042**
									Weighted mean from dates in bold (2 sigma error): 58.323 ± 0.017 (0.025) [0.068] MSWD = 0.8, pof = 0.54, n = 6[h]													

									Radiogenic isotope ratios									Isotopic dates					
		Th	$^{206}Pb^*$	mol %	Pb*	Pb_c	Pb*	^{206}Pb	^{208}Pb	^{207}Pb		^{207}Pb		^{206}Pb		corr.	^{207}Pb		^{207}Pb		^{206}Pb	
Sample	LA-ICPMS	U	x10-13 mol	$^{206}Pb^*$	(pg)	(pg)	Pbc	^{204}Pb	^{206}Pb	^{206}Pb	% err	^{235}U	% err	^{238}U	% err	coef.	^{206}Pb	±	^{235}U	±	^{238}U	±
(a)	label	(b)	(c)	(c)	(c)	(c)	(c)	(d)	(e)	(e)	(f)	(e)	(f)	(e)	(f)		(g)	(f)	(g)	(f)	(g)	(f)
10EW232-1																						
z6	N/A	0.290	4.840	99.84%	113.8	0.63	181	11585	0.093	0.047	0.073	0.057	0.137	0.009	0.072	0.962	57.74	1.74	55.835	0.075	55.790	0.040
z3	N/A	0.263	2.932	99.81%	68.4	0.47	145	9303	0.084	0.047	0.087	0.056	0.148	0.009	0.074	0.922	57.53	2.08	55.501	0.080	**55.454**	**0.041**
z4	N/A	0.254	5.277	99.93%	122.8	0.31	394	25364	0.081	0.047	0.082	0.056	0.141	0.009	0.075	0.899	58.04	1.96	55.471	0.076	**55.412**	**0.041**
z5	N/A	0.256	5.246	99.91%	122.2	0.41	298	19157	0.082	0.047	0.071	0.056	0.134	0.009	0.072	0.955	57.30	1.69	55.450	0.072	**55.408**	**0.040**
z2	N/A	0.273	8.840	99.91%	206.8	0.63	329	21193	0.088	0.047	0.068	0.056	0.132	0.009	0.074	0.954	58.93	1.61	55.469	0.071	**55.389**	**0.041**
z1	N/A	0.264	5.384	99.88%	125.7	0.53	236	15166	0.085	0.047	0.072	0.056	0.136	0.009	0.073	0.949	56.92	1.73	55.417	0.073	**55.382**	**0.040**
10MC042A																						
z1	N/A	0.324	0.216	98.81%	5.1	0.22	24	1514	0.104	0.047	0.427	0.056	0.484	0.009	0.083	0.737	46.59	10.20	55.451	0.261	55.656	0.046
z6	N/A	0.344	0.073	97.08%	1.7	0.18	10	617	0.110	0.046	1.282	0.055	1.368	0.009	0.121	0.733	22.13	30.76	54.770	0.729	55.519	0.067
z3	N/A	0.245	0.232	98.79%	5.4	0.24	23	1490	0.079	0.047	0.473	0.056	0.530	0.009	0.085	0.738	46.73	11.28	55.236	0.285	55.432	0.047
z4	N/A	0.295	0.280	99.19%	6.6	0.19	35	2220	0.095	0.047	0.405	0.056	0.456	0.009	0.081	0.690	48.76	9.67	55.172	0.245	**55.320**	**0.045**
z5	N/A	0.402	0.108	97.92%	2.6	0.19	14	866	0.129	0.047	0.851	0.055	0.923	0.009	0.103	0.734	29.44	20.38	54.712	0.491	**55.291**	**0.057**
z2	N/A	0.224	0.328	99.30%	7.6	0.19	39	2582	0.072	0.047	0.270	0.056	0.323	0.009	0.077	0.773	49.65	6.44	55.149	0.173	**55.276**	**0.042**
10-RC-131-1																						
z3	N/A	0.248	4.224	99.85%	98.1	0.54	183	11783	0.080	0.047	0.084	0.062	0.144	0.010	0.072	0.920	59.62	2.00	61.192	0.085	**61.233**	**0.044**
z1	N/A	0.253	3.842	99.87%	89.4	0.42	215	13827	0.081	0.047	0.070	0.062	0.137	0.010	0.075	0.958	61.69	1.67	61.231	0.081	**61.219**	**0.046**
z2	N/A	0.294	5.056	99.85%	119.0	0.63	190	12113	0.094	0.047	0.080	0.062	0.143	0.010	0.076	0.918	61.42	1.91	61.197	0.085	**61.191**	**0.046**
z4	N/A	0.263	2.796	99.78%	65.2	0.52	126	8083	0.084	0.047	0.132	0.062	0.178	0.010	0.077	0.738	64.61	3.14	61.265	0.106	**61.179**	**0.047**
z6	N/A	0.217	4.163	99.89%	95.8	0.39	243	15824	0.069	0.047	0.074	0.062	0.137	0.010	0.072	0.947	58.92	1.77	61.110	0.081	**61.166**	**0.044**
z5	N/A	0.317	4.816	99.85%	114.1	0.61	187	11807	0.102	0.047	0.081	0.062	0.142	0.010	0.073	0.929	61.23	1.93	61.089	0.084	61.085	0.044
10RC171-2																						
z2	N/A	0.394	1.665	99.50%	40.3	0.70	58	3609	0.126	0.047	0.147	0.058	0.200	0.009	0.073	0.828	57.70	3.50	57.225	0.111	**57.214**	**0.042**
z3	N/A	0.386	1.752	99.79%	42.3	0.30	141	8763	0.124	0.047	0.106	0.058	0.165	0.009	0.072	0.912	59.38	2.53	57.253	0.092	**57.202**	**0.041**
z6	N/A	0.413	2.741	99.92%	66.7	0.19	345	21259	0.132	0.047	0.058	0.058	0.131	0.009	0.070	0.900	56.43	1.39	57.170	0.073	**57.187**	**0.040**
z5	N/A	0.426	1.664	99.86%	40.6	0.19	209	12857	0.136	0.047	0.104	0.058	0.164	0.009	0.072	0.924	58.70	2.47	57.217	0.091	**57.181**	**0.041**
z1	N/A	0.367	3.048	99.80%	73.2	0.51	144	9004	0.118	0.047	0.109	0.058	0.162	0.009	0.073	0.847	57.55	2.60	57.179	0.090	**57.170**	**0.041**
z4	N/A	0.426	2.546	99.89%	62.2	0.23	267	16410	0.137	0.047	0.083	0.058	0.144	0.009	0.072	0.932	58.32	1.99	57.190	0.080	**57.163**	**0.041**
10SI003-1																						
z4	N/A	0.165	1.863	99.79%	42.2	0.33	128	8484	0.053	0.047	0.133	0.049	0.183	0.008	0.075	0.802	52.87	3.16	48.468	0.086	48.380	0.036
z3	N/A	0.224	4.565	99.95%	105.3	0.19	547	35497	0.072	0.047	0.071	0.049	0.134	0.008	0.073	0.953	50.24	1.70	48.255	0.063	48.215	0.035
z5	N/A	0.171	2.061	99.89%	46.8	0.19	243	16010	0.055	0.047	0.087	0.049	0.148	0.008	0.075	0.923	51.58	2.08	48.262	0.070	48.196	0.036
z6	N/A	0.160	3.029	99.93%	68.6	0.19	364	24070	0.051	0.047	0.081	0.049	0.142	0.008	0.074	0.928	50.41	1.93	48.217	0.067	**48.173**	**0.035**
z1	N/A	0.162	2.995	99.92%	67.9	0.20	346	22865	0.052	0.047	0.088	0.049	0.147	0.007	0.073	0.919	53.52	2.10	48.252	0.069	**48.146**	**0.035**
z2	N/A	0.147	3.144	99.91%	70.9	0.24	291	19313	0.047	0.047	0.084	0.049	0.144	0.007	0.073	0.927	51.31	2.00	48.193	0.068	**48.130**	**0.035**
10VLS141-2																						
z5	N/A	0.201	0.564	99.47%	12.9	0.25	52	3384	0.065	0.047	0.202	0.053	0.254	0.008	0.075	0.794	56.92	4.81	52.310	0.130	**52.209**	**0.039**
z1	N/A	0.132	0.658	99.48%	14.8	0.29	51	3441	0.042	0.047	0.190	0.053	0.241	0.008	0.075	0.789	54.42	4.52	52.247	0.123	**52.200**	**0.039**
z6	N/A	0.256	0.537	99.26%	12.5	0.33	37	2429	0.082	0.047	0.313	0.053	0.358	0.008	0.094	0.580	51.02	7.48	52.165	0.182	**52.190**	**0.049**
z4	N/A	0.338	0.324	99.15%	7.7	0.23	34	2125	0.108	0.047	0.288	0.053	0.342	0.008	0.080	0.758	48.84	6.87	52.109	0.174	**52.180**	**0.041**
z2	N/A	0.257	0.804	99.60%	18.7	0.27	71	4558	0.082	0.047	0.169	0.053	0.220	0.008	0.075	0.794	53.61	4.02	52.206	0.112	**52.175**	**0.039**
z3	N/A	0.313	1.381	99.79%	32.7	0.24	139	8799	0.100	0.047	0.108	0.053	0.163	0.008	0.074	0.858	50.94	2.58	52.142	0.083	**52.168**	**0.038**

Weighted mean from dates in bold (2 sigma error): 55.409 ± 0.018 (0.025) [0.065] MSWD = 1.9, pof = 0.10, n = 5[h]

Weighted mean from dates in bold (2 sigma error): 55.295 ± 0.027 (0.032) [0.068] MSWD = 1.0, pof = 0.35, n = 3[h]

Weighted mean from dates in bold (2 sigma error): 61.198 ± 0.020 (0.037) [0.075] MSWD = 1.6, pof = 0.18, n = 5[h]

Weighted mean from dates in bold (2 sigma error): 57.186 ± 0.017 (0.024) [0.066] MSWD = 0.9, pof = 0.50, n = 6[h]

Weighted mean from dates in bold (2 sigma error): 48.150 ± 0.020 (0.025) [0.058] MSWD = 1.5, pof = 0.22, n = 3[h]

Weighted mean from dates in bold (2 sigma error): 52.187 ± 0.017 (0.023) [0.061] MSWD = 0.6, pof = 0.67, n = 6[h]

									Radiogenic isotope ratios									Isotopic dates					
		Th	$^{206}Pb^*$	mol %	Pb*	Pb_c	Pb*	^{206}Pb	^{208}Pb	^{207}Pb		^{207}Pb		^{206}Pb		corr.	^{207}Pb		^{207}Pb		^{206}Pb	
Sample	LA-ICPMS	U	x10-13 mol	$^{206}Pb^*$	(pg)	(pg)	Pbc	^{204}Pb	^{206}Pb	^{206}Pb	% err	^{235}U	% err	^{238}U	% err	coef.	^{206}Pb	±	^{235}U	±	^{238}U	±
(a)	label	(b)	(c)	(c)	(c)	(c)	(c)	(d)	(e)	(e)	(f)	(e)	(f)	(e)	(f)		(g)	(f)	(g)	(f)	(g)	(f)
11EW025-1																						
z5	N/A	0.537	0.721	99.37%	18.1	0.38	48	2864	0.172	0.047	0.218	0.058	0.265	0.009	0.077	0.720	56.00	5.19	57.689	0.149	57.730	0.044
z2	N/A	0.368	0.703	99.25%	16.9	0.44	38	2395	0.118	0.047	0.230	0.058	0.279	0.009	0.080	0.704	59.83	5.49	57.704	0.156	57.653	0.046
z1	N/A	0.520	2.637	99.65%	66.1	0.77	86	5170	0.167	0.047	0.120	0.058	0.173	0.009	0.073	0.843	57.54	2.86	57.647	0.097	57.650	0.042
z3	N/A	0.420	0.741	99.30%	18.1	0.44	42	2568	0.135	0.047	0.249	0.058	0.296	0.009	0.079	0.690	58.17	5.94	57.604	0.166	**57.591**	**0.045**
z4	N/A	0.545	0.903	99.38%	22.8	0.47	49	2919	0.175	0.047	0.209	0.058	0.257	0.009	0.078	0.725	53.80	4.97	57.499	0.144	**57.588**	**0.045**
z6	N/A	0.452	0.683	99.15%	16.8	0.49	34	2113	0.145	0.047	0.254	0.058	0.304	0.009	0.077	0.737	51.59	6.06	57.442	0.170	**57.582**	**0.044**
				Weighted mean from dates in bold (2 sigma error): 57.587 ± 0.026 (0.031) [0.070] MSWD = 0.0, pof = 0.96, n = 3[h]																			
11EW049-1																						
z3	N/A	0.721	0.244	98.12%	6.4	0.39	17	961	0.231	0.047	0.572	0.058	0.631	0.009	0.093	0.687	37.31	13.68	57.439	0.352	57.923	0.054
z6	N/A	0.385	0.141	95.72%	3.4	0.52	7	422	0.124	0.047	1.155	0.058	1.246	0.009	0.129	0.739	29.00	27.67	57.230	0.694	**57.907**	**0.074**
z1	N/A	0.486	0.387	98.71%	9.6	0.42	23	1396	0.156	0.047	0.363	0.058	0.416	0.009	0.084	0.708	45.10	8.67	57.535	0.233	**57.835**	**0.048**
z5	N/A	0.577	0.324	98.22%	8.2	0.49	17	1013	0.185	0.047	0.505	0.059	0.563	0.009	0.089	0.705	57.16	12.03	57.818	0.316	**57.834**	**0.051**
z4	N/A	0.506	0.296	98.56%	7.4	0.36	21	1252	0.162	0.047	0.422	0.059	0.477	0.009	0.084	0.714	55.19	10.06	57.764	0.268	**57.827**	**0.048**
				Weighted mean from dates in bold (2 sigma error): 57.841 ± 0.027 (0.032) [0.070] MSWD = 1.2, pof = 0.31, n = 4[h]																			
11SI075-1																						
z1	N/A	0.475	1.962	99.64%	48.5	0.59	83	5047	0.152	0.047	0.129	0.058	0.181	0.009	0.076	0.808	56.21	3.08	57.627	0.102	**57.662**	**0.044**
z5	N/A	0.504	1.104	99.44%	27.5	0.52	53	3216	0.162	0.047	0.169	0.058	0.221	0.009	0.073	0.801	55.00	4.03	57.596	0.124	**57.658**	**0.042**
z6	N/A	0.660	1.039	99.42%	27.0	0.51	53	3098	0.212	0.047	0.182	0.058	0.234	0.009	0.074	0.803	52.56	4.33	57.534	0.131	**57.653**	**0.042**
z2	N/A	0.532	1.701	99.72%	42.7	0.40	106	6363	0.171	0.047	0.115	0.058	0.171	0.009	0.073	0.864	50.94	2.75	57.490	0.096	**57.647**	**0.042**
z3	N/A	0.419	0.596	99.05%	14.5	0.48	31	1898	0.134	0.047	0.290	0.059	0.340	0.009	0.078	0.728	61.69	6.90	57.741	0.191	**57.646**	**0.045**
z4	N/A	0.366	0.515	98.85%	12.4	0.50	25	1573	0.117	0.047	0.370	0.058	0.419	0.009	0.083	0.669	51.32	8.81	57.476	0.234	**57.624**	**0.048**
				Weighted mean from dates in bold (2 sigma error): 57.649 ± 0.018 (0.025) [0.067] MSWD = 0.3, pof = 0.88, n = 6[h]																			
13SI018-1																						
z3	98	0.122	2.186	99.86%	48.9	0.25	196	13128	0.039	0.047	0.085	0.047	0.145	0.007	0.073	0.927	49.64	2.02	46.221	0.065	46.155	0.034
z6	89	0.183	1.071	99.70%	24.4	0.27	91	6020	0.059	0.047	0.135	0.047	0.189	0.007	0.074	0.839	49.01	3.23	46.194	0.085	46.140	0.034
z1	53	0.140	1.254	99.72%	28.2	0.29	96	6430	0.045	0.047	0.121	0.046	0.175	0.007	0.074	0.855	46.55	2.88	45.948	0.079	45.936	0.034
z5	88	0.125	1.297	99.76%	29.1	0.26	112	7485	0.040	0.047	0.116	0.046	0.172	0.007	0.073	0.880	49.42	2.77	45.951	0.077	45.885	0.033
z4	87	0.177	1.465	99.75%	33.3	0.30	110	7252	0.057	0.047	0.111	0.046	0.167	0.007	0.074	0.882	48.75	2.64	45.837	0.075	**45.781**	**0.034**
z2	55	0.104	1.225	99.77%	27.3	0.24	115	7772	0.033	0.047	0.117	0.046	0.173	0.007	0.074	0.880	51.58	2.78	45.883	0.078	**45.774**	**0.034**
				Weighted mean from dates in bold (2 sigma error): 45.777 ± 0.024 (0.027) [0.057] MSWD = 0.1, pof = 0.76, n = 2[h]																			
13SI029																						
z4	10	0.122	0.242	98.98%	5.4	0.21	26	1763	0.039	0.048	0.371	0.075	0.423	0.011	0.090	0.652	92.64	8.78	73.688	0.300	73.105	0.065
z1a	2, 3	0.136	0.391	99.42%	8.8	0.19	46	3092	0.044	0.047	0.307	0.057	0.354	0.009	0.080	0.679	66.77	7.29	56.452	0.195	56.209	0.045
z1b	2, 3	0.094	0.390	99.41%	8.7	0.19	45	3061	0.030	0.047	0.307	0.057	0.357	0.009	0.078	0.722	70.15	7.29	56.397	0.196	56.074	0.044
z5	44	0.020	0.122	97.52%	2.6	0.26	10	727	0.007	0.047	0.889	0.057	0.961	0.009	0.109	0.695	61.28	21.18	55.843	0.522	55.716	0.060
13SI045-1																						
z2	N/A	0.200	2.372	99.82%	54.4	0.35	157	10295	0.064	0.047	0.091	0.059	0.151	0.009	0.072	0.920	59.51	2.17	58.020	0.085	57.984	0.042
z5	N/A	0.206	1.043	99.68%	23.9	0.28	86	5657	0.066	0.047	0.131	0.059	0.187	0.009	0.072	0.865	60.74	3.13	58.016	0.105	57.950	0.042
z6	128, 129	0.158	0.162	97.18%	3.7	0.39	9	641	0.051	0.047	0.952	0.059	1.027	0.009	0.112	0.709	60.13	22.67	57.791	0.577	57.734	0.064
z1	N/A	0.200	0.932	99.75%	21.4	0.19	110	7184	0.064	0.047	0.138	0.058	0.193	0.009	0.072	0.849	59.00	3.29	57.658	0.108	57.626	0.041
z3	N/A	0.131	2.344	99.86%	52.6	0.27	193	12911	0.042	0.047	0.088	0.058	0.148	0.009	0.072	0.923	59.74	2.10	57.491	0.083	57.437	0.041
z4	N/A	0.135	1.655	99.70%	37.2	0.41	90	6040	0.043	0.047	0.116	0.058	0.171	0.009	0.073	0.862	57.98	2.77	57.391	0.095	57.377	0.042
13SI183-1																						
z2	N/A	0.251	1.229	99.61%	28.6	0.40	72	4664	0.081	0.047	0.148	0.057	0.199	0.009	0.073	0.814	60.85	3.52	55.881	0.108	**55.765**	**0.040**

									Radiogenic isotope ratios									Isotopic dates					
		Th	$^{206}Pb^*$	mol %	Pb*	Pb_c	Pb*	^{206}Pb	^{208}Pb	^{207}Pb		^{207}Pb		^{206}Pb		corr.	^{207}Pb		^{207}Pb		^{206}Pb	
Sample	LA-ICPMS	U	x10-13 mol	$^{206}Pb^*$	(pg)	(pg)	Pbc	^{204}Pb	^{206}Pb	^{206}Pb	% err	^{235}U	% err	^{238}U	% err	coef.	^{206}Pb	±	^{235}U	±	^{238}U	±
(a)	label	(b)	(c)	(c)	(c)	(c)	(c)	(d)	(e)	(e)	(f)	(e)	(f)	(e)	(f)		(g)	(f)	(g)	(f)	(g)	(f)
z1	N/A	0.256	1.111	99.47%	25.9	0.50	52	3375	0.082	0.047	0.183	0.057	0.231	0.009	0.074	0.758	60.39	4.36	55.870	0.126	**55.765**	**0.041**
z3	N/A	0.274	0.836	99.31%	19.6	0.48	40	2606	0.088	0.047	0.237	0.056	0.288	0.009	0.082	0.718	49.98	5.66	55.623	0.156	**55.754**	**0.045**
z4	N/A	0.203	1.068	99.61%	24.5	0.35	70	4619	0.065	0.047	0.176	0.057	0.220	0.009	0.077	0.705	61.32	4.18	55.873	0.120	**55.746**	**0.043**
z6	N/A	0.245	0.834	99.55%	19.4	0.32	61	3968	0.079	0.047	0.164	0.056	0.216	0.009	0.074	0.810	55.50	3.90	55.733	0.117	**55.738**	**0.041**
z5	N/A	0.272	0.714	99.46%	16.7	0.32	52	3351	0.087	0.047	0.208	0.056	0.257	0.009	0.074	0.758	55.52	4.96	55.724	0.139	**55.729**	**0.041**
				Weighted mean from dates in bold (2 sigma error): 55.749 ± 0.017 (0.024) [0.065] MSWD = 0.5, pof = 0.77, n = 6[h]																		
13SI206-1																						
z2	N/A	0.240	1.030	99.58%	23.9	0.36	66	4293	0.077	0.047	0.162	0.056	0.211	0.009	0.074	0.773	58.09	3.87	55.098	0.113	55.030	0.041
z3	N/A	0.262	3.131	99.80%	73.0	0.51	142	9135	0.084	0.047	0.088	0.056	0.148	0.009	0.073	0.918	66.51	2.10	55.133	0.080	54.871	0.040
z4	N/A	0.253	3.674	99.84%	85.5	0.49	176	11347	0.081	0.047	0.081	0.055	0.142	0.009	0.072	0.933	55.30	1.93	54.699	0.075	54.686	0.039
z1	N/A	0.230	3.142	99.88%	72.6	0.31	233	15137	0.074	0.047	0.078	0.055	0.140	0.009	0.072	0.943	57.63	1.86	54.694	0.074	**54.627**	**0.039**
z5	N/A	0.255	4.669	99.83%	108.7	0.65	168	10898	0.082	0.047	0.081	0.055	0.142	0.009	0.072	0.932	58.12	1.93	54.695	0.075	**54.617**	**0.039**
				Weighted mean from dates in bold (2 sigma error): 54.622 ± 0.028 (0.032) [0.067] MSWD = 0.2, pof = 0.70, n = 2[h]																		
15SI142-1																						
z5	158	0.325	0.544	97.64%	13.1	1.09	12	777	0.104	0.060	0.730	0.088	0.805	0.011	0.129	0.636	593.70	15.81	85.554	0.660	68.450	0.088
z4	167	0.331	0.382	98.74%	9.1	0.40	23	1432	0.106	0.051	0.416	0.072	0.469	0.010	0.083	0.695	230.79	9.60	70.416	0.319	65.782	0.055
z3	155	0.307	0.478	98.97%	11.3	0.41	27	1748	0.098	0.047	0.385	0.059	0.434	0.009	0.082	0.669	62.23	9.16	58.301	0.246	58.206	0.047
z6	160	0.350	0.448	99.22%	10.7	0.29	37	2307	0.112	0.047	0.377	0.058	0.425	0.009	0.081	0.659	51.58	9.00	57.195	0.236	**57.329**	**0.046**
z1b	169	0.350	0.372	98.75%	8.9	0.39	23	1441	0.112	0.047	0.552	0.058	0.607	0.009	0.101	0.610	67.41	13.13	57.529	0.339	**57.292**	**0.057**
z1a	169	0.335	0.494	99.15%	11.8	0.35	33	2110	0.107	0.047	0.263	0.058	0.313	0.009	0.074	0.758	61.02	6.26	57.370	0.175	**57.283**	**0.042**
				Weighted mean from dates in bold (2 sigma error): 57.301 ± 0.027 (0.032) [0.070] MSWD = 1.2, pof = 0.31, n = 3[h]																		
16SI166																						
z1	97	0.397	0.674	99.27%	16.3	0.41	39	2455	0.127	0.047	0.267	0.052	0.316	0.008	0.081	0.697	52.45	6.37	51.067	0.157	51.038	0.041
z8	118	0.332	0.590	99.34%	14.0	0.33	43	2736	0.107	0.047	0.258	0.052	0.305	0.008	0.077	0.711	52.83	6.15	51.041	0.152	51.002	0.039
z2	119	0.279	0.413	99.13%	9.7	0.30	32	2065	0.090	0.047	0.362	0.051	0.410	0.008	0.082	0.664	47.25	8.64	50.884	0.203	50.961	0.042
z7	123	0.369	0.892	98.36%	21.4	1.23	17	1118	0.118	0.047	0.267	0.051	0.318	0.008	0.078	0.742	49.07	6.37	50.910	0.158	50.949	0.039
z3	138	0.330	0.314	98.58%	7.5	0.38	20	1267	0.106	0.047	0.419	0.051	0.475	0.008	0.081	0.746	50.02	10.00	50.916	0.236	**50.935**	**0.041**
z4	94	0.275	1.128	99.68%	26.4	0.30	89	5713	0.088	0.047	0.130	0.051	0.186	0.008	0.073	0.870	50.82	3.10	50.915	0.092	**50.917**	**0.037**
z6	125	0.285	0.639	99.39%	15.0	0.33	46	2947	0.091	0.047	0.201	0.051	0.249	0.008	0.075	0.749	48.11	4.79	50.825	0.123	**50.883**	**0.038**
z5	101	0.280	1.652	99.78%	38.7	0.30	129	8253	0.090	0.047	0.092	0.051	0.151	0.008	0.073	0.911	53.49	2.19	50.928	0.075	**50.874**	**0.037**
				Weighted mean from dates in bold (2 sigma error): 50.901 ± 0.019 (0.024) [0.060] MSWD = 2.2, pof = 0.09, n = 4[h]																		
16SILK01																						
z6	29	0.937	1.871	99.85%	52.1	0.23	222	11948	0.301	0.047	0.086	0.057	0.147	0.009	0.072	0.943	55.42	2.04	56.636	0.081	56.665	0.040
z1	22	0.899	2.943	99.93%	81.2	0.18	455	24722	0.288	0.047	0.079	0.057	0.140	0.009	0.072	0.936	56.97	1.89	56.573	0.077	**56.563**	**0.040**
z3	25	0.996	4.989	99.96%	140.8	0.17	834	44261	0.320	0.047	0.065	0.057	0.131	0.009	0.072	0.972	56.36	1.56	56.523	0.072	**56.527**	**0.040**
z2	23	0.965	3.997	99.95%	112.0	0.16	698	37335	0.310	0.047	0.075	0.057	0.137	0.009	0.072	0.941	58.39	1.80	56.561	0.075	**56.517**	**0.040**
z4	26	0.857	2.526	99.93%	68.9	0.15	448	24592	0.275	0.047	0.078	0.057	0.140	0.009	0.072	0.948	55.41	1.85	56.490	0.077	**56.515**	**0.040**
				Weighted mean from dates in bold (2 sigma error): 56.530 ± 0.020 (0.026) [0.066] MSWD = 1.2, pof = 0.30, n = 4[h]																		
19MY002-1																						
z6	66	0.261	1.096	99.84%	25.6	0.14	178	11427	0.084	0.047	0.093	0.053	0.152	0.008	0.073	0.907	57.77	2.21	52.527	0.078	**52.412**	**0.038**
z3	76	0.250	1.196	99.86%	27.8	0.13	206	13289	0.080	0.047	0.078	0.053	0.143	0.008	0.073	0.956	58.44	1.87	52.522	0.073	**52.392**	**0.038**
z5	57	0.283	1.043	99.85%	24.5	0.13	194	12394	0.091	0.047	0.099	0.053	0.156	0.008	0.074	0.877	55.68	2.37	52.459	0.080	**52.388**	**0.038**
z1	51	0.247	1.226	99.83%	28.5	0.18	160	10328	0.079	0.047	0.090	0.053	0.150	0.008	0.074	0.911	57.06	2.15	52.475	0.077	**52.375**	**0.038**
z2	48	0.285	1.529	99.84%	35.9	0.20	177	11280	0.092	0.047	0.083	0.053	0.144	0.008	0.073	0.926	56.95	1.98	52.469	0.074	**52.371**	**0.038**
z4	77	0.263	1.493	99.89%	34.8	0.14	245	15755	0.084	0.047	0.079	0.053	0.141	0.008	0.072	0.945	56.31	1.87	52.454	0.072	**52.370**	**0.038**
				Weighted mean from dates in bold (2 sigma error): 52.384 ± 0.016 (0.022) [0.061] MSWD = 0.7, pof = 0.60, n = 6[h]																		
19TF02																						
z3	116	0.438	1.143	99.44%	28.0	0.53	53	3237	0.140	0.047	0.155	0.057	0.205	0.009	0.075	0.785	56.70	3.69	56.314	0.112	**56.305**	**0.042**
z1	117	0.379	1.644	99.68%	39.6	0.44	90	5604	0.122	0.047	0.115	0.057	0.170	0.009	0.076	0.842	60.00	2.73	56.362	0.093	**56.277**	**0.043**

									Radiogenic isotope ratios								Isotopic dates					
		Th	^{206}Pb*	mol %	Pb*	Pb_c	Pb*	^{208}Pb	^{208}Pb	^{207}Pb		^{207}Pb		^{206}Pb		corr.	^{207}Pb		^{207}Pb		^{206}Pb	
Sample	LA-ICPMS	U	x10-13 mol	^{206}Pb*	(pg)	(pg)	Pbc	^{204}Pb	^{206}Pb	^{206}Pb	% err	^{235}U	% err	^{238}U	% err	coef.	^{206}Pb	±	^{235}U	±	^{238}U	±
(a)	label	(b)	(c)	(c)	(c)	(c)	(c)	(d)	(e)	(e)	(f)	(e)	(f)	(e)	(f)		(g)	(f)	(g)	(f)	(g)	(f)
z6	145	0.405	1.272	99.86%	30.9	0.15	212	13112	0.130	0.047	0.083	0.057	0.144	0.009	0.073	0.931	62.14	1.97	56.403	0.079	**56.268**	**0.041**
z2	118	0.404	0.694	99.71%	16.8	0.17	101	6265	0.130	0.047	0.127	0.057	0.181	0.009	0.074	0.842	56.91	3.02	56.275	0.099	**56.260**	**0.041**
z4	119	0.405	0.787	99.76%	19.1	0.16	121	7500	0.130	0.047	0.127	0.057	0.179	0.009	0.074	0.816	57.86	3.04	56.294	0.098	**56.258**	**0.041**
z5	129	0.367	1.412	99.83%	33.9	0.20	173	10827	0.118	0.047	0.085	0.057	0.146	0.009	0.074	0.922	61.58	2.02	56.379	0.080	**56.257**	**0.041**
				Weighted mean from dates in bold (2 sigma error): 56.270 ± 0.017 (0.024) [0.065] MSWD = 0.8, pof = 0.57, n = 6[h]																	
21PS017-2																						
z3	186	0.366	0.535	99.63%	12.9	0.16	79	4926	0.118	0.047	0.248	0.058	0.283	0.009	0.085	0.546	68.55	5.90	57.333	0.158	57.064	0.048
z1	173	0.330	0.317	97.66%	7.5	0.63	12	777	0.106	0.047	0.640	0.058	0.685	0.009	0.119	0.454	65.75	15.23	57.262	0.381	57.060	0.068
z2	189	0.333	0.294	99.54%	7.0	0.11	62	3897	0.107	0.047	0.303	0.058	0.353	0.009	0.081	0.697	64.87	7.22	57.233	0.197	57.051	0.046
z5	176	0.343	0.304	99.41%	7.2	0.15	48	3046	0.110	0.047	0.189	0.058	0.239	0.009	0.074	0.781	59.92	4.49	57.100	0.133	**57.033**	**0.042**
z4	174	0.369	0.624	99.75%	15.0	0.13	114	7138	0.118	0.047	0.132	0.058	0.185	0.009	0.075	0.822	60.10	3.14	57.054	0.102	**56.981**	**0.043**
z6	194	0.337	0.480	99.71%	11.4	0.12	97	6141	0.108	0.047	0.142	0.058	0.195	0.009	0.076	0.801	60.61	3.39	57.064	0.108	**56.979**	**0.043**
				Weighted mean from dates in bold (2 sigma error): 56.998 ± 0.025 (0.030) [0.068] MSWD = 2.1, pof = 0.13, n = 3[h]																	

(a) z1, z2, etc. are labels for analyses composed of single zircon grains that were annealed and chemically abraded (Mattinson, 2005). z1a and z1b are fragments from the same grain.

(b) Model Th/U ratio calculated from radiogenic ^{208}Pb/^{206}Pb ratio and ^{207}Pb/^{235}U date.

(c) Pb* and Pbc are radiogenic and common Pb, respectively. mol % ^{206}Pb* is with respect to radiogenic and blank Pb.

(d) Measured ratio corrected for spike and fractionation only. Pb fractionation correction is 0.15 or 0.16 ± 0.03 (1 sigma) %/amu (atomic mass unit) for single-collector Daly analyses on the Isoprobe-T mass spectrometer based on recent analyses of EARTHTIME ^{202}Pb-^{205}Pb ET2535 tracer solution.

(e) Corrected for fractionation and spike. Common Pb in zircon analyses is assigned to procedural blank with composition of ^{206}Pb/^{204}Pb = 18.04 ± 0.61%; ^{207}Pb/^{204}Pb = 15.54 ± 0.52%; ^{208}Pb/^{204}Pb = 37.69 ± 0.63% (1 sigma).

^{206}Pb/^{238}U and ^{207}Pb/^{206}Pb ratios corrected for initial disequilibrium in ^{230}Th/^{238}U using a D(Th/U) of 0.20 ± 0.05 (1 sigma).

(f) Errors are 2 sigma, propagated using algorithms of Schmitz and Schoene (2007) and Crowley et al. (2007).

(g) Calculations based on the decay constants of Jaffey et al. (1971). ^{206}Pb/^{238}U and ^{207}Pb/^{206}Pb dates corrected for initial disequilibrium in ^{230}Th/^{238}U using a D(Th/U) of 0.20 ± 0.05 (1 sigma).

(h) ^{206}Pb/^{238}U date (Ma) ± random (+tracer) [+decay constant]. MSWD = Mean Square Weighted Deviation. pof = probability of fit.

Sample 09DM010B (Fig. 3) is a foliated biotite-hornblende granodiorite collected on the northeast side of the Shakwak trench. This station is located on the ridge 16 km due south of Dogpack Lake (61.541531°, -139.222299°). The zircons in this sample were not imaged. Eight zircons analyzed by CA-TIMS yielded concordant, but not overlapping, ^{206}Pb/^{238}U dates that range from 65.01 ± 0.05 to 63.76 ± 0.05 Ma (Table 2; Fig. 3a). A robust crystallization age interpretation is not possible, but the youngest zircon grain indicates a crystallization age of 63.76 ± 0.05 Ma or younger.

Sample 09EW057-1 (Fig. 4) is a sugary aplite to medium-grained granite collected in the Kluane Plateau. This station is located on the ridge 9.7 km due north of Doghead Point of Kluane Lake (61.443903°, -138.793624°). This sample yielded complex zircons, most with cores and rims (Fig. 4a). Analyses were done on broken tips. Four zircon tips analyzed by CA-TIMS yielded concordant, but not overlapping, ^{206}Pb/^{238}U dates that range from 63.22 ± 0.05 to 60.80 ± 0.05 Ma (Table 2; Fig. 4b). A robust crystallization age interpretation is not possible, but the youngest zircon grain indicates a crystallization age of 60.80 ± 0.05 Ma or younger.

Sample 09EW186 (Fig. 5) is a feldspar porphyry with miarolitic cavities collected 24 km east- northeast of Tin Cup Lake, in the Nisling Range (61.933179°, -138.859738°). It yielded a mix of dark or light, stubby to elongate zircons with a length to width ratio of 2:1 to 4:1 and oscillatory zoning (Fig. 5a). Six zircon grains analyzed by CA-TIMS yielded concordant ^{206}Pb/^{238}U dates that range from 57.315 ± 0.041 to 57.234 ± 0.041 Ma (Table 2), all six grains have a weighted mean age of 57.263 ± 0.017 Ma (mean square weighted deviation [MSWD] = 2.1, n = 6/6). The weighted mean age of 57.263 ± 0.017 Ma is interpreted as the crystallization age of this sample.

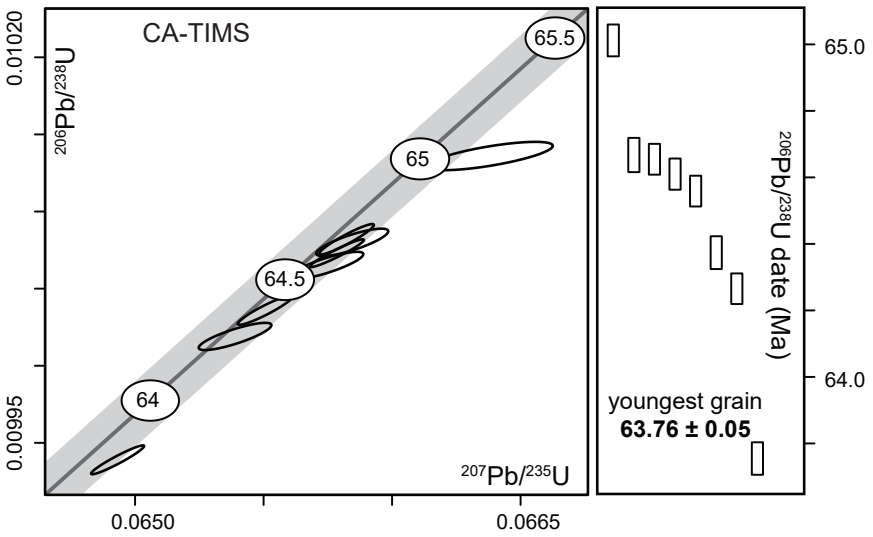

Figure 3. *The U-Pb geochronological results for sample 09DM010B. Concordia diagram (left) and ranked $^{206}Pb/^{238}U$ dates (right) for zircons analyzed by chemical abrasion-isotope dilution-thermal ionization mass spectrometry (CA-TIMS). The light grey band around Concordia (dark grey line) shows the decay constant uncertainties. Line-type designations are the same in all plots. Errors in all plots are at 2σ. MSWD = mean squared weighted deviation, pof = probability of fit, n = number of analyses included in age calculation.*

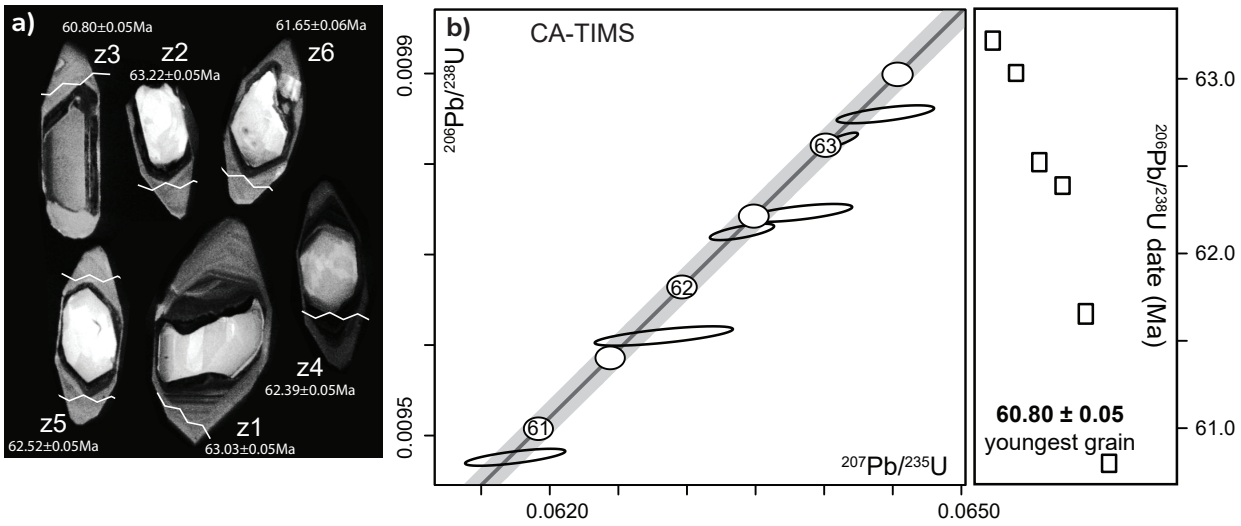

Figure 4. *The U-Pb geochronological results for sample 09EW057-1. (a) Cathodoluminescence (CL) images of representative igneous zircons. White analysis number and age with associated error refers to grain analyzed by CA-TIMS. Jagged white lines show approximate location of break where tips were broken off for analysis. (b) Concordia diagram (left) and ranked $^{206}Pb/^{238}U$ dates (right) for zircons analyzed by CA-TIMS. The light grey band around Concordia (dark grey line) shows the decay constant uncertainties. Line-type designations are the same in all plots. Errors in all plots are at 2σ.*

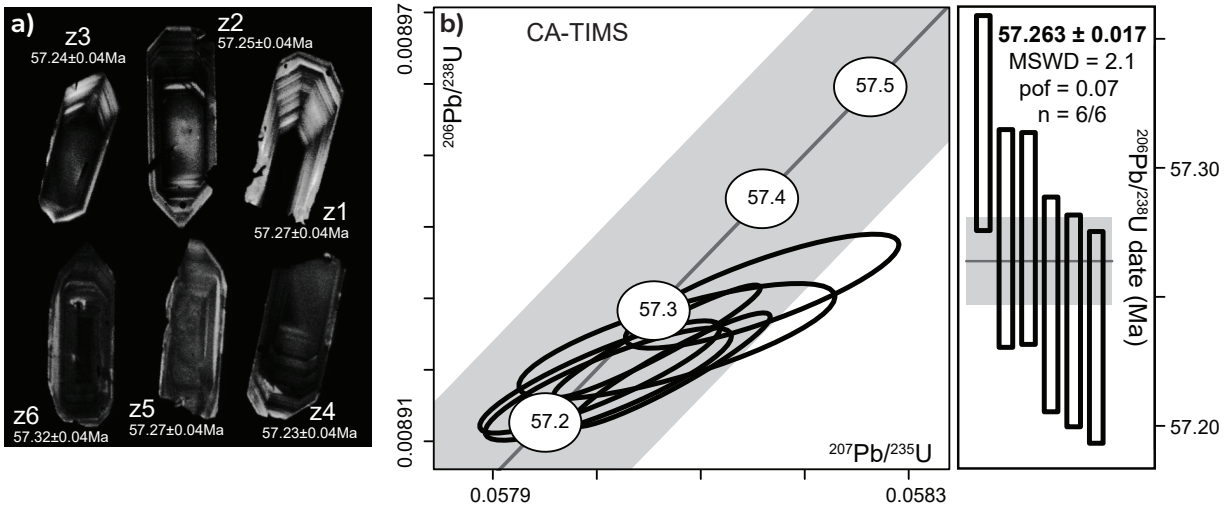

Figure 5. *The U-Pb geochronological results for sample 09EW186. (a) Cathodoluminescence (CL) images of representative igneous zircons. White labels indicate CA-TIMS analysis number and age with associated error. (b) Concordia diagram (left) and ranked $^{206}Pb/^{238}U$ dates (right) for zircons analyzed by CA-TIMS. The light grey band around Concordia (dark grey line) shows the decay constant uncertainties. Analyses included in weighted mean age (light grey horizontal bar) calculations are bold; analyses with thin lines are not used in calculations. Errors in all plots are at 2σ.*

Sample 10EW024-1 (Fig. 6) is a granite that intrudes into tonalite and was collected 6.5 km west- southwest of Gladstone Lakes, in the Ruby Range (61.293074°, -138.273567°). It yielded mostly dark, stubby zircons with a length to width ratio of 2:1 and sector zoning (Fig. 6a). Six zircon grains analyzed by CA-TIMS yielded concordant $^{206}Pb/^{238}U$ dates that range from 57.330 ± 0.042 to 57.275 ± 0.051 Ma (Table 2), all six grains have a weighted mean age of 57.311 ± 0.018 Ma (MSWD = 0.6, n = 6/6). The weighted mean age of 57.311 ± 0.018 Ma is interpreted as the crystallization age of this sample.

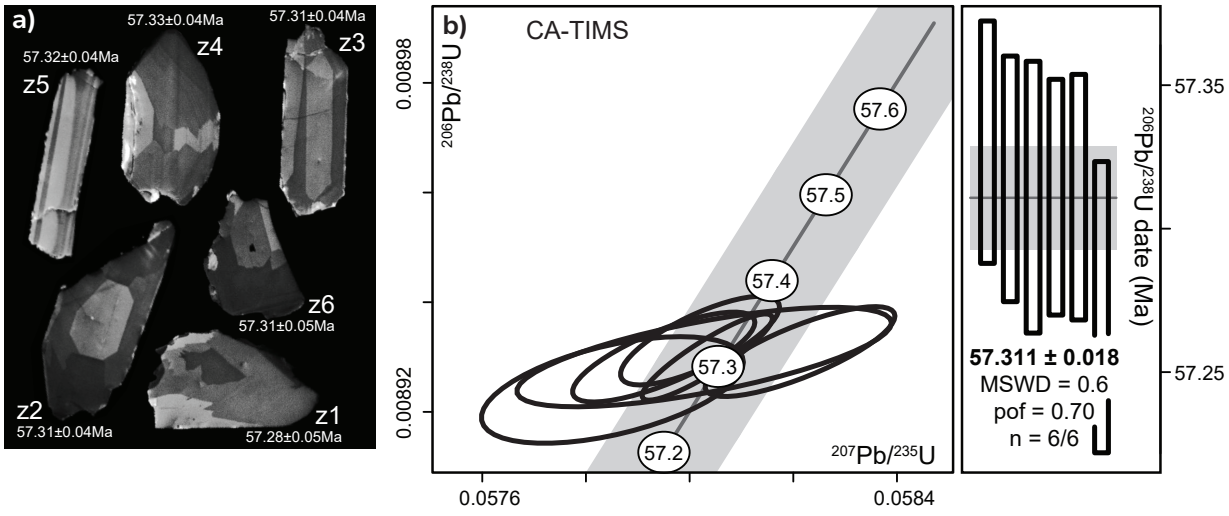

Figure 6. *The U-Pb geochronological results for sample 10EW024-1. (a) Cathodoluminescence (CL) images of representative igneous zircons. White labels indicate CA-TIMS analysis number and age with associated error. (b) Concordia diagram (left) and ranked $^{206}Pb/^{238}U$ dates (right) for zircons analyzed by CA-TIMS. The light grey band around Concordia (dark grey line) shows the decay constant uncertainties. Analyses included in weighted mean age (light grey horizontal bar) calculations are bold; analyses with thin lines are not used in calculations. Errors in all plots are at 2σ.*

Sample 10EW130-1 (Fig. 7) is an undeformed diorite to quartz-diorite collected 8 km southeast of Shutdunmun Lake, in the Ruby Range (61.07569°, -137.617362°). It yielded mostly dark, stubby zircons with a length to width ratio of 2:1 and faint oscillatory to sector zoning (Fig. 7a). The LA-ICPMS analyses of eight zircons have $^{206}Pb/^{238}U$ dates between 52.8 and 49.7 Ma (Appendix B). These eight grains have a weighted mean of 50.9 ± 1.6 Ma (Fig. 7b). The weighted mean age of 50.9 ± 1.6 Ma is interpreted as the crystallization age of this sample.

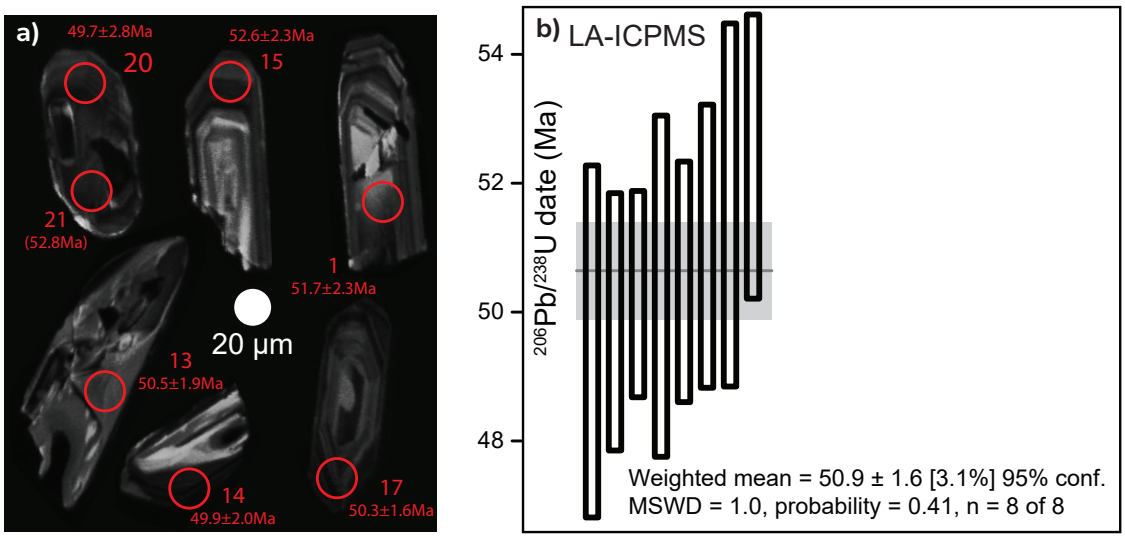

Figure 7. *The U-Pb geochronological results for sample 10EW130-1. (a) Cathodoluminescence (CL) images of representative igneous zircons. Red labels indicate LA-ICPMS analysis number and age with associated error; the red open circle indicates the location of the analysis spot. (b) Ranked plot of laser ablation-inductively coupled plasma mass spectrometry (LA-ICPMS) $^{206}Pb/^{238}U$ dates. Grey horizontal bar shows calculated weighted mean with errors. Analyses included in weighted mean age (light grey horizontal bar) calculations are bold; analyses with thin lines are not used in calculations. Line-type designations are the same in all plots. Errors in all plots are at 2σ.*

Sample 10EW176-3 (Fig. 8) is a quartz plagioclase porphyry that cuts across mafic dikes and through Snowcap Assemblage. It was collected 12.5 km east of the Talbot Arm of Kluane Lake and 9 km south of Talbot Creek, in the Ruby Range (61.542887°, -138.399338°). Zircons were not imaged. Six zircon grains analyzed by CA-TIMS yielded concordant $^{206}Pb/^{238}U$ dates that range from 58.348 ± 0.042 to 58.294 ± 0.042 Ma (Table 2), all six grains have a weighted mean age of 58.323 ± 0.017 Ma (MSWD = 0.8, n = 6/6). The weighted mean age of 58.323 ± 0.017 Ma is interpreted as the crystallization age of this sample.

Sample 10EW232-1 (Fig. 9) is a megacrystic tonalite that cuts across gneissic rocks of the Kluane Schist and was collected 17 km west of Otter Falls, in the Ruby Range (61.080516°, -137.30748°). It yielded mostly dark, elongate zircons with a length to width ratio of >4:1 and faint oscillatory zoning (Fig. 9a). Six zircon grains analyzed by CA-TIMS yielded concordant $^{206}Pb/^{238}U$ dates that range from 55.790 ± 0.040 to 55.382 ± 0.040 Ma (Table 2), five of six grains have a weighted mean age of 55.409 ± 0.018 Ma (MSWD = 1.9, n = 5/6), the slightly older 55.790 grain is interpreted as an antecryst. The weighted mean age of 55.409 ± 0.018 Ma is interpreted as the crystallization age of this sample.

Sample 10MC042A (Fig. 10) is a rhyodacite collected northeast of Marsh Lake on an alpine ridge at an elevation of 4963 ft, 5.5 km south of Michie Lake (60.623518°, -134.164221°). Zircons were not imaged. Six zircon grains analyzed by CA-TIMS yielded concordant $^{206}Pb/^{238}U$ dates that range from 55.656 ± 0.046 to 55.276 ± 0.042 Ma (Table 2), the three

youngest grains have a weighted mean age of 55.295 ± 0.027 Ma (MSWD = 1.0, n = 3/6), the three slightly older grains are interpreted as antecrysts. The weighted mean age of 55.295 ± 0.027 Ma is interpreted as the crystallization age of this sample.

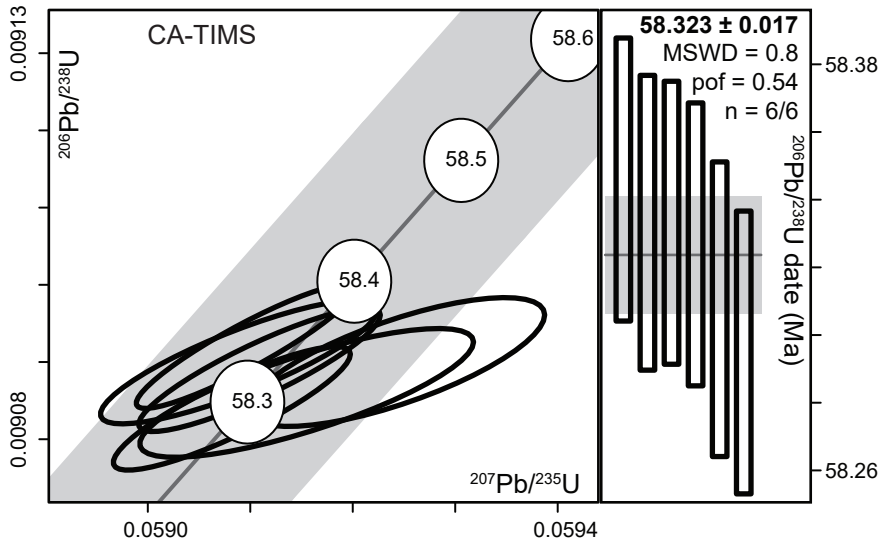

Figure 8. *The U-Pb geochronological results for sample 10EW176-3. Concordia diagram (left) and ranked $^{206}Pb/^{238}U$ dates (right) for zircons analyzed by CA-TIMS. The light grey band around Concordia (dark grey line) shows the decay constant uncertainties. Analyses included in weighted mean age (light grey horizontal bar) calculations are bold; analyses with thin lines are not used in calculations. Errors in all plots are at 2σ.*

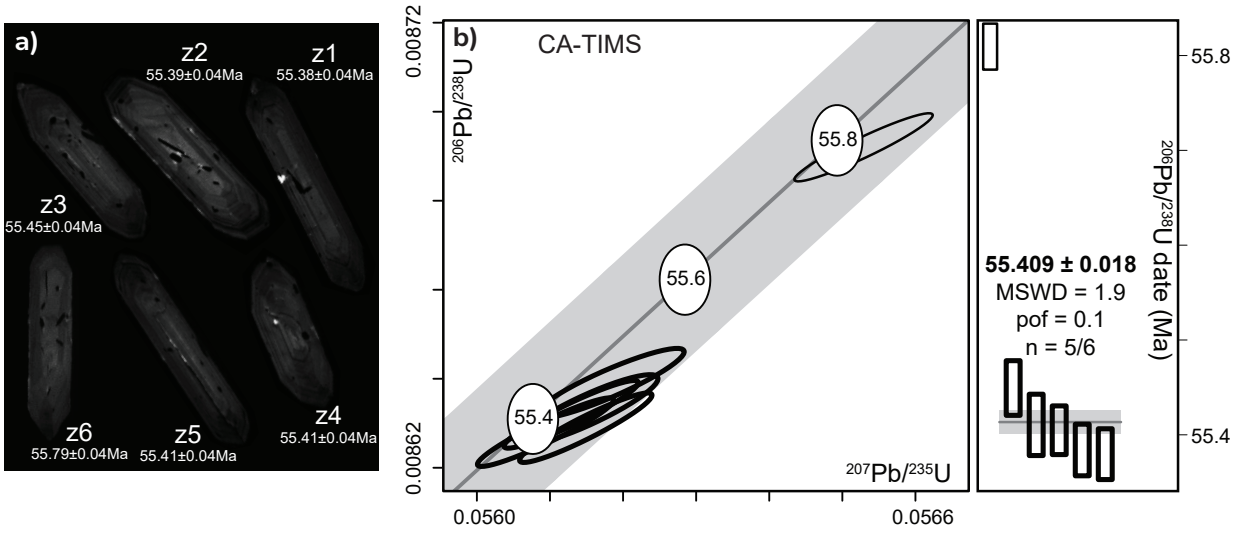

Figure 9. *The U-Pb geochronological results for sample 10EW232-1. (a) Cathodoluminescence (CL) images of representative igneous zircons. White labels indicate CA-TIMS analysis number and age with associated error. (b) Concordia diagram (left) and ranked $^{206}Pb/^{238}U$ dates (right) for zircons analyzed by CA-TIMS. The light grey band around Concordia (dark grey line) shows the decay constant uncertainties. Analyses included in weighted mean age (light grey horizontal bar) calculations are bold; analyses with thin lines are not used in calculations. Errors in all plots are at 2σ.*

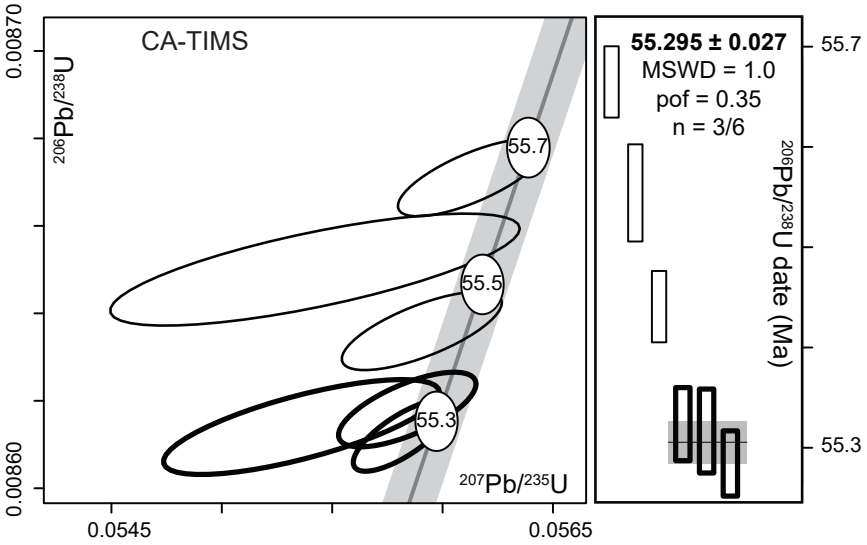

Figure 10. *The U-Pb geochronological results for sample 10MC042A. Concordia diagram (left) and ranked $^{206}Pb/^{238}U$ dates (right) for zircons analyzed by CA-TIMS. The light grey band around Concordia (dark grey line) shows the decay constant uncertainties. Analyses included in weighted mean age (light grey horizontal bar) calculations are bold; analyses with thin lines are not used in calculations. Errors in all plots are at 2σ.*

Sample 10RC131-1 (Fig. 11) is a granite collected in the Nisling Range. This station is located on Dwarf Birch Creek 10 km upstream from the confluence with Rhyolite Creek (61.860591°, -138.238955°). This sample yielded equant, dark, concentrically zoned zircon (Fig. 11a). Six zircon grains analyzed by CA-TIMS yielded concordant $^{206}Pb/^{238}U$ dates that range from 61.233 ± 0.044 to 61.085 ± 0.044 Ma (Table 2; Fig. 11b). The weighted mean of 61.198 ± 0.020 Ma for the five oldest analyses is interpreted as the crystallization age; the youngest analysis is interpreted to have minor Pb-loss.

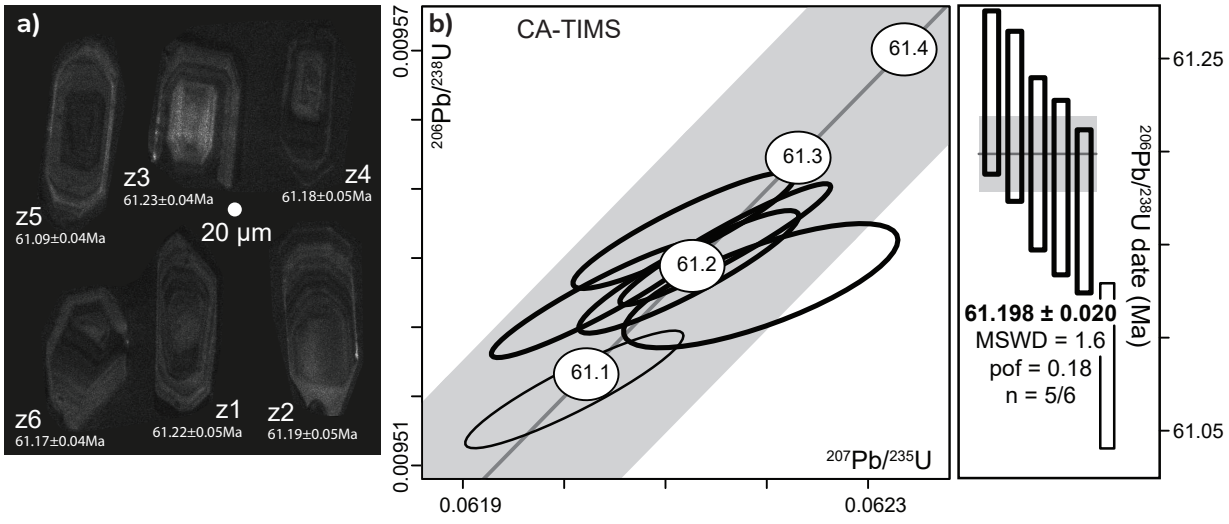

Figure 11. *The U-Pb geochronological results for sample 10RC131-1. (a) Cathodoluminescence (CL) images of representative igneous zircons. White analysis number and age with associated error refers to grain analyzed by CA-TIMS. (b) Concordia diagram (left) and ranked $^{206}Pb/^{238}U$ dates (right) for zircons analyzed by CA-TIMS. The light grey band around Concordia (dark grey line) shows the decay constant uncertainties. Line-type designations are the same in all plots. Errors in all plots are at 2σ.*

Sample 10RC171-2 (Fig. 12) is a tonalite with miarolitic cavities collected 11 km west of Sekelmun Lake and 7 km north of Isaac Creek, in the Ruby Range (61.488992°, -137.811908°). It yielded a mix of dark or light, stubby to elongate zircons with a length to width ratio of 2:1 to 4:1 and faint oscillatory zoning (Fig. 12a). Six zircon grains analyzed by CA-TIMS yielded concordant $^{206}Pb/^{238}U$ dates that range from 57.214 ± 0.042 to 57.163 ± 0.041 Ma (Table 2), all six grains have a weighted mean age of 57.186 ± 0.017 Ma (MSWD = 2.1, n = 6/6). The weighted mean age of 57.186 ± 0.017 Ma is interpreted as the crystallization age of this sample.

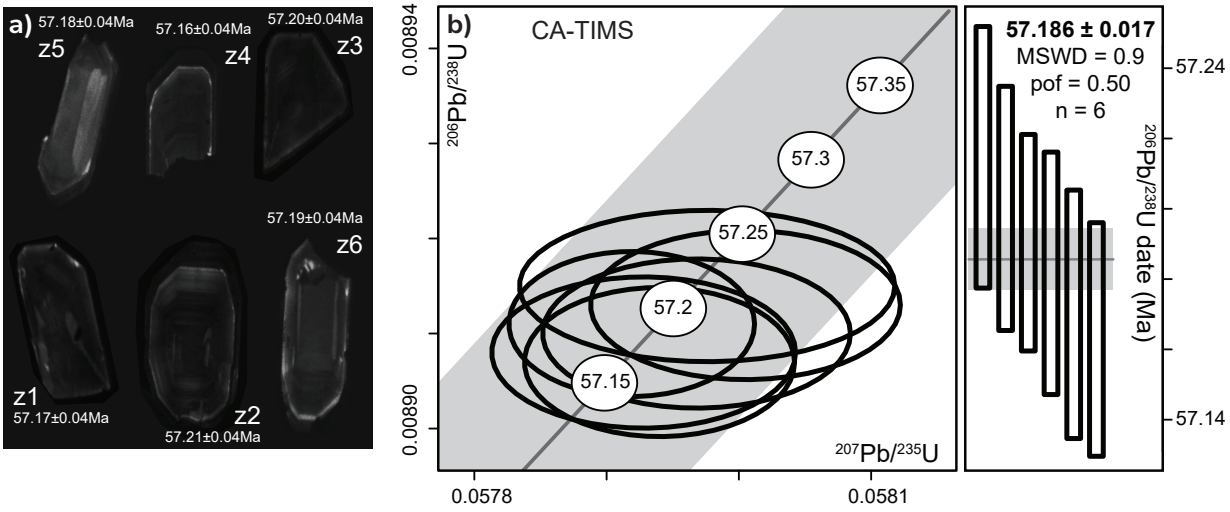

Figure 12. *The U-Pb geochronological results for sample 10RC171-2. (a) Cathodoluminescence (CL) images of representative igneous zircons. White labels indicate CA-TIMS analysis number and age with associated error. (b) Concordia diagram (left) and ranked $^{206}Pb/^{238}U$ dates (right) for zircons analyzed by CA-TIMS. The light grey band around Concordia (dark grey line) shows the decay constant uncertainties. Analyses included in weighted mean age (light grey horizontal bar) calculations are bold; analyses with thin lines are not used in calculations. Errors in all plots are at 2σ.*

Sample 10RC197-1 (Fig. 13) is a magnetic and weakly foliated quartz diorite of the Ruby Range batholith collected in the Ruby Range. This station is located 500 m south of the headwaters of Lister Creek and 12 km west of Aishihik Lake (61.265759°, -137.294425°). This sample yielded complex zircons, most with large cores and thin magmatic rims (Fig. 13a). Fifty-eight LA-ICPMS analyses have $^{206}Pb/^{238}U$ dates between 253 and 56.0 Ma (Fig. 13b; Appendix B). There is one inherited core at 253 Ma, the weighted mean age of 35 of 58 analyses is 61.0 ± 1.7 Ma, and the youngest grains are interpreted to have undergone minor Pb-loss. The weighted mean age of 61.0 ± 1.7 Ma is interpreted as the crystallization age of this sample.

Sample 10SI003-1 (Fig. 14) is an undeformed biotite tonalite with local garnet collected 15 km east of Silver City, in the Kluane Hills (61.031099°, -138.110053°). It yielded elongate zircons that are either dark or bright, with a length to width ratio of >4:1 and well-developed oscillatory zoning (Fig. 14a). Six zircon grains analyzed by CA-TIMS yielded concordant $^{206}Pb/^{238}U$ dates that range from 48.150 ± 0.036 to 48.130 ± 0.035 Ma (Table 2), the three youngest grains have a weighted mean age of 48.150 ± 0.020 Ma (MSWD = 1.5, n = 3/6); the three slightly older grains are interpreted as antecrysts. The weighted mean age of 48.150 ± 0.020 Ma is interpreted as the crystallization age of this sample.

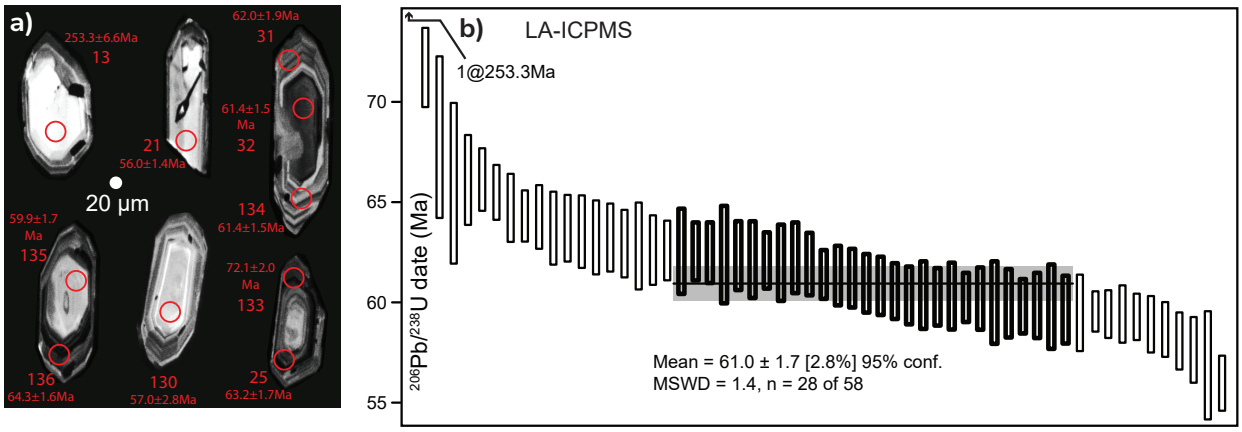

Figure 13. *The U-Pb geochronological results for sample 10RC197-1. (a) Cathodoluminescence (CL) images of representative igneous zircons. Red labels indicate LA-ICPMS analysis number and age with associated error; the red open circle indicates the location of the analysis spot. (b) Ranked plot of LA-ICPMS $^{206}Pb/^{238}U$ dates. Grey horizontal bar shows calculated weighted mean with error. Analyses included in weighted mean age (light grey horizontal bar) calculations are bold; analyses with thin lines are not used in calculations. Errors are at 2σ.*

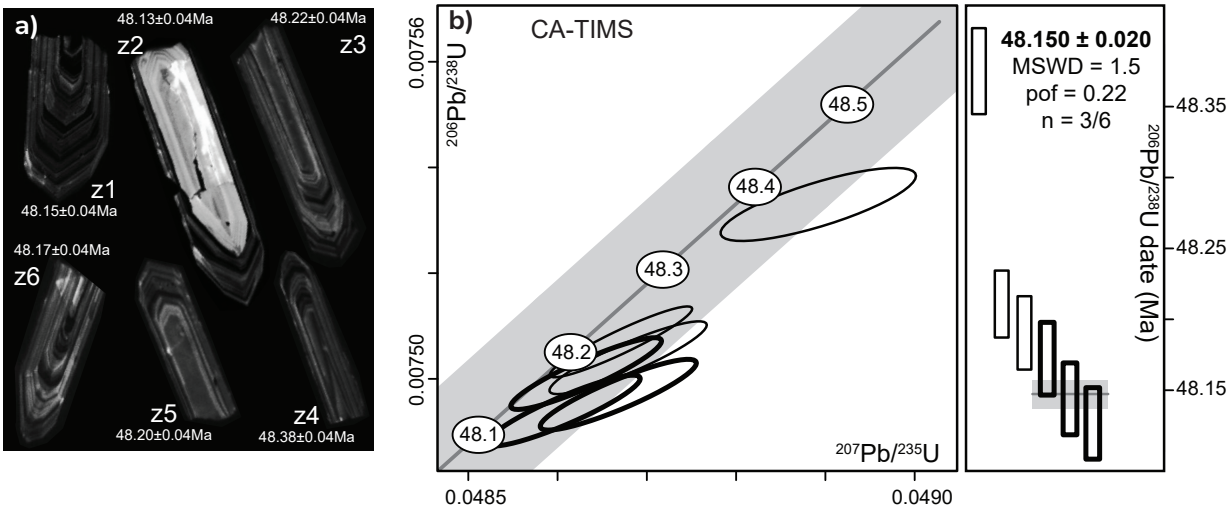

Figure 14. *The U-Pb geochronological results for sample 10SI003-1. (a) Cathodoluminescence (CL) images of representative igneous zircons. White labels indicate CA-TIMS analysis number and age with associated error. (b) Concordia diagram (left) and ranked $^{206}Pb/^{238}U$ dates (right) for zircons analyzed by CA-TIMS. The light grey band around Concordia (dark grey line) shows the decay constant uncertainties. Analyses included in weighted mean age (light grey horizontal bar) calculations are bold; analyses with thin lines are not used in calculations. Errors in all plots are at 2σ.*

Sample 10SI035-1 (Fig. 15) is an undeformed hornblende-biotite tonalite with smoky quartz. It was collected 2.5 km southeast of where Raft Creek enters Talbot Arm of Kluane Lake, in the Ruby Range (61.466609°, -138.55564°). The sample yielded a mix of light (mostly cores) and dark (rim to entire grain), stubby to elongate zircons with a length to width ratio of 2:1 to 5:1 and faint oscillatory to sector zoning (Fig. 15a). The LA-ICPMS analyses of 26 zircons have $^{206}Pb/^{238}U$ dates between 70.1 and 53.0 Ma (Fig. 15b; Appendix B). Fourteen of these twenty-six grains have a weighted mean of 55.2 ± 1.3 Ma; the ten oldest grains are interpreted as xenocrysts and the three slightly older grains as antecrysts. The weighted mean of 55.2 ± 1.3 Ma is interpreted as the crystallization age of this sample.

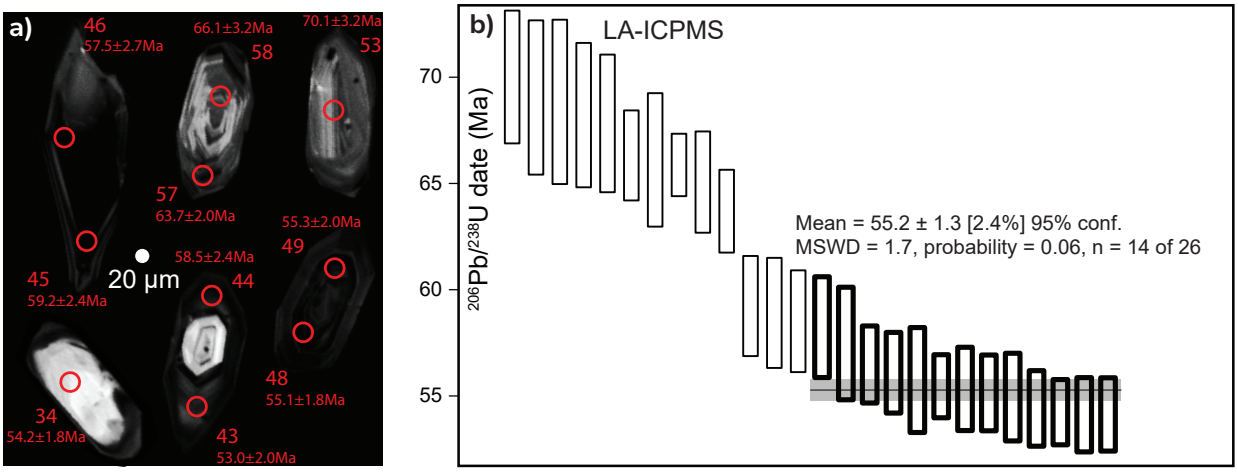

Figure 15. *The U-Pb geochronological results for sample 10SI035-1. (a) Cathodoluminescence (CL) images of representative igneous zircons. Red labels indicate LA-ICPMS analysis number and age with associated error; the red open circle indicates the location of the analysis spot. (b) Ranked plot of LA-ICPMS $^{206}Pb/^{238}U$ dates. Grey horizontal bar shows calculated weighted mean with errors. Analyses included in weighted mean age (light grey horizontal bar) calculations are bold; analyses with thin lines are not used in calculations. Line-type designations are the same in all plots. Errors in all plots are at 2σ.*

Sample 10VLS141-2 (Fig. 16) is a massive, unfoliated quartz feldspar porphyry collected 11 km east of Cultus Bay on Kluane Lake, in the Ruby Range (61.212095°, -138.253329°). Zircons were not imaged. Six zircon grains analyzed by CA-TIMS yielded concordant $^{206}Pb/^{238}U$ dates that range from 52.209 ± 0.039 to 52.168 ± 0.038 Ma (Table 2), all six grains have a weighted mean age of 52.187 ± 0.017 Ma (MSWD = 0.6, n = 6/6). The weighted mean age of 52.187 ± 0.017 Ma is interpreted as the crystallization age of this sample.

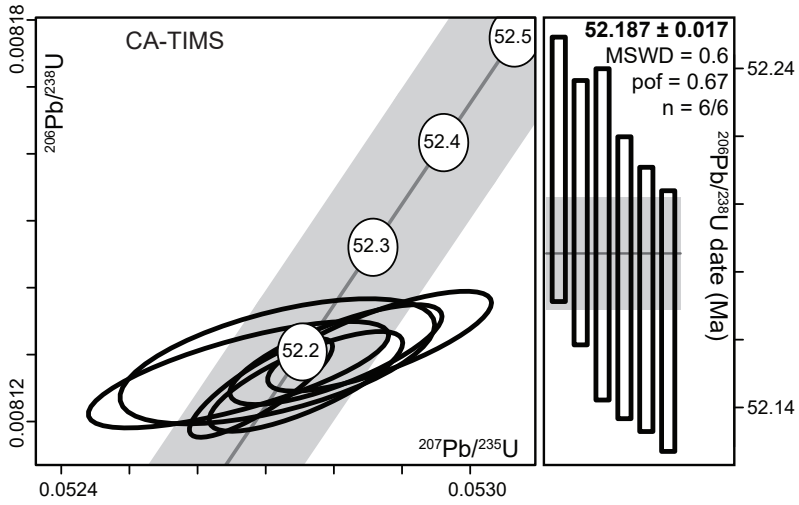

Figure 16. *The U-Pb geochronological results for sample 10VLS141-2. Concordia diagram (left) and ranked $^{206}Pb/^{238}U$ dates (right) for zircons analyzed by CA-TIMS. The light grey band around Concordia (dark grey line) shows the decay constant uncertainties. Analyses included in weighted mean age (light grey horizontal bar) calculations are bold; analyses with thin lines are not used in calculations. Errors in all plots are at 2σ.*

Sample 11EW025-1 (Fig. 17) is a myrolitic tonalite to granodiorite collected 24 km west of Stevens Lake and 5 km east of Tyrell Creek, in the Nisling Range (61.690309°, -137.963621°). Zircons were not imaged. Six zircon grains analyzed by CA-TIMS yielded concordant $^{206}Pb/^{238}U$ dates that range from 57.730 ± 0.044 to 57.582 ± 0.044 Ma (Table 2), the three youngest grains have a weighted mean age of 57.587 ± 0.026 Ma (MSWD = 0.0, n = 3/6). The weighted mean age of 58.587 ± 0.026 Ma is interpreted as the crystallization age of this sample.

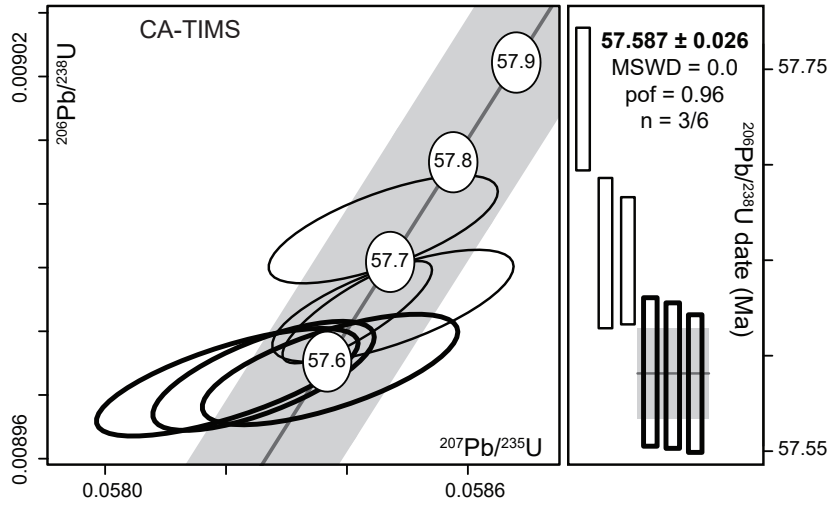

Figure 17. *The U-Pb geochronological results for sample 11EW025-1. Concordia diagram (left) and ranked $^{206}Pb/^{238}U$ dates (right) for zircons analyzed by CA-TIMS. The light grey band around Concordia (dark grey line) shows the decay constant uncertainties. Analyses included in weighted mean age (light grey horizontal bar) calculations are bold; analyses with thin lines are not used in calculations. Errors in all plots are at 2σ.*

Sample 11EW049-1 (Fig. 18) is a dacite dike cutting through volcaniclastics collected 12.5 km west of Polecat Lake and 17.5 km east of Tyrrell Creek, in the Nisling Range (61.685111°, -137.738484°). It yielded mostly dark, stubby to elongate zircons with a length to width ratio of 2:1 to 4:1 and oscillatory zoning (Fig. 18a). Five zircon grains analyzed by CA-TIMS yielded concordant $^{206}Pb/^{238}U$ dates that range from 57.923 ± 0.054 to 57.827 ± 0.048 Ma (Table 2), four of five grains have a weighted mean age of 57.841 ± 0.027 Ma (MSWD = 1.2, n = 4/5). The weighted mean age of 57.841 ± 0.027 Ma is interpreted as the crystallization age of this sample.

Sample 11SI075-1 (Fig. 19) is a rhyolite collected 11.5 km west-northwest of Stevens Lake and 11.5 km east of the Tyrrell Creek, in the Nisling Range (61.742008°, -137.814088°). It yielded mostly dark, stubby zircons with a length to width ratio of 2:1 and faint oscillatory zoning (Fig. 19a). Six zircon grains analyzed by CA-TIMS yielded concordant $^{206}Pb/^{238}U$ dates that range from 57.662 ± 0.044 to 57.624 ± 0.048 Ma (Table 2), all six grains have a weighted mean age of 57.649 ± 0.018 Ma (MSWD = 0.3, n = 6/6). The weighted mean age of 57.649 ± 0.018 Ma is interpreted as the crystallization age of this sample.

Sample 13SI018-1 (Fig. 20) is a quartz-diorite to granodiorite collected 1 km northeast of Hayden Lake in the Shakwak trench (60.962989°, -138.038367°). This sample yielded a mix of light and dark, mostly elongate zircons with a length to width ratio of >4:1 and faint-to-well developed oscillatory zoning (Fig. 20a). The LA-ICPMS analyses of 34 zircons have $^{206}Pb/^{238}U$ dates between 53.9 and 43.1 Ma (Fig. 20b; Appendix B). Thirty-one of these grains have a weighted mean of 46.4 ± 1.2 Ma; the two oldest grains are interpreted as antecrysts

and the youngest as having undergone minor Pb-loss. Six zircon grains analyzed by CA-TIMS yielded concordant $^{206}Pb/^{238}U$ dates that range from 46.155 ± 0.034 to 45.774 ± 0.034 Ma (Table 2; Fig. 20c), the youngest two grains have a weighted mean age of 45.777 ± 0.024 Ma (MSWD = 0.1, n = 2); the four older grains are interpreted as antecrysts. The weighted mean age of 45.777 ± 0.024 Ma is interpreted as the crystallization age of this sample.

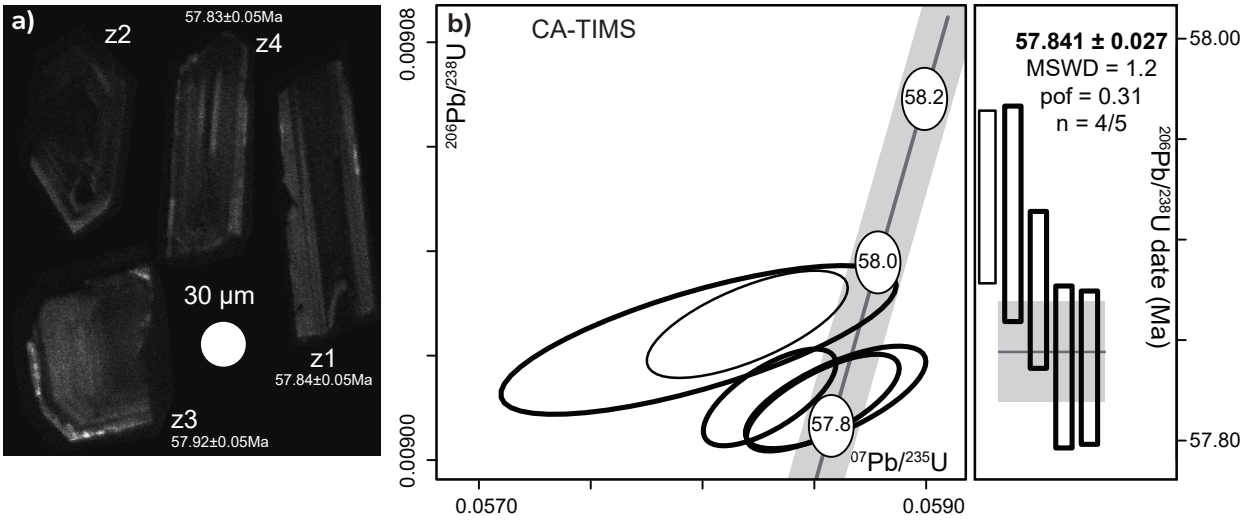

Figure 18. *The U-Pb geochronological results for sample 11EW049-1. (a) Cathodoluminescence (CL) images of representative igneous zircons. White labels indicate CA-TIMS analysis number and age with associated error. (b) Concordia diagram (left) and ranked $^{206}Pb/^{238}U$ dates (right) for zircons analyzed by CA-TIMS. The light grey band around Concordia (dark grey line) shows the decay constant uncertainties. Analyses included in weighted mean age (light grey horizontal bar) calculations are bold; analyses with thin lines are not used in calculations. Errors in all plots are at 2σ.*

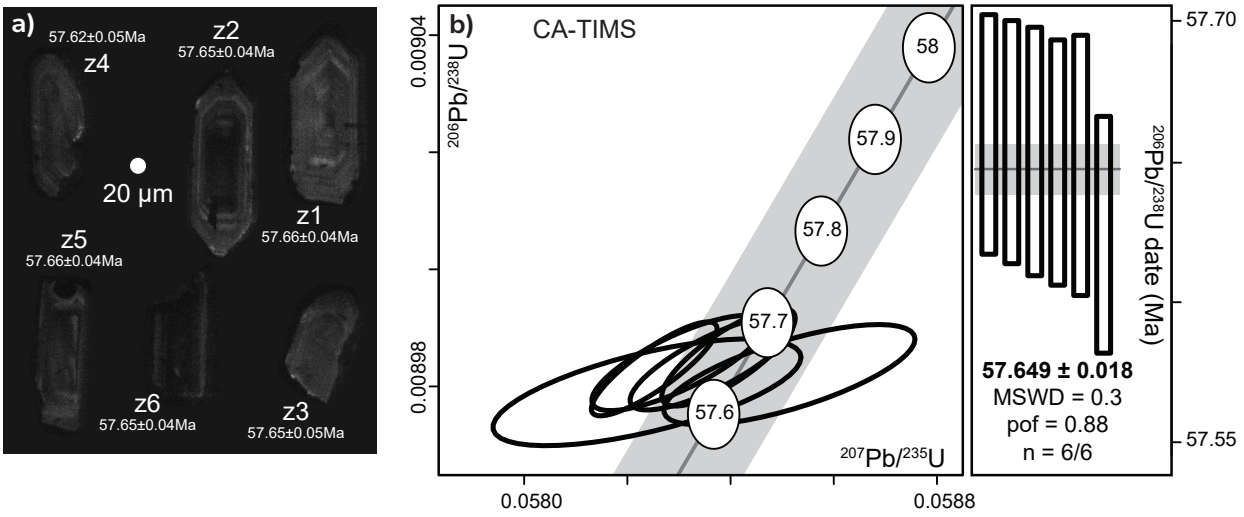

Figure 19. *The U-Pb geochronological results for sample 11SI075-1. (a) Cathodoluminescence (CL) images of representative igneous zircons. White labels indicate CA-TIMS analysis number and age with associated error. (b) Concordia diagram (left) and ranked $^{206}Pb/^{238}U$ dates (right) for zircons analyzed by CA-TIMS. The light grey band around Concordia (dark grey line) shows the decay constant uncertainties. Analyses included in weighted mean age (light grey horizontal bar) calculations are bold; analyses with thin lines are not used in calculations. Errors in all plots are at 2σ.*

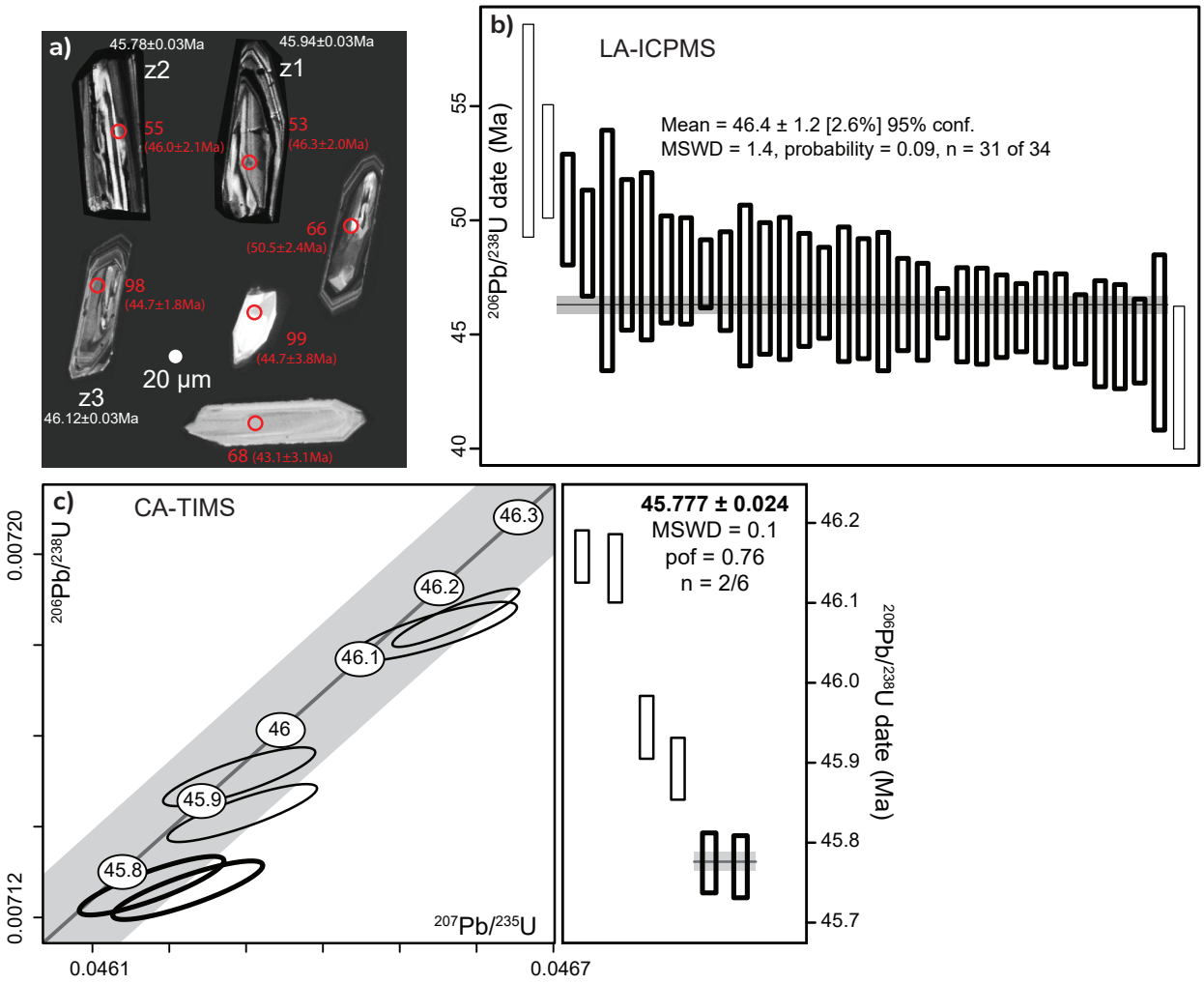

Figure 20. *The U-Pb geochronological results for sample 13SI018-1. (a) Cathodoluminescence (CL) images of representative igneous zircons. Red labels indicate LA-ICPMS analysis number and age with associated error; the red open circle indicates the location of the analysis spot, white analysis number and age with associated error refers to grain analyzed by CA-TIMS. (b) Ranked plot of LA-ICPMS* $^{206}Pb/^{238}U$ *dates. Grey horizontal bar shows calculated weighted mean with error. Analyses included in weighted mean age (light grey horizontal bar) calculations are bold; analyses with thin lines are not used in calculations. (c) Concordia diagram (left) and ranked* $^{206}Pb/^{238}U$ *dates (right) for zircons analyzed by CA-TIMS. The light grey band around Concordia (dark grey line) shows the decay constant uncertainties. Line-type designations are the same in all plots. Errors in all plots are at 2σ.*

Sample 13SI029-1 (Fig. 21) is a biotite granodiorite body that intrudes Kluane Schist on Mount Bratnober, in the Dezadeash Range. This station is located 500 m northwest of Mount Bratnober's western peak (60.731121°, -136.696479°). This sample yielded complex zircons, most with cores and rims (Fig. 21a). Forty-seven LA-ICPMS analyses have $^{206}Pb/^{238}U$ dates between 336 and 53.9 Ma (Fig. 21b; Appendix B). Inherited grains or cores include one Paleozoic core at 336 Ma, seven Early Jurassic cores ca. 185 Ma, an undefined population of Early Cretaceous grains and six Late Cretaceous analyses ca. 77 Ma. The weighted mean age of 17 of the youngest 18 analyses is 57.4 ± 1.8 Ma; the youngest grain is interpreted to have undergone minor Pb-loss. Four zircon grains analyzed by CA-TIMS yielded concordant $^{206}Pb/^{238}U$ dates that range from 73.105 ± 0.065 to 55.716 ± 0.060 Ma (Table 2; Fig. 21c). The analyses do not overlap, the youngest analyses at 55.716 ± 0.060 Ma is interpreted as the maximum crystallization age of this sample.

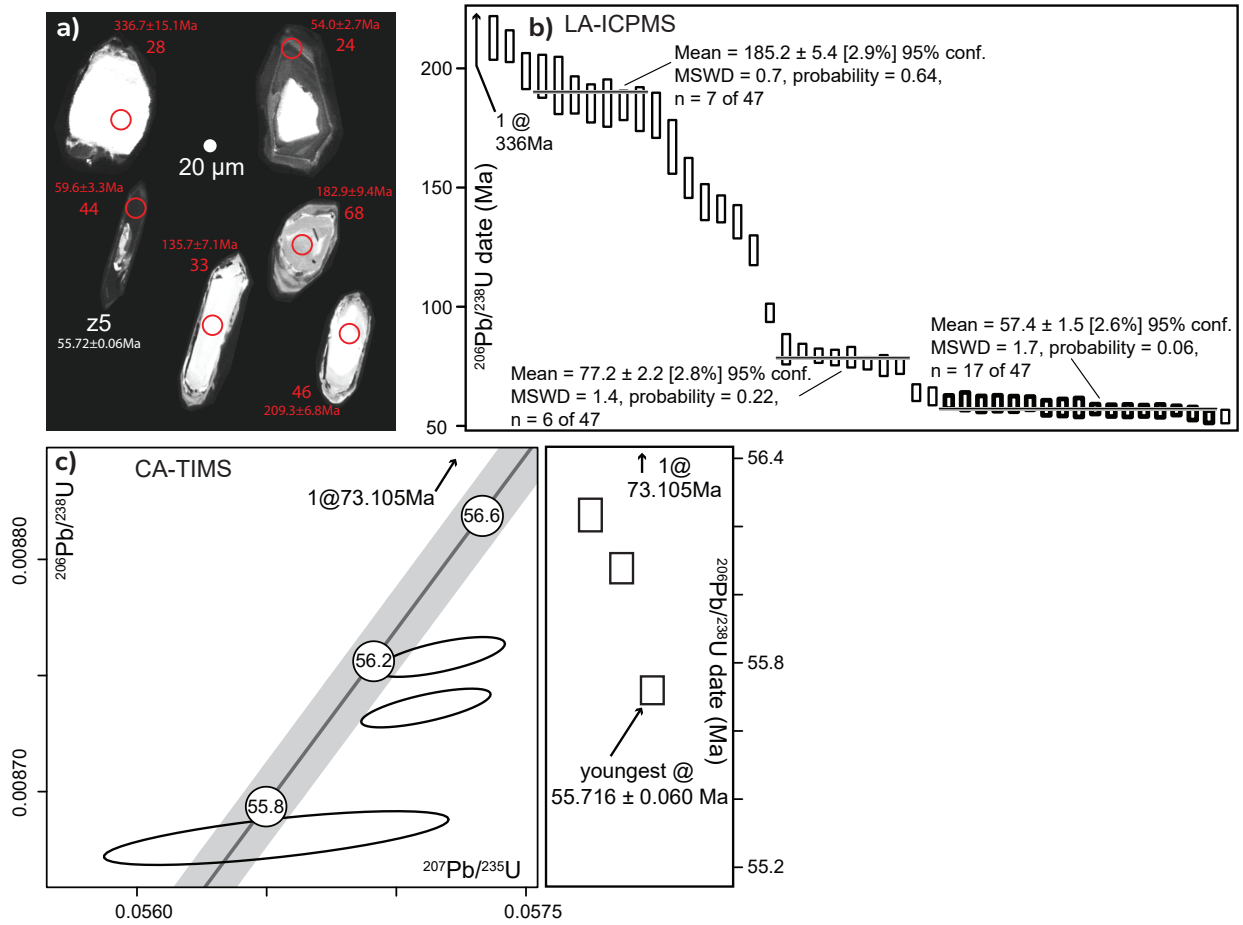

Figure 21. *The U-Pb geochronological results for sample 13SI029-1. (a) Cathodoluminescence (CL) images of representative igneous zircons. Red labels indicate LA-ICPMS analysis number and age with associated error; the red open circle indicates the location of the analysis spot, white analysis number and age with associated error refers to grain analyzed by CA-TIMS. (b) Ranked plot of LA-ICPMS* $^{206}Pb/^{238}U$ *dates. Grey horizontal bar shows calculated weighted mean with error. Analyses included in weighted mean age (light grey horizontal bar) calculations are bold; analyses with thin lines are not used in calculations. (c) Concordia diagram (left) and ranked* $^{206}Pb/^{238}U$ *dates (right) for zircons analyzed by CA-TIMS. The light grey band around Concordia (dark grey line) shows the decay constant uncertainties. Line-type designations are the same in all plots. Errors in all plots are at 2σ.*

Sample 13SI045-1 (Fig. 22) is a granodiorite collected 6 km northeast of the headwaters of Moose Creek, in the Dezadeash Range (60.697663°, -136.794815°). This sample yielded bright, mostly stubby, zircons with a length to width ratio of <3:1, and faint to well developed oscillatory zoning (Fig. 22a). The LA-ICPMS analyses of 32 zircons have $^{206}Pb/^{238}U$ dates between 66.0 and 51.1 Ma (Fig. 22b; Appendix B). The weighted mean age of twenty-seven analyses is 56.4 ± 1.5 Ma; the oldest four grains are interpreted to be antecrysts and the youngest grain to have undergone minor Pb-loss. Six zircon grains analyzed by CA-TIMS yielded concordant $^{206}Pb/^{238}U$ dates that range from 57.984 ± 0.042 to 57.377 ± 0.042 Ma (Table 2; Fig. 22c). The analyses do not overlap, the youngest analysis at 57.377 ± 0.042 Ma is interpreted as the maximum crystallization age of this sample.

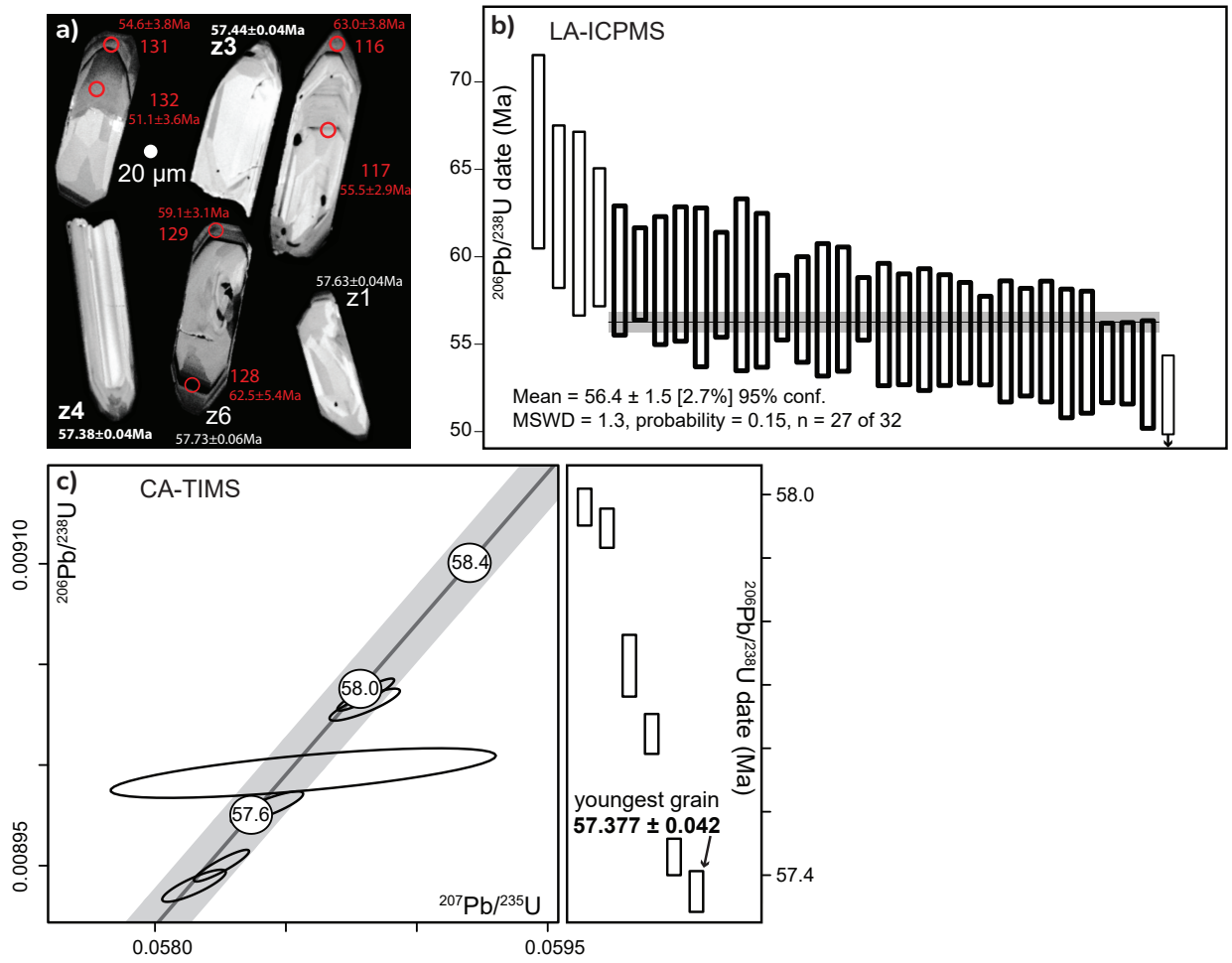

Figure 22. *The U-Pb geochronological results for sample 13SI045-1. (a) Cathodoluminescence (CL) images of representative igneous zircons. Red labels indicate LA-ICPMS analysis number and age with associated error; the red open circle indicates the location of the analysis spot, white analysis number and age with associated error refers to grain analyzed by CA-TIMS. (b) Ranked plot of LA-ICPMS* $^{206}Pb/^{238}U$ *dates. Grey horizontal bar shows calculated weighted mean with error. Analyses included in weighted mean age (light grey horizontal bar) calculations are bold; analyses with thin lines are not used in calculations. (c) Concordia diagram (left) and ranked* $^{206}Pb/^{238}U$ *dates (right) for zircons analyzed by CA-TIMS. The light grey band around Concordia (dark grey line) shows the decay constant uncertainties. Line-type designations are the same in all plots. Errors in all plots are at 2σ.*

Sample 13SI183-1 (Fig. 23) is a granodiorite collected 1.3 km northeast of Granite Lake, in the Dezadeash Range (60.711919°, -137.044112°). It yielded bright, elongate zircons with a length to width ratio of >5:1 and oscillatory zoning (Fig. 23a). Six zircon grains analyzed by CA-TIMS yielded concordant $^{206}Pb/^{238}U$ dates that range from 55.765 ± 0.040 to 55.729 ± 0.041 Ma (Table 2), all six grains have a weighted mean age of 55.749 ± 0.017 Ma (MSWD = 0.5, n = 6/6). The weighted mean age of 55.749 ± 0.017 Ma is interpreted as the crystallization age of this sample.

Sample 13SI206-1 (Fig. 24) is a granodiorite collected 1.8 km southwest of the headwaters of Red Squirrel Creek, in the Kluane Plateau (60.60128°, -137.005419°). It yielded mostly bright, elongate zircons with a length to width ratio of 2:1 to 4:1 and well-developed oscillatory zoning (Fig. 24a). Six zircon grains analyzed by CA-TIMS yielded concordant $^{206}Pb/^{238}U$ dates that range from 55.030 ± 0.041 to 54.617 ± 0.039 Ma (Table 2), the two youngest grains

have a mean age of 54.622 ± 0.028 Ma (MSWD = 02, n = 2/5); the other three grains are interpreted as antecrysts. The weighted mean age of 54.622 ± 0.028 Ma is interpreted as the crystallization age of this sample.

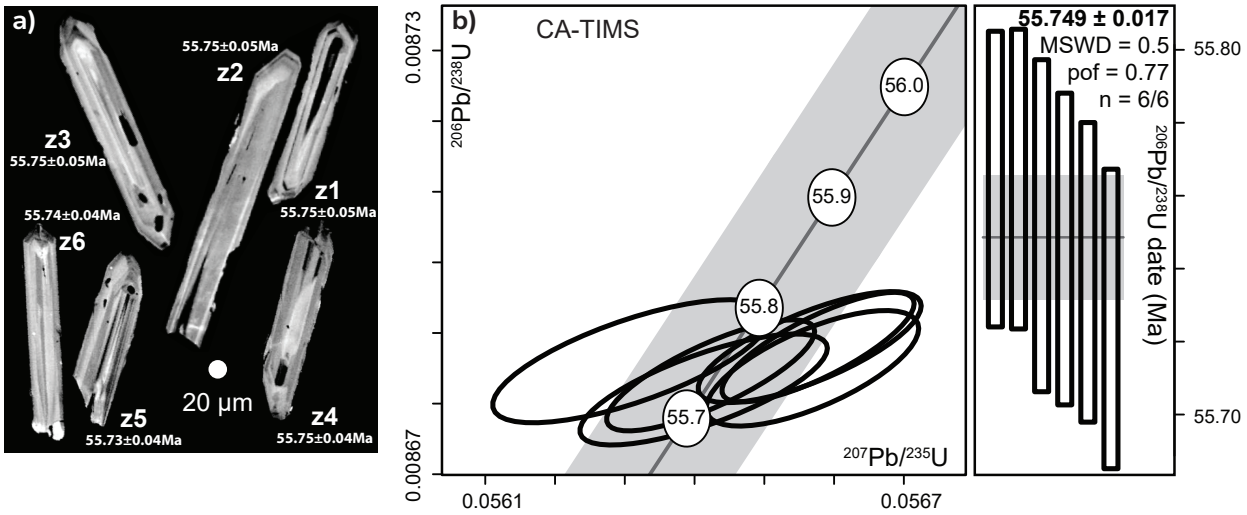

Figure 23. *The U-Pb geochronological results for sample 13SI183-1. (a) Cathodoluminescence (CL) images of representative igneous zircons. White labels indicate CA-TIMS analysis number and age with associated error. (b) Concordia diagram (left) and ranked $^{206}Pb/^{238}U$ dates (right) for zircons analyzed by CA-TIMS. The light grey band around Concordia (dark grey line) shows the decay constant uncertainties. Analyses included in weighted mean age (light grey horizontal bar) calculations are bold; analyses with thin lines are not used in calculations. Errors in all plots are at 2σ.*

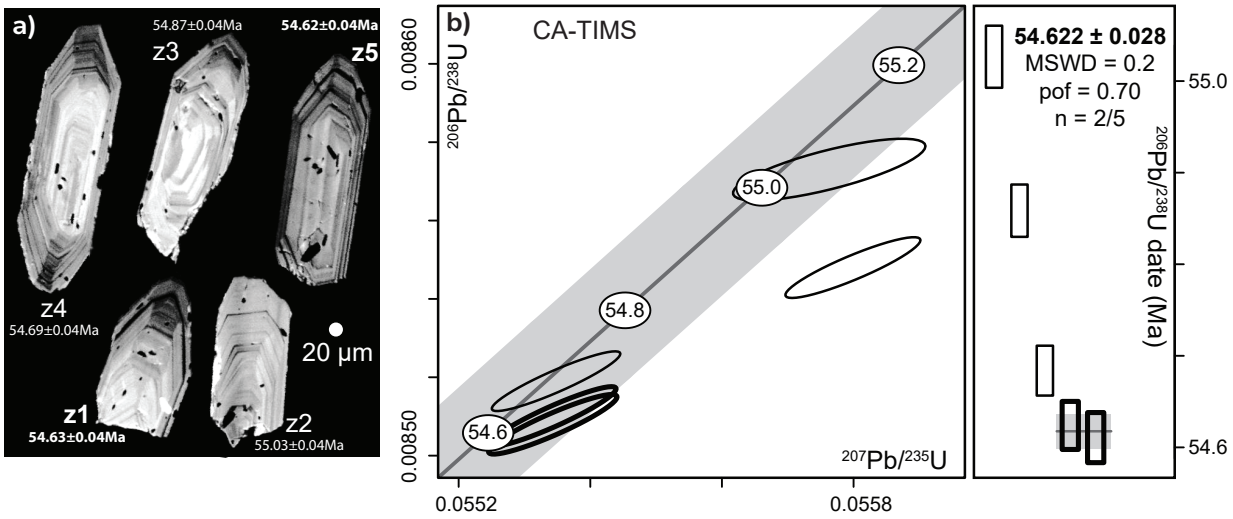

Figure 24. *The U-Pb geochronological results for sample 13SI206-1. (a) Cathodoluminescence (CL) images of representative igneous zircons. White labels indicate CA-TIMS analysis number and age with associated error. (b) Concordia diagram (left) and ranked $^{206}Pb/^{238}U$ dates (right) for zircons analyzed by CA-TIMS. The light grey band around Concordia (dark grey line) shows the decay constant uncertainties. Analyses included in weighted mean age (light grey horizontal bar) calculations are bold; analyses with thin lines are not used in calculations. Errors in all plots are at 2σ.*

Sample 15SI142 (Fig. 25) is a granite collected on the Aishihik Road 2.3 km south of Lacelle Lake (61.353588°, -136.987685°). This sample yielded a mix of dark and bright, mostly stubby to elongate, zircons with a length to width ratio of <4:1 and oscillatory to sector zoning (Fig. 25a). The LA-ICPMS analyses of 41 zircons have $^{206}Pb/^{238}U$ dates between 63.7 and 52.0 Ma (Fig. 25b; Appendix B). The weighted mean age of thirty-five analyses is 57.5 ± 1.5 Ma; the oldest four grains are interpreted to be xenocrysts and the youngest grain to have undergone minor Pb-loss. Six zircon grains analyzed by CA-TIMS yielded concordant $^{206}Pb/^{238}U$ dates that range from 68.450 ± 0.088 to 57.283 ± 0.042 Ma (Table 2; Fig. 25c), the youngest three grains have a weighed mean age of 57.301 ± 0.027 Ma (MSWD = 1.2, n = 3); the three oldest grains are interpreted as xenocrysts. The weighted mean age of 57.301 ± 0.027 Ma is interpreted as the crystallization age of this sample.

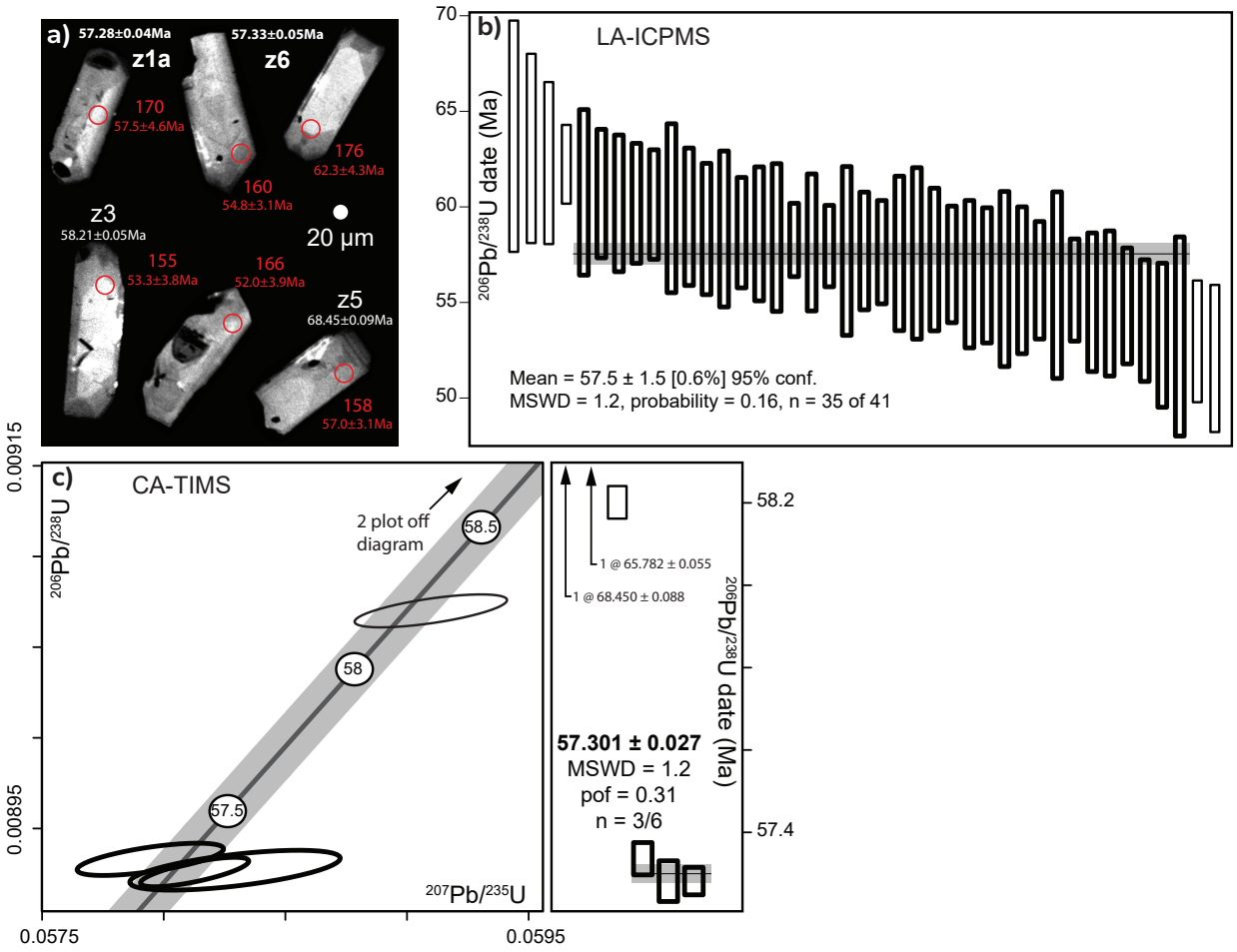

Figure 25. *The U-Pb geochronological results for sample 15SI142. (a) Cathodoluminescence (CL) images of representative igneous zircons. Red labels indicate LA-ICPMS analysis number and age with associated error; the red open circle indicates the location of the analysis spot, white analysis number and age with associated error refers to grain analyzed by CA-TIMS. (b) Ranked plot of LA-ICPMS $^{206}Pb/^{238}U$ dates. Grey horizontal bar shows calculated weighted mean with error. Analyses included in weighted mean age (light grey horizontal bar) calculations are bold; analyses with thin lines are not used in calculations. (c) Concordia diagram (left) and ranked $^{206}Pb/^{238}U$ dates (right) for zircons analyzed by CA-TIMS. The light grey band around Concordia (dark grey line) shows the decay constant uncertainties. Line-type designations are the same in all plots. Errors in all plots are at 2σ.*

Sample 16SI166 (Fig. 26) is a granodiorite collected 7.8 km east-northeast of the junction of the Aishihik Road and the Alaska Highway (60.884°, -136.90343°). This sample yielded a mix of dark or bright, stubby to elongate zircons with a length to width ratio of <4:1 and oscillatory to sector zoning (Fig. 26a). The LA-ICPMS analyses of 32 zircons have $^{206}Pb/^{238}U$ dates between 56.4 and 46.9 Ma (Fig. 26b; Appendix B). The weighted mean age of twenty-three analyses is 51.8 ± 1.3 Ma; the oldest four grains are interpreted to be antecrysts and the youngest seven grains to have undergone minor Pb-loss. Eight zircon grains analyzed by CA-TIMS yielded concordant $^{206}Pb/^{238}U$ dates that range from 51.038 ± 0.041 to 50.874 ± 0.037 Ma (Table 2; Fig. 26c), the youngest four grains have a weighted mean age of 50.901 ± 0.019 Ma (MSWD = 2.2, n = 4); the four oldest grains are interpreted as antecrysts. The weighted mean age of 50.901 ± 0.019 Ma is interpreted as the crystallization age of this sample.

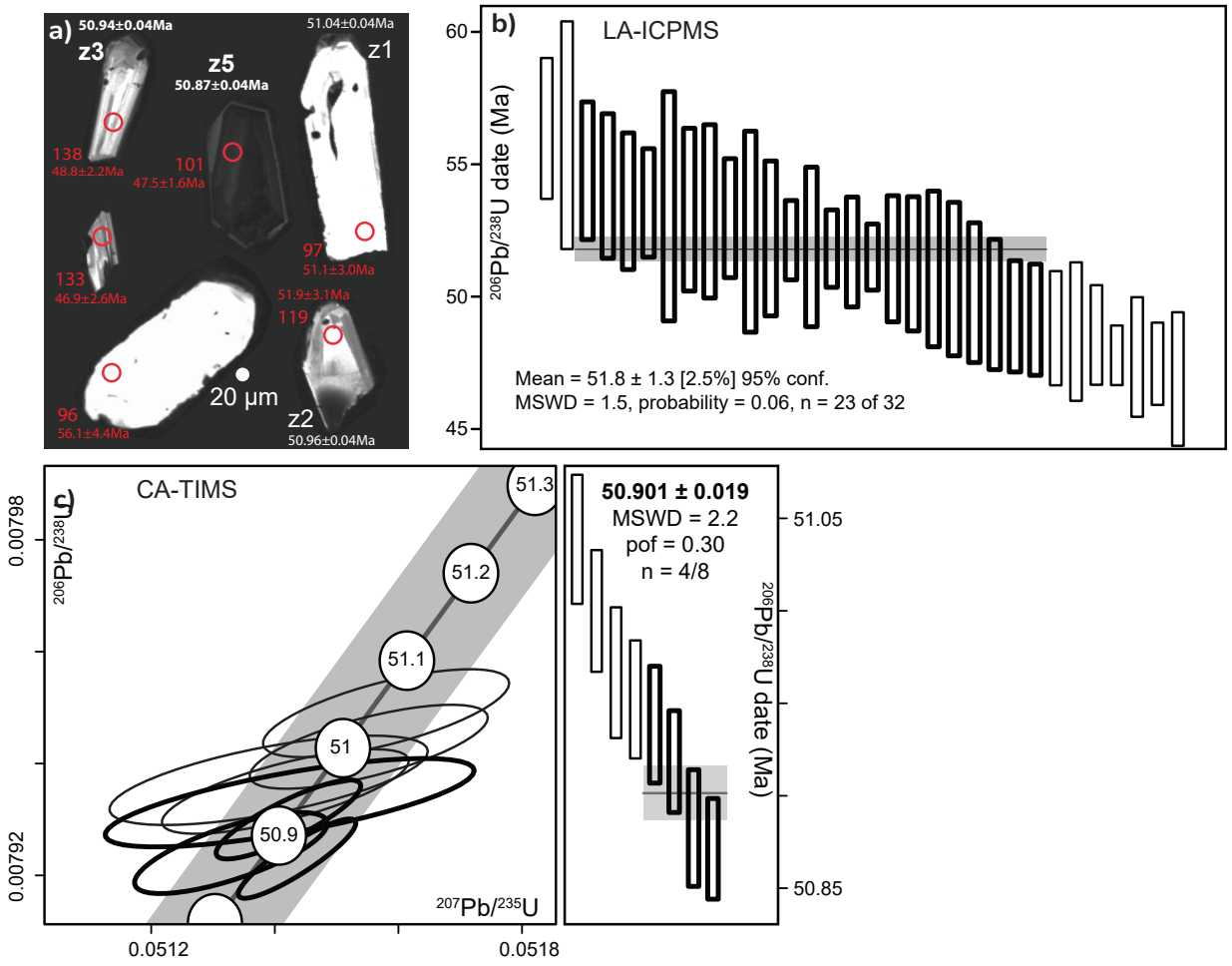

Figure 26. *The U-Pb geochronological results for sample 16SI166. (a) Cathodoluminescence (CL) images of representative igneous zircons. Red labels indicate LA-ICPMS analysis number and age with associated error; the red open circle indicates the location of the analysis spot, white analysis number and age with associated error refers to grain analyzed by CA-TIMS. (b) Ranked plot of LA-ICPMS $^{206}Pb/^{238}U$ dates. Grey horizontal bar shows calculated weighted mean with error. Analyses included in weighted mean age (light grey horizontal bar) calculations are bold; analyses with thin lines are not used in calculations. (c) Concordia diagram (left) and ranked $^{206}Pb/^{238}U$ dates (right) for zircons analyzed by CA-TIMS. The light grey band around Concordia (dark grey line) shows the decay constant uncertainties. Line-type designations are the same in all plots. Errors in all plots are at 2σ.*

Sample 16SILK001 (Fig. 27) is a maroon dacite flow collected 16.5 km northwest of Satasha Lake (61.59383°, -136.53688°). This sample yielded half dark, equant zircons and half bright, elongate zircons both with oscillatory to sector zoning (Fig. 27a). The LA-ICPMS analyses of 38 zircons have $^{206}Pb/^{238}U$ dates between 185.2 and 54.4 Ma (Fig. 27b; Appendix B). The weighted mean age of 36 analyses is 56.6 ± 1.6 Ma; the oldest grain is interpreted to be inherited and the other slightly older grain is interpreted as antecryst. Five zircon grains analyzed by CA-TIMS yielded concordant $^{206}Pb/^{238}U$ dates that range from 56.665 ± 0.040 to 56.515 ± 0.040 Ma (Table 2; Fig. 27c), the youngest four grains have a weighed mean age of 56.530 ± 0.020 Ma (MSWD = 1.2, n = 4); the oldest grain is interpreted as an antecryst. The weighted mean age of 56.530 ± 0.020 Ma is interpreted as the crystallization age of this sample.

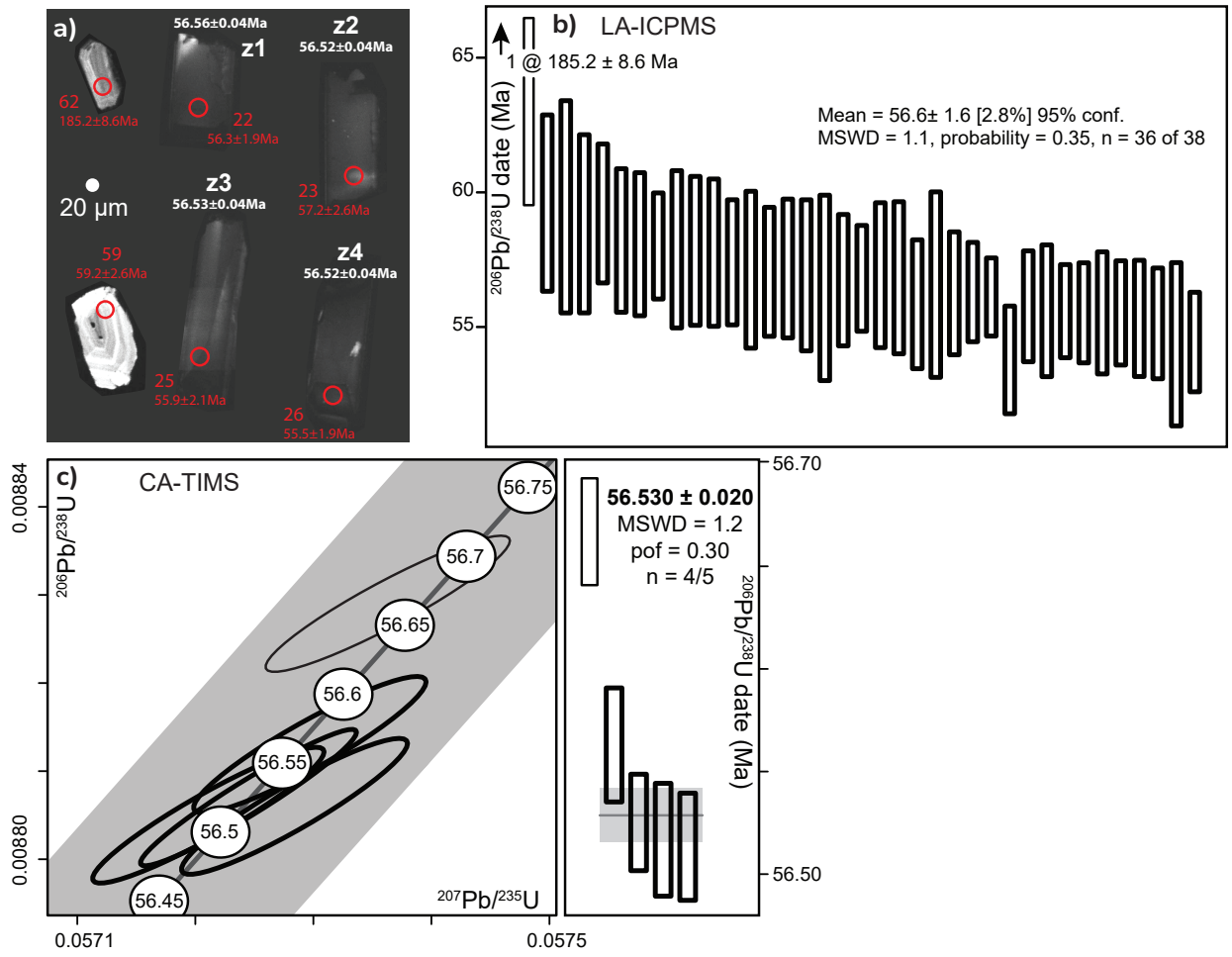

Figure 27. *The U-Pb geochronological results for sample 16SILK001. (a) Cathodoluminescence (CL) images of representative igneous zircons. Red labels indicate LA-ICPMS analysis number and age with associated error; the red open circle indicates the location of the analysis spot, white analysis number and age with associated error refers to grain analyzed by CA-TIMS. (b) Ranked plot of LA-ICPMS $^{206}Pb/^{238}U$ dates. Grey horizontal bar shows calculated weighted mean with error. Analyses included in weighted mean age (light grey horizontal bar) calculations are bold; analyses with thin lines are not used in calculations. (c) Concordia diagram (left) and ranked $^{206}Pb/^{238}U$ dates (right) for zircons analyzed by CA-TIMS. The light grey band around Concordia (dark grey line) shows the decay constant uncertainties. Line-type designations are the same in all plots. Errors in all plots are at 2σ.*

Sample 19MY002-1 (Fig. 28) is fine- to medium-grained quartz monzonite to granodiorite with minor molybdenite along fractures. It was collected 2 km southwest of the headwaters of Alaskite Creek, in the Ruby Range (61.485195°, -138.186005°). This sample yielded moderate brightness, stubby to equant zircons with a length to width ratio of <2:1 and well developed oscillatory to sector zoning (Fig. 28a). The LA-ICPMS analyses of 42 zircons have $^{206}Pb/^{238}U$ dates between 54.5 and 49.1 Ma (Fig. 28b; Appendix B). The weighted mean age of thirty-six analyses is 51.9 ± 1.1 Ma; the oldest three grains are interpreted to be antecrysts and the youngest three grains to have undergone minor Pb-loss. Six zircon grains analyzed by CA-TIMS yielded concordant $^{206}Pb/^{238}U$ dates that range from 52.412 ± 0.038 to 52.370 ± 0.038 Ma (Table 2; Fig. 28c), all six grains have a weighted mean age of 52.384 ± 0.016 Ma (MSWD = 0.7, n = 6). The weighted mean age of 52.384 ± 0.016 Ma is interpreted as the crystallization age of this sample.

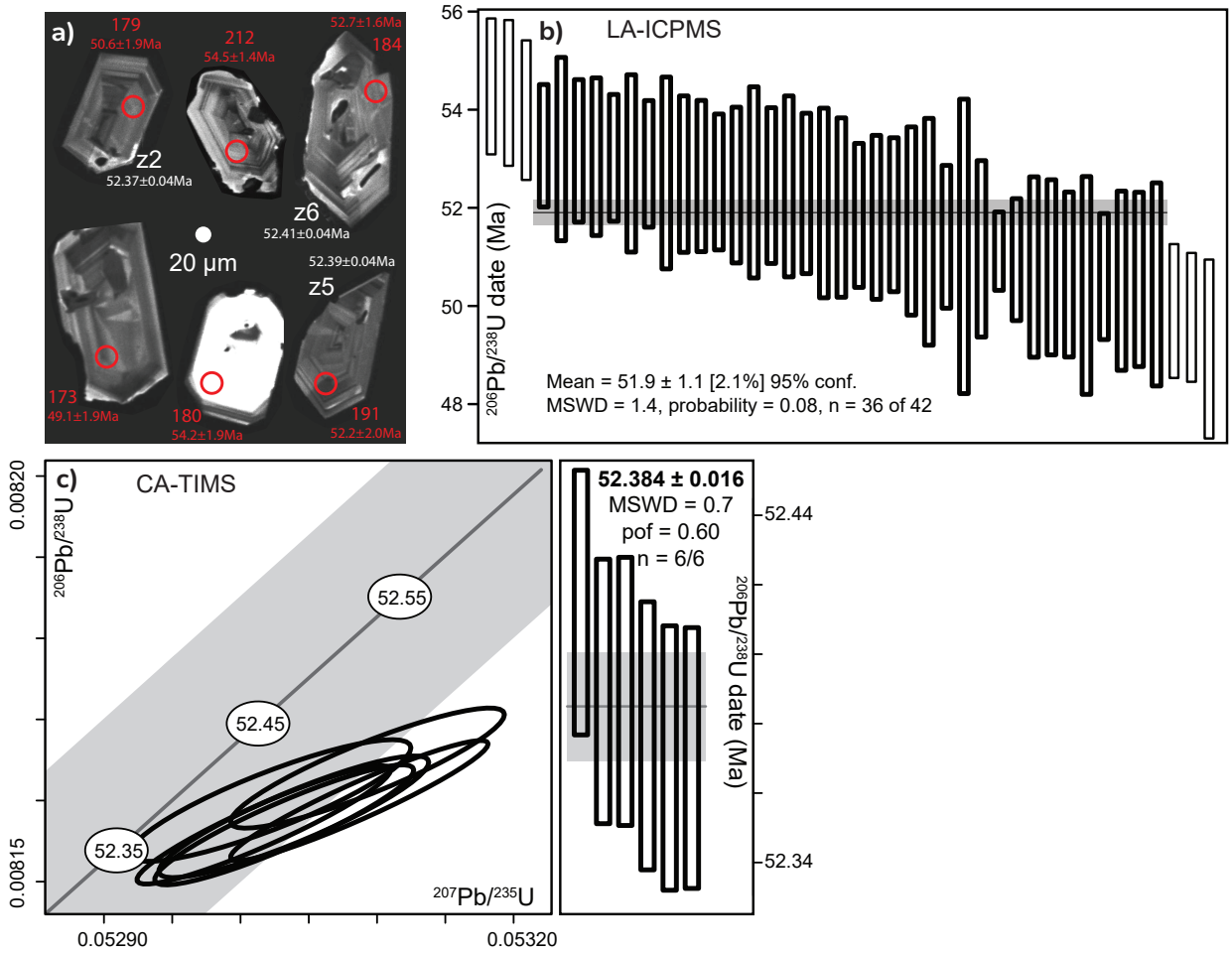

Figure 28. *The U-Pb geochronological results for sample 19MY002-1. (a) Cathodoluminescence (CL) images of representative igneous zircons. Red labels indicate LA-ICPMS analysis number and age with associated error; the red open circle indicates the location of the analysis spot, white analysis number and age with associated error refers to grain analyzed by CA-TIMS. (b) Ranked plot of LA-ICPMS $^{206}Pb/^{238}U$ dates. Grey horizontal bar shows calculated weighted mean with error. Analyses included in weighted mean age (light grey horizontal bar) calculations are bold; analyses with thin lines are not used in calculations. (c) Concordia diagram (left) and ranked $^{206}Pb/^{238}U$ dates (right) for zircons analyzed by CA-TIMS. The light grey band around Concordia (dark grey line) shows the decay constant uncertainties. Line-type designations are the same in all plots. Errors in all plots are at 2σ.*

Sample 19TF002 (Fig. 29) is a granodiorite collected 3 km northwest of the Tahkini hot springs (60.89293°, -135.40885°). This sample yielded moderate to bright, stubby to equant, zircons with a length to width ratio of <2:1 and well-developed oscillatory zoning (Fig. 29a). The LA-ICPMS analyses of 54 zircons have $^{206}Pb/^{238}U$ dates between 58.7 and 51.7 Ma (Fig. 29b; Appendix B). The weighted mean age of fifty analyses is 54.9 ± 1.2 Ma; the oldest four grains are interpreted to be antecrysts and the youngest grain to have undergone minor Pb-loss. Six zircon grains analyzed by CA-TIMS yielded concordant $^{206}Pb/^{238}U$ dates that range from 56.305 ± 0.042 to 56.257 ± 0.041 Ma (Table 2; Fig. 29c), all six grains have a weighted mean age of 56.270 ± 0.017 Ma (MSWD = 0.8, n = 6). The weighted mean age of 56.270 ± 0.017 Ma is interpreted as the crystallization age of this sample.

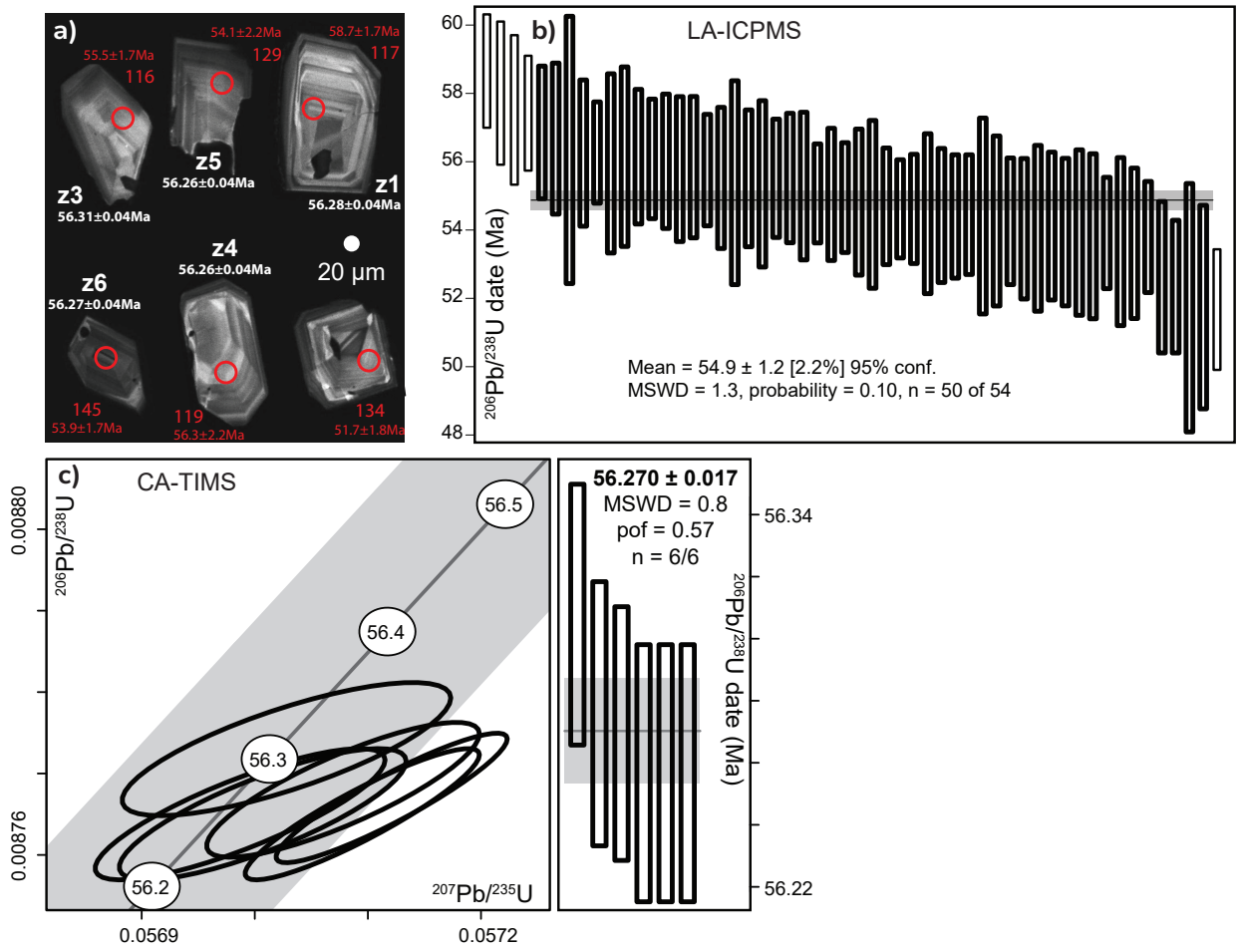

Figure 29. *The U-Pb geochronological results for sample 19TF002. (a) Cathodoluminescence (CL) images of representative igneous zircons. Red labels indicate LA-ICPMS analysis number and age with associated error; the red open circle indicates the location of the analysis spot, white analysis number and age with associated error refers to grain analyzed by CA-TIMS. (b) Ranked plot of LA-ICPMS $^{206}Pb/^{238}U$ dates. Grey horizontal bar shows calculated weighted mean with error. Analyses included in weighted mean age (light grey horizontal bar) calculations are bold; analyses with thin lines are not used in calculations. (c) Concordia diagram (left) and ranked $^{206}Pb/^{238}U$ dates (right) for zircons analyzed by CA-TIMS. The light grey band around Concordia (dark grey line) shows the decay constant uncertainties. Line-type designations are the same in all plots. Errors in all plots are at 2σ.*

Sample 21PS017-2 (Fig. 30) is a monzonite dike within Late Cretaceous andesitic volcanic rocks and was collected 9 km west of the Annie Lake Road on Red Ridge, in the Boundary Ranges (60.355178°, -135.161825°). This sample yielded moderate brightness, stubby to equant zircons with a length to width ratio of <2:1 and oscillatory to sector zoning (Fig. 30a). The LA-ICPMS analyses of 33 zircons have $^{206}Pb/^{238}U$ dates between 61.6 and 53.3 Ma (Fig. 30b; Appendix B). The weighted mean age of twenty-seven analyses is 56.3 ± 1.3 Ma; the oldest five grains are interpreted to be antecrysts and the youngest grain to have undergone minor Pb-loss. Six zircon grains analyzed by CA-TIMS yielded concordant $^{206}Pb/^{238}U$ dates that range from 57.064 ± 0.048 to 56.979 ± 0.043 Ma (Table 2; Fig. 30c), the three youngest grains have a weighted mean age of 56.998 ± 0.025 Ma (MSWD = 2.1, n = 3). The weighted mean age of 56.998 ± 0.025 Ma is interpreted as the crystallization age of this sample.

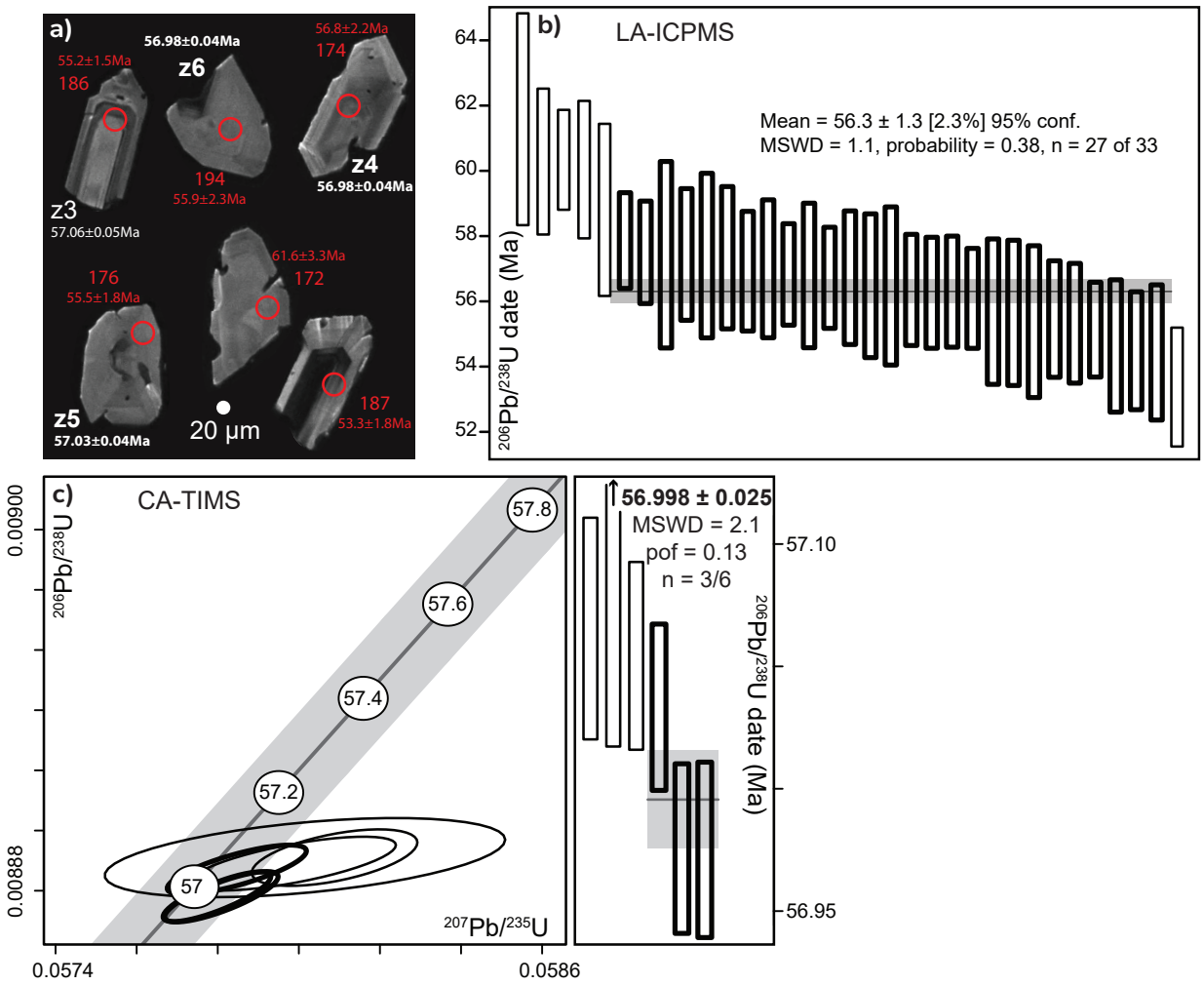

Figure 30. *The U-Pb geochronological results for sample 21PS017-2. (a) Cathodoluminescence (CL) images of representative igneous zircons. Red labels indicate LA-ICPMS analysis number and age with associated error; the red open circle indicates the location of the analysis spot, white analysis number and age with associated error refers to grain analyzed by CA-TIMS. (b) Ranked plot of LA-ICPMS $^{206}Pb/^{238}U$ dates. Grey horizontal bar shows calculated weighted mean with error. Analyses included in weighted mean age (light grey horizontal bar) calculations are bold; analyses with thin lines are not used in calculations. (c) Concordia diagram (left) and ranked $^{206}Pb/^{238}U$ dates (right) for zircons analyzed by CA-TIMS. The light grey band around Concordia (dark grey line) shows the decay constant uncertainties. Line-type designations are the same in all plots. Errors in all plots are at 2σ.*

Summary

Twenty-eight new U-Pb zircon ages, twenty-five by CA-TIMS and three by LA-ICPMS, between 63.76 ± 0.05 Ma and 45.777 ± 0.057 Ma, provide refined geochronological constraints on the age of Ruby Range, Rhyolite Creek and Hayden Lake magmatism in southwest Yukon.

Acknowledgments

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Appendices

Appendix A: Cathodoluminescence images

This appendix is only available digitally. The files are included in a .zip file that accompanies this report, and are available from https://data.geology.gov.yk.ca.

Appendix B: LA-ICPMS analyses

This appendix is only available digitally. The files are included in a .zip file that accompanies this report, and are available from https://data.geology.gov.yk.ca.

Yukon Geological Survey
Energy, Mines and Resources
Government of Yukon