Supplementary material

Supplementary methods:

Lu-Hf isotopes were measured at the University of Bristol (Bristol Isotope Group) using a ThermoFinnigan Neptune multicollector inductively-coupled plasma mass spectrometer (MC-ICP-MS) coupled with a Photon-Machine Analyte G2 Excimer laser (193 nm wavelength) (see **supplementary Table S2**). Ablation was performed using a 50 µm spot size, a laser frequency of 4 Hz, and the energy density of the laser beam was ca. 5.5 J/cm^2. A typical analysis was 90 s, including a 30 s background measurement and a 60 s ablation period. Correction for the interferences and mass bias followed the Bristol routine procedure (Hawkesworth and Kemp, 2006; Kemp et al., 2009). The correction for the isobaric interference of Yb and Lu on ^{176}Hf was made following a method detailed in Fisher et al. (2011). For Yb, the interference-free ^{171}Yb was corrected for mass bias effects using an exponential law and ^{173}Yb/^{171}Yb = 1.132685 (Chu et al., 2002). The mass bias-corrected ^{171}Yb was monitored during the run and the magnitude of the ^{176}Yb interference on ^{176}Hf was calculated using ^{176}Yb/^{171}Yb = 0.901864 (Chu et al., 2002). For Lu, the interference-free ^{175}Lu was corrected for mass bias effects assuming βLu = βYb and using an exponential law. The mass bias-corrected ^{176}Lu was monitored during the run and the magnitude of the ^{176}Lu interference on ^{176}Hf was calculated using ^{176}Lu/^{175}Lu = 0.02655 (Vervoort et al., 2004). Interference-corrected ^{176}Hf/^{177}Hf were corrected for mass bias using an exponential law and ^{179}Hf/^{177}Hf = 0.7325 (Patchett et al., 1981), and were finally normalized to JMC-475 = 0.282160. The accuracy and long-term reproducibility of the measurements were gauged by analyzing three zircon reference standards: Plesovice (^{176}Hf/^{177}Hf = 0.282479±23, *n* = 63), Mud Tank (^{176}Hf/^{177}Hf = 0.282510±22, *n* = 64) and TEMORA 2 (^{176}Hf/^{177}Hf = 0.282686±33, n = 24). All errors at 2 s.d. level.

Supplementary Tables:

Table S1: Lead isotope data summary for feldspar inclusions within zircons from Antarctica and Australia

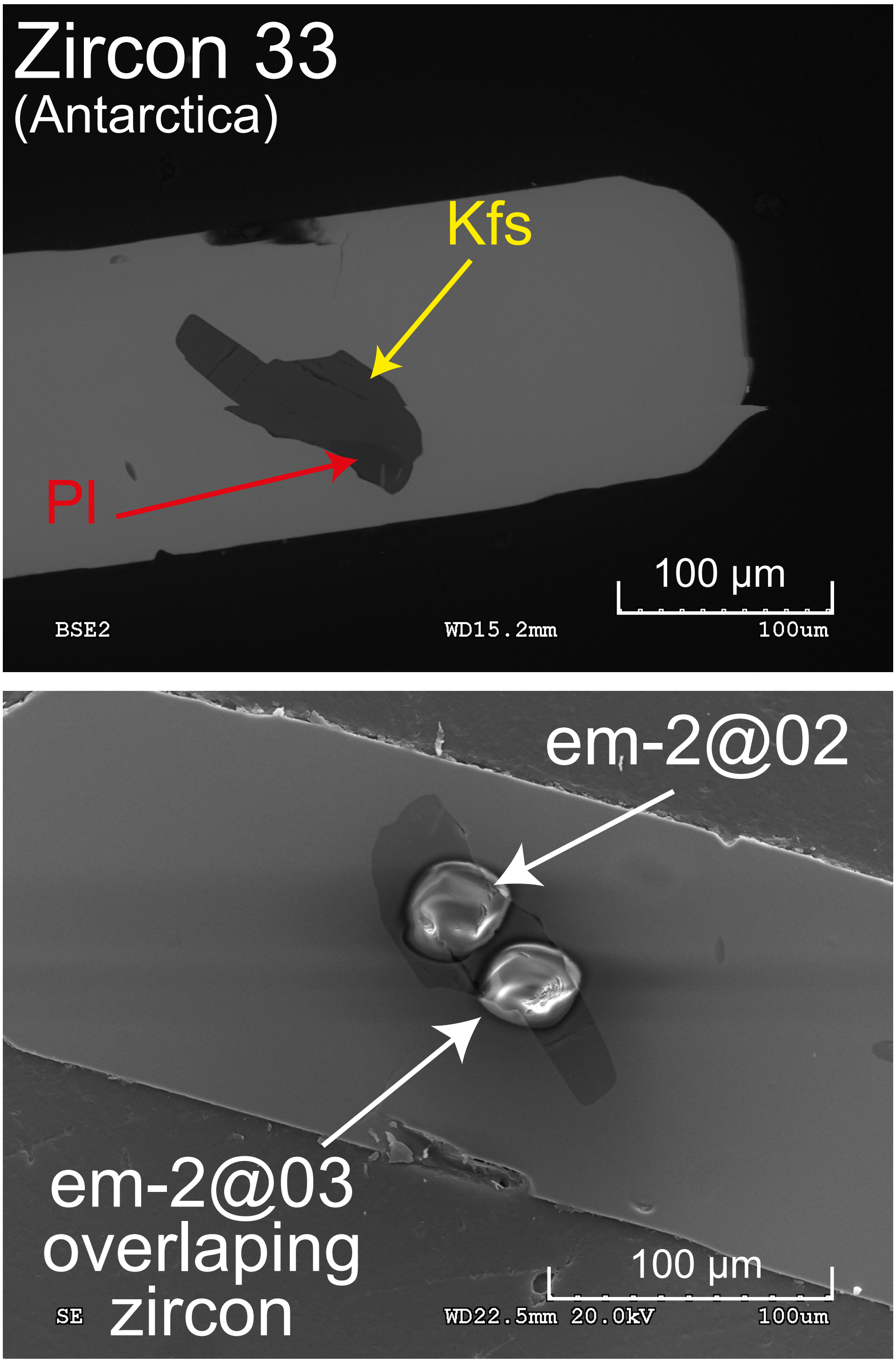
Location	Sample name	Zircon name	Type of inlusion	Analyse name	$^{206}Pb/^{204}Pb$	2σ (%)	$^{207}Pb/^{204}Pb$	2σ (%)	$^{208}Pb/^{204}Pb$	2σ (%)	$^{207}Pb/^{206}Pb$	2σ (%)	$^{208}Pb/^{206}Pb$	2σ (%)
Antarctica	Z7.3.1	zircon 33	K-feldspar	em-2@2.ais	16.80	1.46	15.27	1.43	36.36	1.41	0.91	0.63	2.16	0.50
Antarctica	Z7.3.1	zircon 47	K-feldspar	em-2@5.ais	16.93	1.26	15.33	1.23	36.85	1.21	0.91	0.53	2.17	0.43
Antarctica	Z7.3.1	zircon 94	K-feldspar	em-2@10.ais	16.93	1.34	15.32	1.31	36.64	1.28	0.90	0.57	2.16	0.46
Antarctica	Z7.3.1	zircon 93	Plagioclase	em-2@15.ais	16.98	2.84	15.43	2.78	37.19	2.73	0.91	1.21	2.19	0.97
Antarctica	Z7.3.1	zircon 75	K-feldspar	em-2@6.ais	16.83	1.18	15.31	1.15	36.64	1.13	0.91	0.50	2.18	0.40
Antarctica	Z7.3.1	zircon 75	K-feldspar	em-2@7.ais	16.79	1.48	15.24	1.45	36.70	1.43	0.91	0.63	2.18	0.51
Australia	Temora 2	zircon 25	K-feldspar	em-2@56.asc	18.95	1.27	15.75	1.05	39.46	2.62	0.83	0.02	2.08	0.05
Australia	Temora 2	zircon 27	K-feldspar	em-2@57.asc	19.27	0.34	15.86	0.28	40.06	0.70	0.82	0.01	2.08	0.01

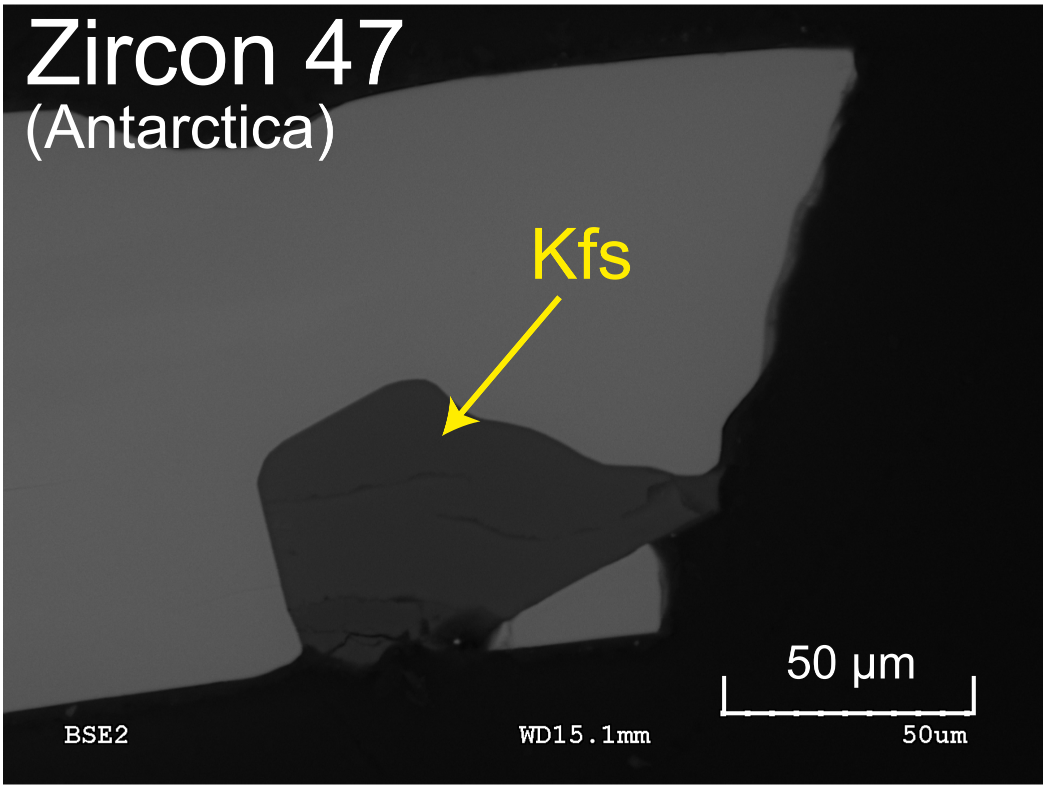
Table S2: Hafnium isotope data summary for zircons from Antarctica and Australia

Location	analyse name or reference	Sample	$^{176}Hf/^{177}Hf$ ±2σ	$^{176}Lu/^{177}Hf$	$^{176}Yb/^{177}Hf$	$^{176}Hf/^{177}Hf_{(t)}$	εHf_t ±2σ	$T(DM)^c$ Ma
Antarctica	Z7-3-1-1	Z7.3.1	0.282271 0.000021	0.00036	0.0096	0.282268	-7.3 0.8	1900
Antarctica	Z7-3-1-2	Z7.3.1	0.282271 0.000024	0.00106	0.0285	0.282261	-7.6 0.8	1915
Antarctica	Z7-3-1-3	Z7.3.1	0.282271 0.000014	0.00031	0.0083	0.282268	-7.3 0.5	1899
Antarctica	Z7-3-1-4	Z7.3.1	0.282292 0.000029	0.00098	0.0265	0.282283	-6.8 1.0	1868
Antarctica	Z7-3-1-5	Z7.3.1	0.282281 0.000029	0.00098	0.0274	0.282272	-7.2 1.0	1891
Antarctica	Z7-3-1-6	Z7.3.1	0.282297 0.000019	0.00087	0.0241	0.282289	-6.6 0.7	1854
Antarctica	Z7-3-1-7	Z7.3.1	0.282287 0.000024	0.00129	0.0352	0.282275	-7.1 0.8	1884
Antarctica	Z7-3-1-8	Z7.3.1	0.282263 0.000017	0.00044	0.0121	0.282259	-7.7 0.6	1920
Antarctica	Z7-3-1-9	Z7.3.1	0.282274 0.000021	0.00063	0.0173	0.282268	-7.3 0.8	1900
Antarctica	Z7-3-1-10	Z7.3.1	0.282268 0.000027	0.00049	0.0135	0.282264	-7.5 0.9	1909
Antarctica	Z7-3-1-11	Z7.3.1	0.282259 0.000020	0.00083	0.0230	0.282251	-7.9 0.7	1936
Antarctica	Z7-3-1-12	Z7.3.1	0.282267 0.000024	0.00049	0.0129	0.282262	-7.5 0.9	1912
Antarctica	Z7-3-1-14	Z7.3.1	0.282265 0.000021	0.00060	0.0143	0.282260	-7.6 0.7	1918
Antarctica	Z7-3-1-15	Z7.3.1	0.282276 0.000020	0.00073	0.0195	0.282269	-7.3 0.7	1897
Antarctica	Z7-3-1-16	Z7.3.2	0.282291 0.000021	0.00098	0.0280	0.282282	-6.8 0.7	1869
							MEAN	**1898**
							2 s.d.	44
Australia	Woodhead & Hergt (2005)	TEMORA 2	0.282686 0.000008	0.00109		0.282677	5.5 0.3	1037

Supplementary figures:

Figure S1: SEM images of the studied inclusions before and after SIMS analyses. Kfs: K-feldspar; Pl: plagioclase; Ap: apatite; Px: pyroxene; Qtz: quartz.

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BSE2
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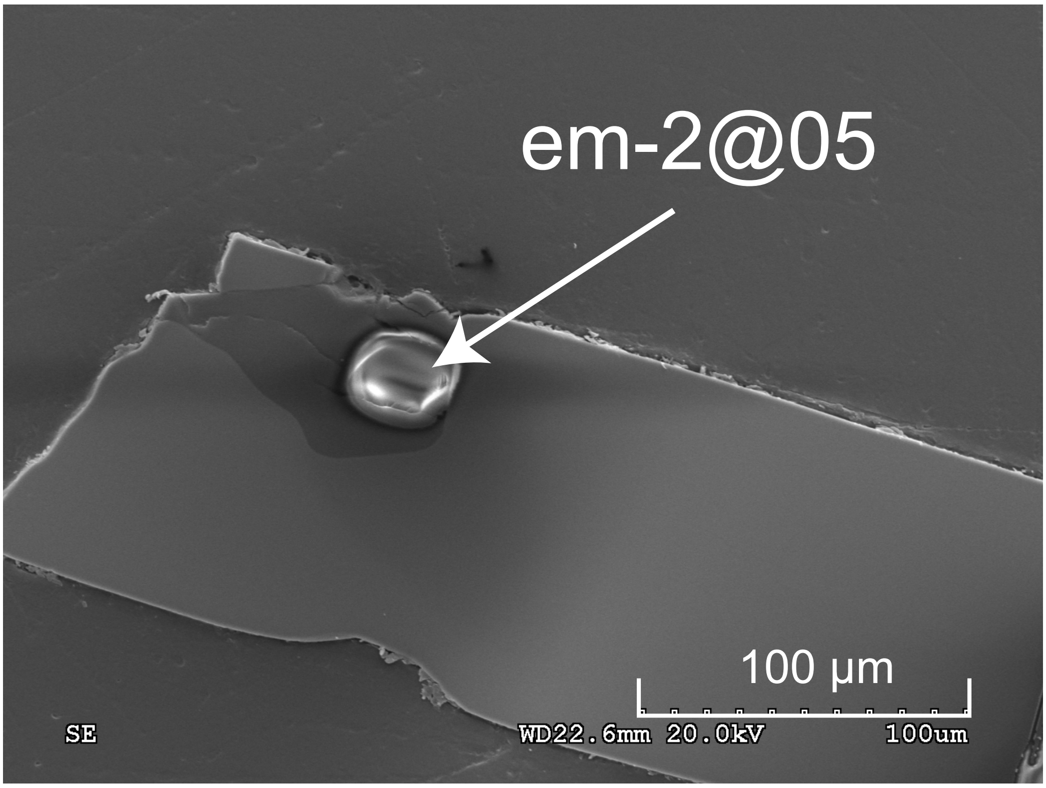
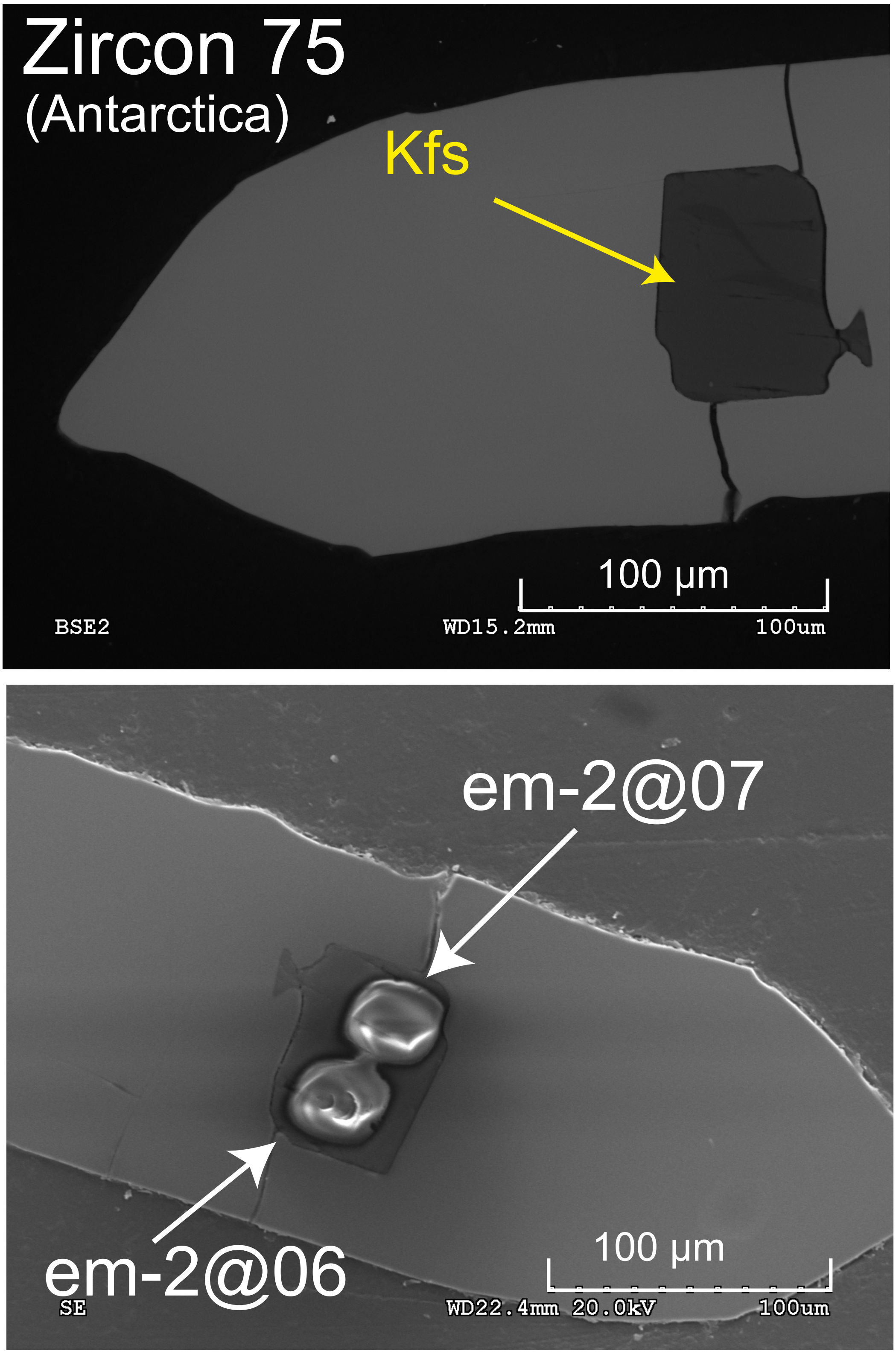
50um


em-2@05
100 µm
SE
WD22.6mm 20.0kV
100um


Zircon 75
(Antarctica)
Kfs
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BSE2
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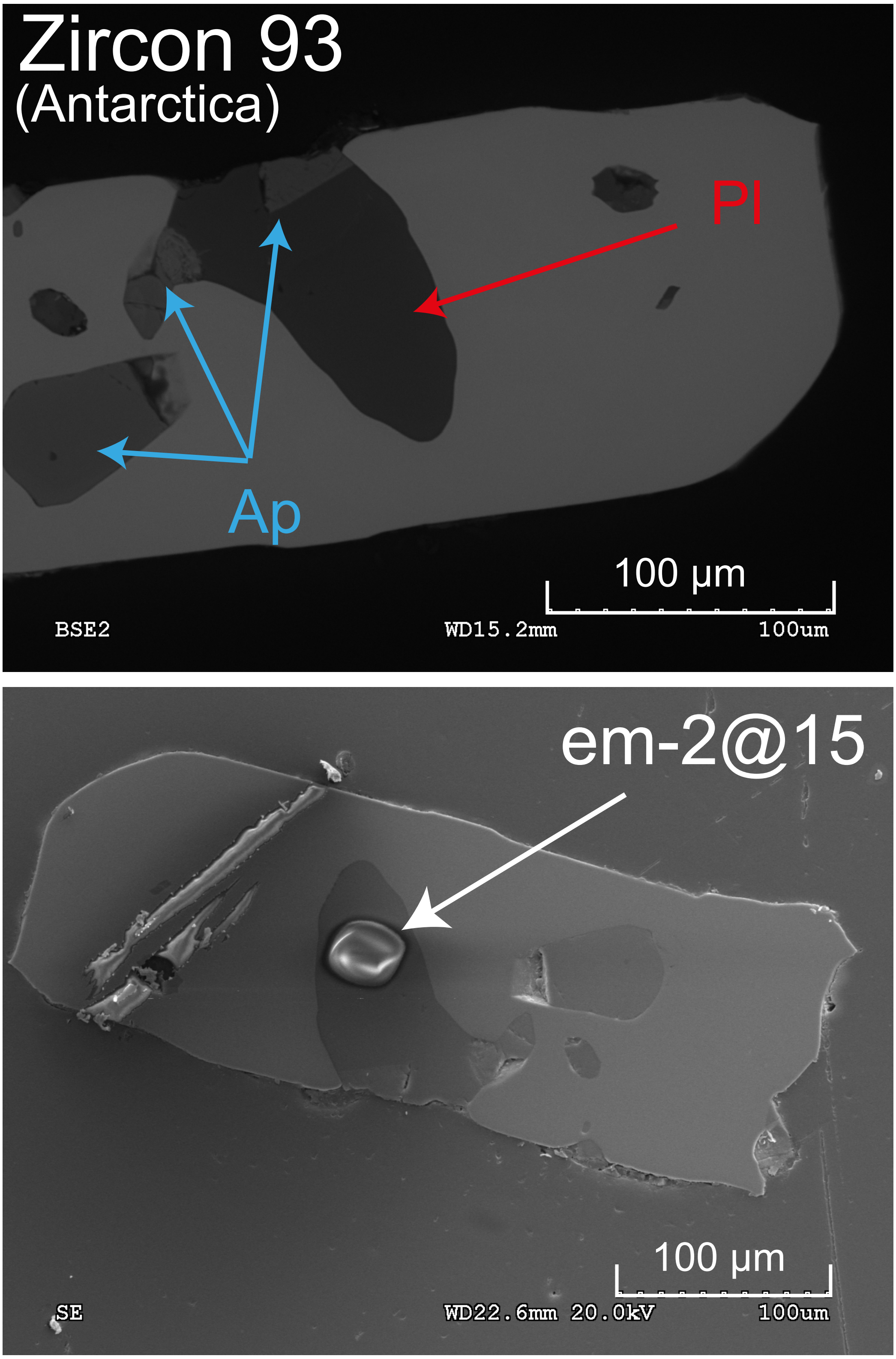
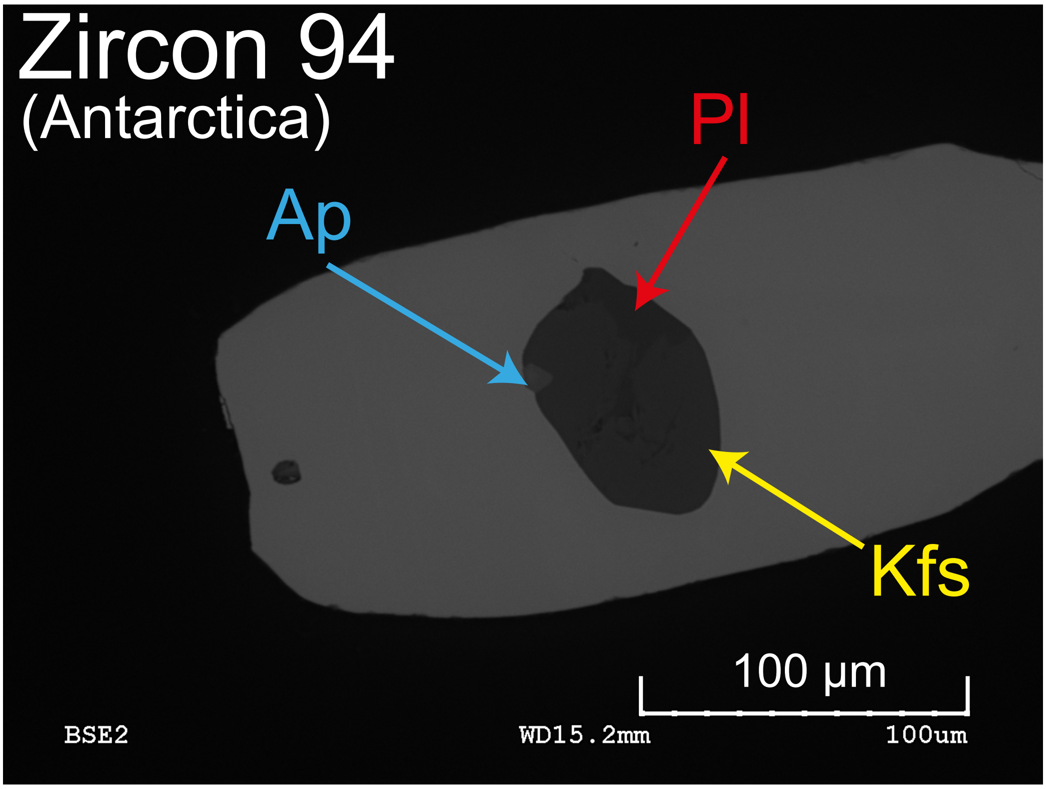
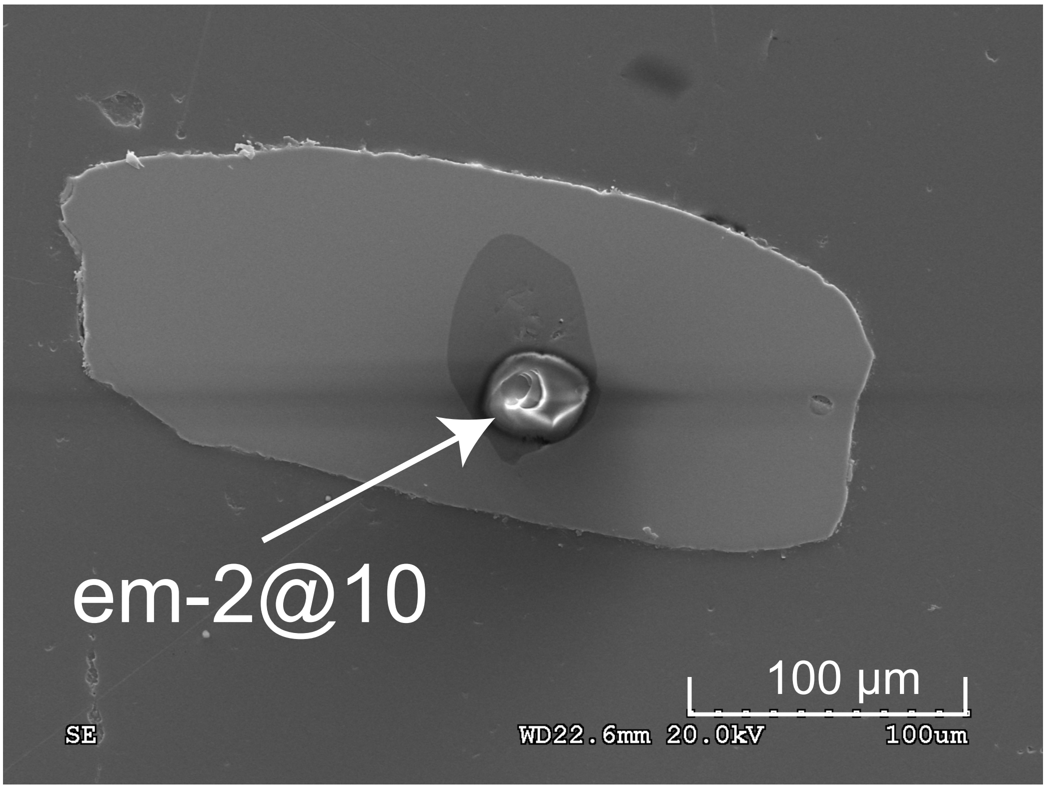
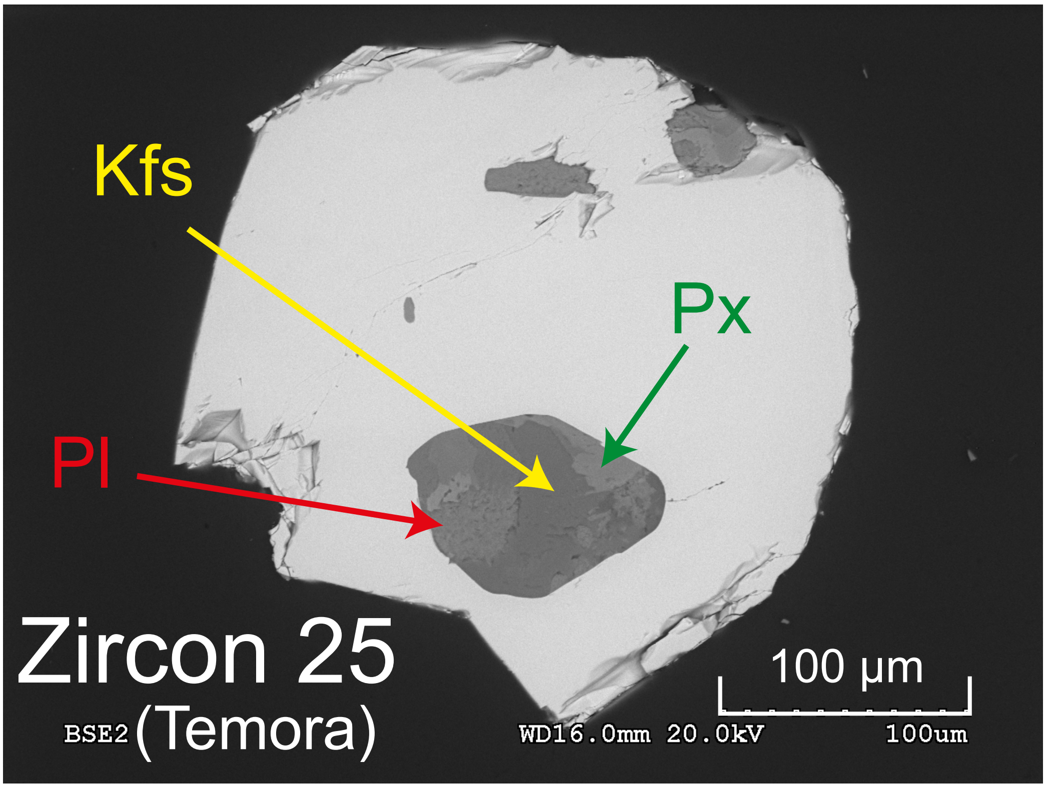
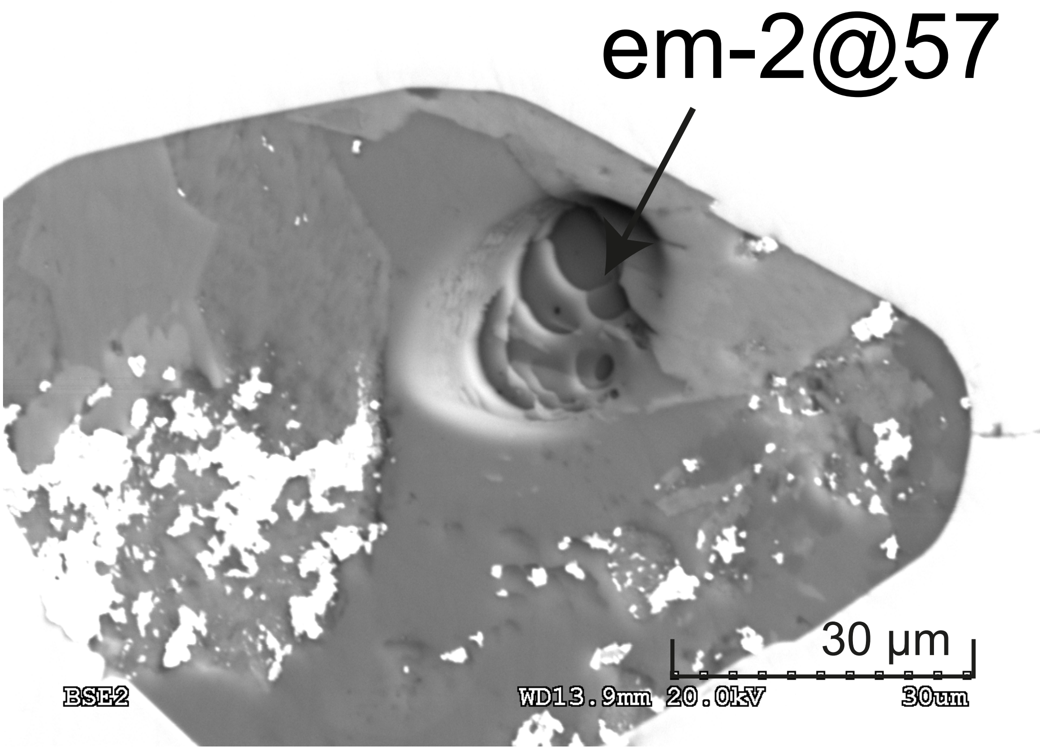
100um
em-2@07
em-2@06
100 µm
SE
WD22.4mm 20.0kV
100um


Zircon 93
(Antarctica)
Pl
Ap
100 µm
BSE2
WD15.2mm
100um
em-2@15
100 µm
SE
WD22.6mm 20.0kV
100um

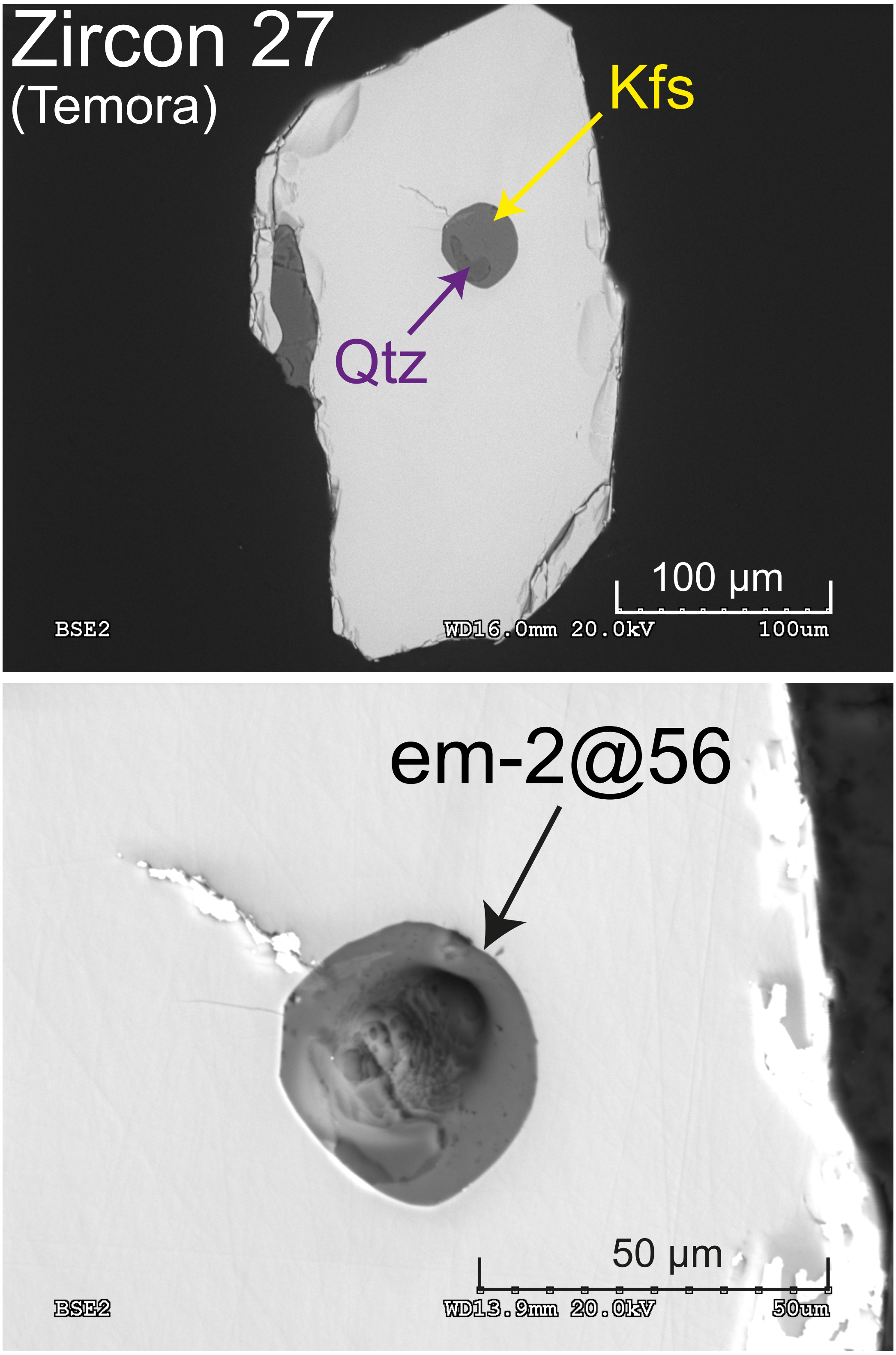

Zircon 94
(Antarctica)
Pl
Ap
Kfs
100 µm
BSE2
WD15.2mm
100um


em-2@10
100 µm
SE
WD22.6mm 20.0kV
100um


Kfs
Px
Pl
Zircon 25
BSE2 (Temora)
100 µm
WD16.0mm 20.0kV 100um


em-2@57
30 µm
BSE2
WD13.9mm 20.0kV 30um

129
130


Zircon 27
(Temora)
Kfs
Qtz
100 µm
BSE2
WD16.0mm 20.0kV
100um
em-2@56
50 µm
BSE2
WD13.9mm 20.0kV
50um

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