Supplementary Materials for

Submicron spatial resolution Pb-Pb and U-Pb Dating by NanoSIMS equipped with the new Radio-Frequency Ion Source

Jia-Long Hao[1],Wei Yang[11], Sen Hu[1], Rui-ying Li[1], Jiang-Long Ji[1], Hitesh Changela[1] and Yang-Ting Lin[1]

[1]Key Laboratory of Earth and Planetary Physics, Institute of Geology and Geophysics, Chinese Academy of Sciences, P.O. Box 9825, Beijing 10029, China

This PDF file includes:

Figs. S1 to S8

Tables S1 to S6

[1] Corresponding author (email: yangw@mail.iggcas.ac.cn)

Fig. S1

FIB images of pt strip deposited on the specimen surface. The width of each pt-line is 1000nm. The distance between the lines is not the same: 250 nm, 700 nm and 1250nm.

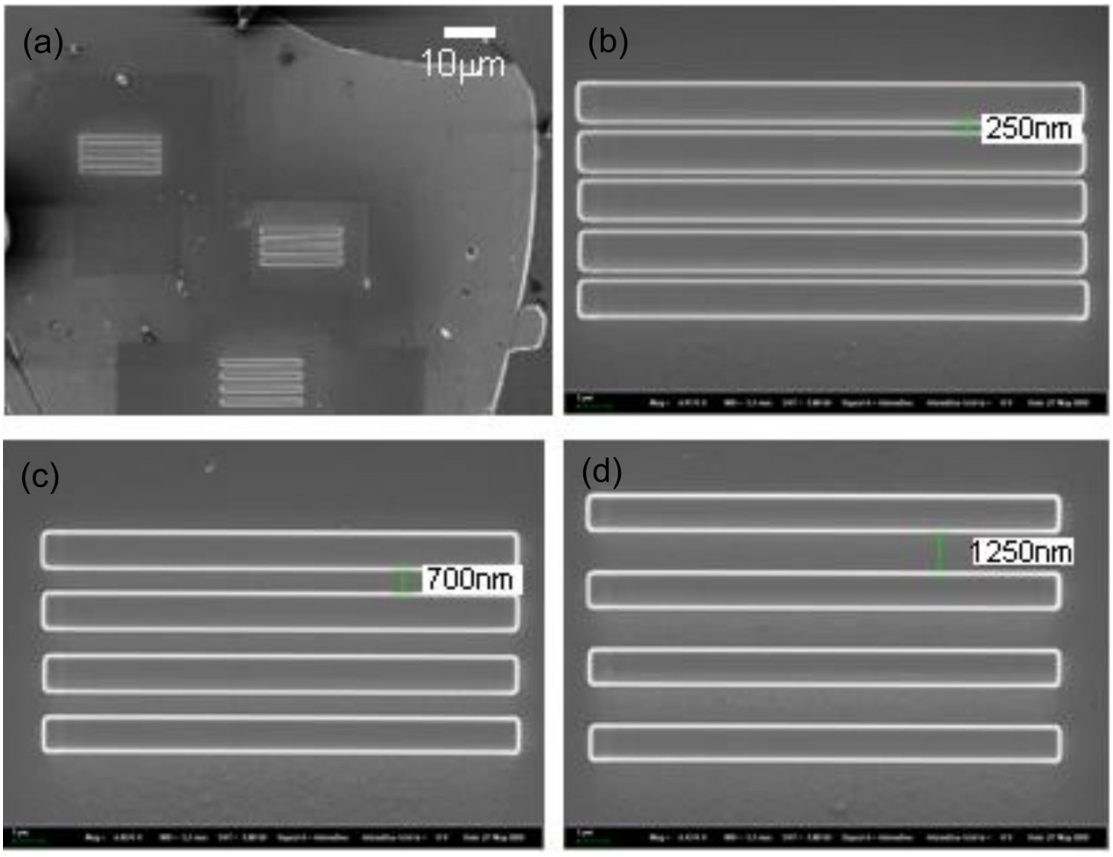


Fig .S2

The comparison record of primary current using Duo source and RF source. (a) The primary current record of duo source when U-pb dating, the beam intensity vary in a wide range from 260 – 300 nA in 18hours. (b) the stability of RF source, which is less than ±1% in more than 170 hours.

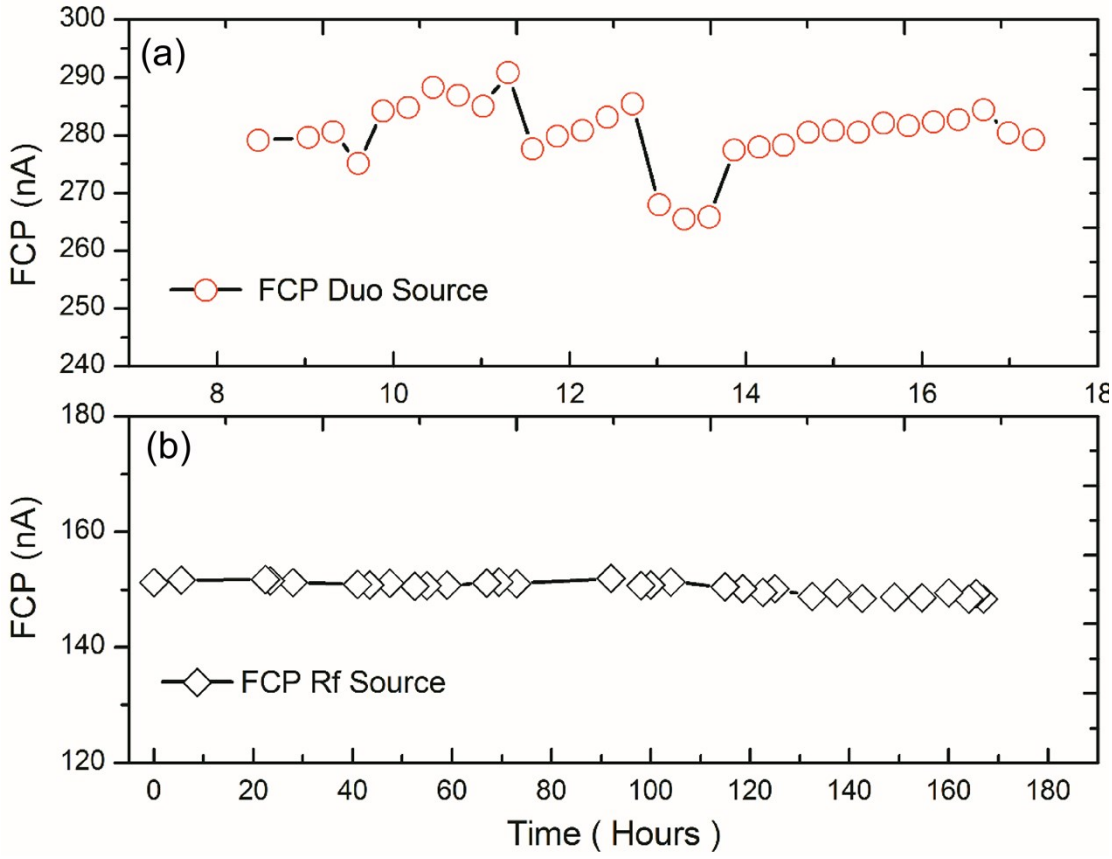


Fig. S3

The plot of the raw data of 207Pb/206Pb Vs. the ROI with the different size used. The dispersion of the ratio data decreases with the ROI size increase. It means that the larger ROI size used, the better precision and the smaller dispersion will be acquired.

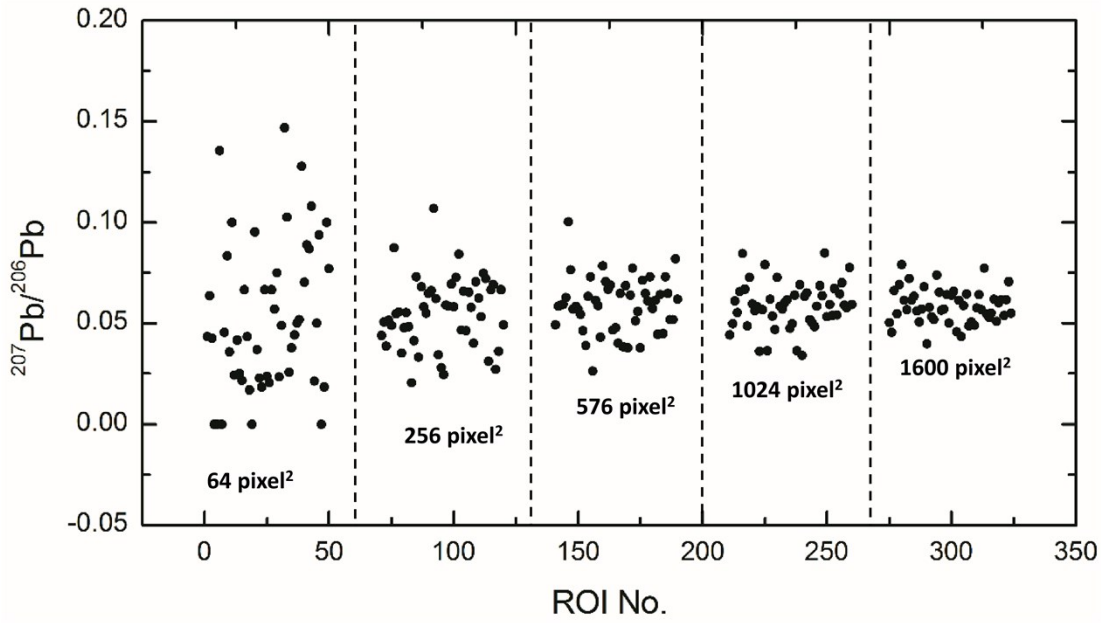
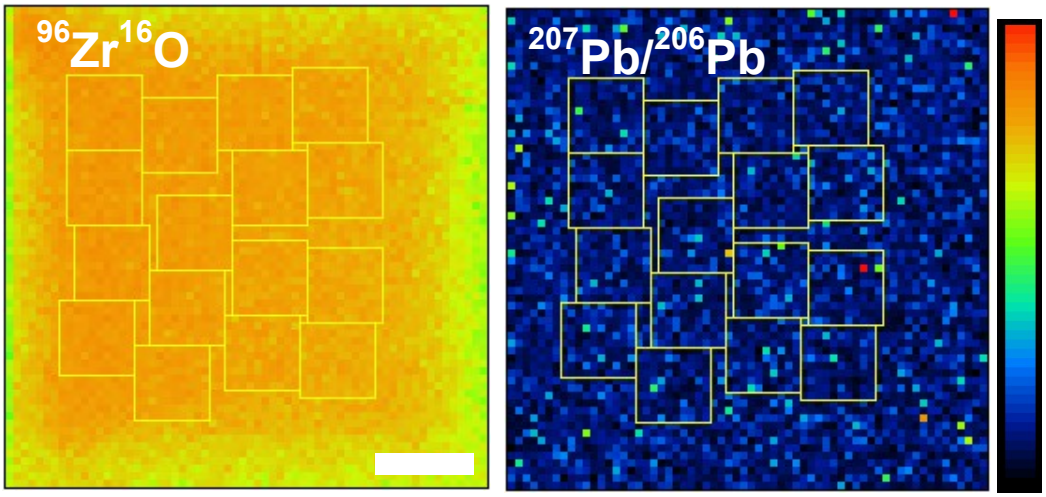


Fig. S4

（a）and (b) the ions image of $^{96}Zr^{16}O$ and ratio image of $^{207}Pb/^{206}Pb$ with the ROIs

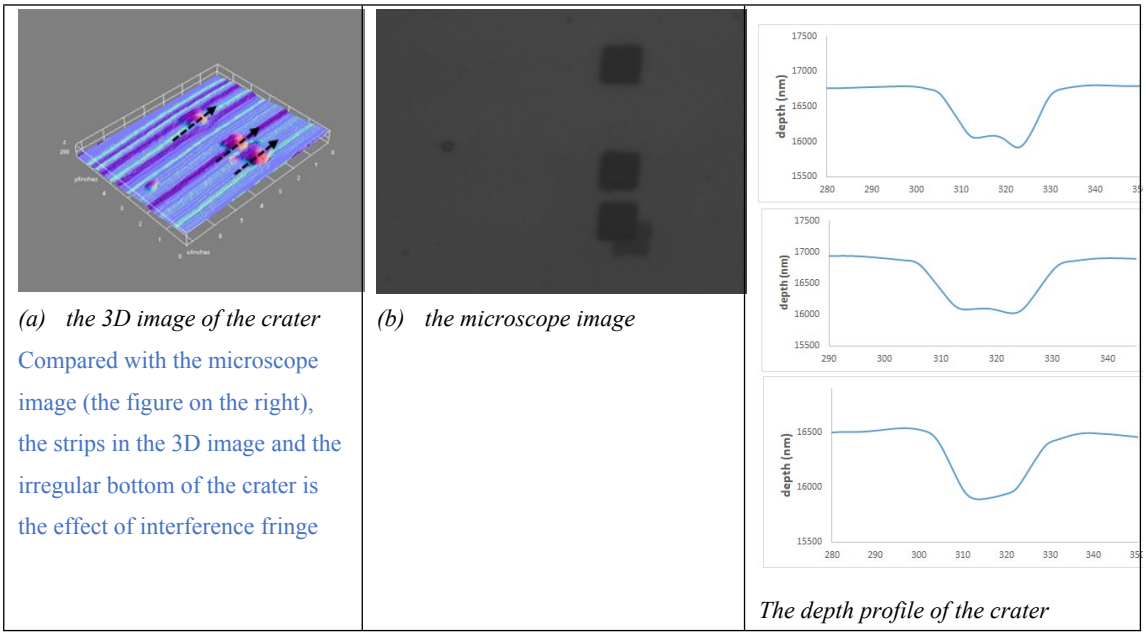


*Scale bar is 2 micron

of the width of ~1.2 × 1.2 μm^2.

Fig. S5

When sputter an area of 10 × 10 μm^2 using < 500pA, the crater depths measurement using the white light interferometer. (a) The 3D image the crater. (b) The micro scope image of the area of depth measurement. (c) the depth profile of the crater. The depth is ~ 700 – 900nm



(a) the 3D image of the crater Compared with the microscope image (the figure on the right), the strips in the 3D image and the irregular bottom of the crater is the effect of interference fringe

(b) the microscope image

The depth profile of the crater

Fig. S6

A correlation diagram between Ln (Pb/UO) and Ln(UO2/UO) of three standard zircons (Qinghu, M257 and 91500). Errors are portrayed at two-sigma level.

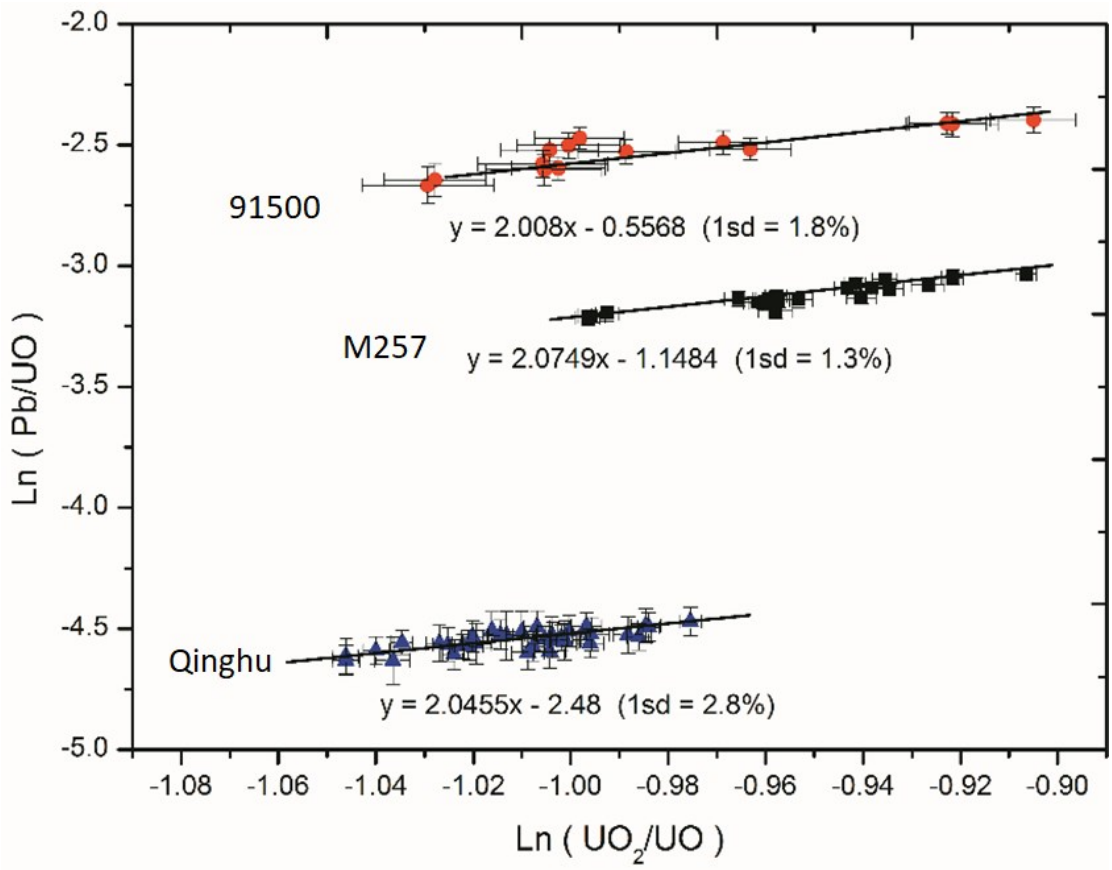
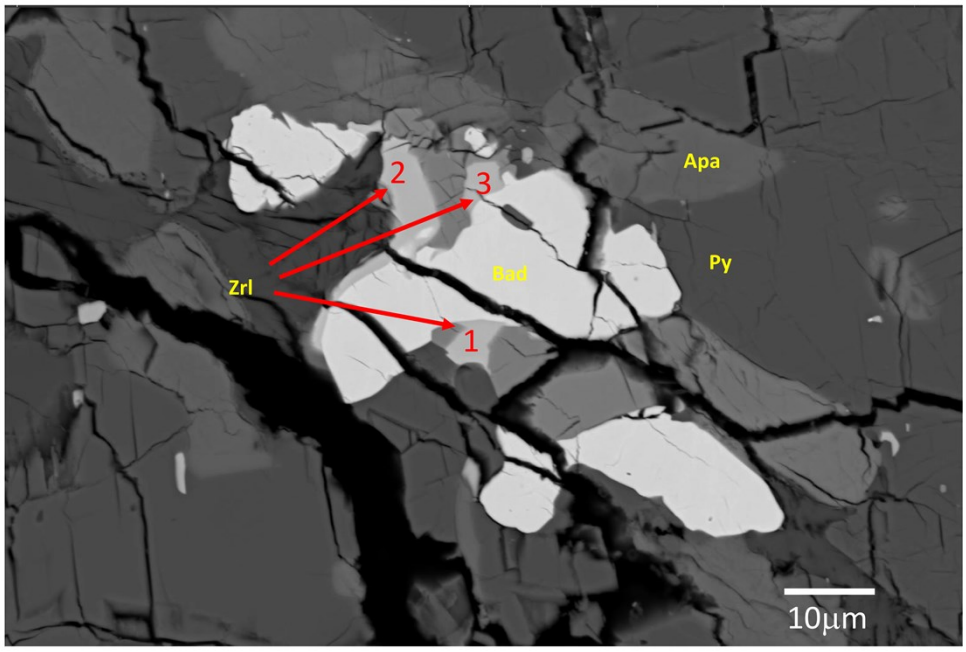


Fig. S7

BSE image of analysis position of NWA 8127.



Zrl: zirconolite Bad:baddeleyite Py: pyroxene Apa:apatite

Fig. S8

The Pb-Pb age results of the three zirconolite grains with the Pb/Zr. It seem that the variation of ages corresponds to the distribution of U and Pb.

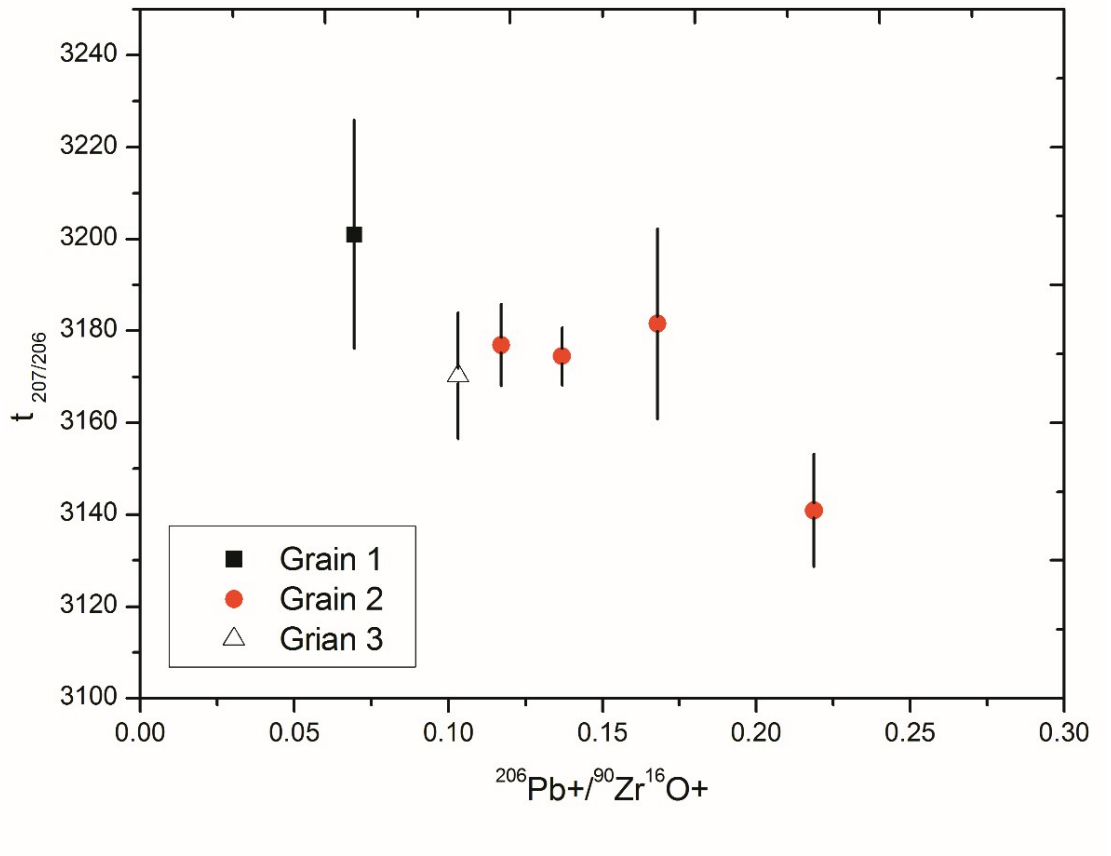


Table S1

The Poisson error and measured relative standard error (RSE) of Pb isotopic data on M257 obtained using the ROIs with various size and shapes

ROI	ROI Size (pixel^2)	Total 207 (counts)	Possion Err (%)	RSE (%)
Square_4×4	16	27	19.2	21.3
Square_8×8	64	117	9.2	9.9
Square_16×16	256	500	4.5	4.4
Square_24×24	576	1137	3.0	3.3
Square_32×32	1024	1812	2.3	2.8
Square_40×40	1600	2388	2.0	2.1
Shape_1	72	138	8.5	9.6
Shape_2	110	205	7.0	7.4
Shape_3	271	549	4.3	4.3
Shape_4	306	684	3.8	4.5
Pb-Pb method*	150	283	5.9	6.6

*The ROI used in the Pb-Pb mapping method, which is rectangle with the size of 3 × 50 pixle^2 equal to 480 nm × 7.8 μm, yielding the RSE of ~6%

Table. S2

The Summary of lead sensitivity reported in previous study and measured in this work

	O^-/O_2^-	Instrument	Sample	Primary (nA)	Beam Size (Raster Size)	cps/na/ ppm
Yang et al. 2012	O-	NanoSIMS (Duo)	m257	0.5	~1.7 μm	4
Liu Y. et al 2011	O-	1280 (DuoO flooding)	m257	0.1	3.4×4.5 μm^2	13
Liu Y. et al 2011	O2-	1280 (DuoO flooding)	m257	0.1	4×5.2 μm^2	21
Liu Y. et al 2015	O2-	1280 (DuoO, flooding)	m257	10	20×30 μm^2	26
Liu Y. et al 2019	O-	1280 HR(DuoO, flooding)	m257	0.2	~2 um	23
Liu.MC et al 2019	O-	1290(RF,)	91500	10	4×3 μm^2	6.3
Liu.MC et al 2019	O-	1290(RF O flooding)	91500	10	4×3 μm^2	14.7
This experiment	O-	NanoSIMS (RF)	m257	0.5	~0.5 μm	5.1

Table S3

Pb isotopic data of NIST610 glass obtained using our method

Image ROI No.	ROI X [(a)]	ROI Y [(a)]	Area (pixel^2)[(b)]	$^{204}Pb/^{206}Pb$	1σ	$^{207}Pb/^{206}Pb$	1σ
20201228_nist610_1_1	8	9	100	0.0551	0.0077	0.893	0.055
20201228_nist610_1_2	9	29	100	0.0649	0.0095	0.907	0.047
20201228_nist610_1_3	8	19	100	0.0734	0.0096	0.904	0.047
20201228_nist610_1_4	7	39	100	0.0675	0.0098	0.947	0.056
20201228_nist610_1_5	18	12	100	0.0600	0.0104	0.924	0.043
20201228_nist610_1_6	20	25	100	0.0735	0.0167	0.892	0.069
20201228_nist610_1_7	28	9	100	0.0549	0.0080	0.906	0.043
20201228_nist610_1_8	19	35	100	0.0505	0.0083	0.994	0.053
20201228_nist610_1_9	30	19	100	0.0666	0.0081	0.908	0.048
20201228_nist610_1_10	17	45	100	0.0545	0.0076	0.886	0.055
20201228_nist610_1_11	38	8	100	0.0481	0.0078	0.921	0.045
20201228_nist610_1_12	30	31	100	0.0521	0.0092	1.005	0.061
20201228_nist610_1_13	29	41	100	0.0804	0.0121	0.934	0.060
20201228_nist610_1_14	40	18	100	0.0530	0.0079	0.995	0.059
20201228_nist610_1_15	40	32	100	0.0756	0.0166	0.930	0.090
20201228_nist610_1_16	39	42	100	0.0533	0.0076	0.857	0.050

(a) The relative coordinates of the ROIs in the ions image. (b) The size of the ROIs 100 pixel^2 (1.2 × 1.2 μm^2

Table. S4

The Pb-Pb age results of the M257 and Phalaborwa standards measured in this work

Image ROI No.	$^{204}pb/^{206}pb$ [a]	1σ	$^{207}Pb/^{206}pb$	1σ	$^{207}Pb^*/^{206}pb^*$	1σ
phalaborwa-1_1.im_ROI_1	2.09E-05	2.09E-06	1.283E-01	6.80E-03	1.280E-01	6.81E-03
phalaborwa-1_1.im_ROI_2	2.09E-05	2.09E-06	1.248E-01	5.95E-03	1.245E-01	5.95E-03
phalaborwa-1_1.im_ROI_3	2.09E-05	2.09E-06	1.168E-01	5.72E-03	1.165E-01	5.72E-03
phalaborwa-1_1.im_ROI_4	2.09E-05	2.09E-06	1.282E-01	6.30E-03	1.279E-01	6.30E-03
phalaborwa-1_1.im_ROI_5	2.09E-05	2.09E-06	1.284E-01	6.08E-03	1.281E-01	6.08E-03
phalaborwa-1_1.im_ROI_6	2.09E-05	2.09E-06	1.383E-01	6.43E-03	1.380E-01	6.43E-03
phalaborwa-1_1.im_ROI_7	2.09E-05	2.09E-06	1.320E-01	6.61E-03	1.317E-01	6.61E-03
phalaborwa-1_1.im_ROI_8	2.09E-05	2.09E-06	1.223E-01	7.27E-03	1.220E-01	7.27E-03
phalaborwa-1_1.im_ROI_9	2.09E-05	2.09E-06	1.378E-01	6.92E-03	1.375E-01	6.93E-03
phalaborwa-1_1.im_ROI_10	2.09E-05	2.09E-06	1.228E-01	6.29E-03	1.225E-01	6.30E-03
phalaborwa-1_1.im_ROI_11	2.09E-05	2.09E-06	1.245E-01	6.40E-03	1.242E-01	6.41E-03
phalaborwa-1_1.im_ROI_12	2.09E-05	2.09E-06	1.192E-01	6.57E-03	1.189E-01	6.58E-03
phalaborwa-1_1.im_ROI_13	2.09E-05	2.09E-06	1.236E-01	6.12E-03	1.233E-01	6.12E-03
phalaborwa-1_1.im_ROI_14	2.09E-05	2.09E-06	1.252E-01	5.89E-03	1.249E-01	5.89E-03
phalaborwa-1_1.im_ROI_15	2.09E-05	2.09E-06	1.288E-01	6.39E-03	1.285E-01	6.39E-03
phalaborwa-1_1.im_ROI_16	2.09E-05	2.09E-06	1.317E-01	6.70E-03	1.314E-01	6.70E-03
phalaborwa-1_10.im_ROI_1	3.41E-05	3.41E-06	1.434E-01	9.66E-03	1.431E-01	9.66E-03
phalaborwa-1_10.im_ROI_2	3.41E-05	3.41E-06	1.219E-01	1.03E-02	1.216E-01	1.03E-02
phalaborwa-1_10.im_ROI_3	3.41E-05	3.41E-06	1.345E-01	9.09E-03	1.342E-01	9.10E-03
phalaborwa-1_10.im_ROI_4	3.41E-05	3.41E-06	1.356E-01	8.73E-03	1.353E-01	8.73E-03
phalaborwa-1_10.im_ROI_5	3.41E-05	3.41E-06	1.353E-01	8.66E-03	1.350E-01	8.66E-03
phalaborwa-1_10.im_ROI_6	3.41E-05	3.41E-06	1.287E-01	8.12E-03	1.284E-01	8.12E-03
phalaborwa-1_10.im_ROI_7	3.41E-05	3.41E-06	1.224E-01	8.00E-03	1.221E-01	8.00E-03
phalaborwa-1_10.im_ROI_8	3.41E-05	3.41E-06	1.335E-01	8.43E-03	1.332E-01	8.44E-03
phalaborwa-1_10.im_ROI_9	3.41E-05	3.41E-06	1.160E-01	7.48E-03	1.156E-01	7.49E-03
phalaborwa-1_10.im_ROI_10	3.41E-05	3.41E-06	1.292E-01	8.86E-03	1.289E-01	8.86E-03
phalaborwa-1_10.im_ROI_11	3.41E-05	3.41E-06	1.246E-01	8.13E-03	1.243E-01	8.14E-03
phalaborwa-1_10.im_ROI_12	3.41E-05	3.41E-06	1.293E-01	8.10E-03	1.290E-01	8.10E-03
phalaborwa-1_10.im_ROI_13	3.41E-05	3.41E-06	1.366E-01	9.51E-03	1.363E-01	9.52E-03
phalaborwa-1_10.im_ROI_14	3.41E-05	3.41E-06	1.378E-01	8.52E-03	1.375E-01	8.52E-03
phalaborwa-1_10.im_ROI_15	3.41E-05	3.41E-06	1.371E-01	9.24E-03	1.368E-01	9.24E-03
phalaborwa-1_11.im_ROI_1	3.49E-05	3.49E-06	1.207E-01	9.98E-03	1.204E-01	9.98E-03
phalaborwa-1_11.im_ROI_2	3.49E-05	3.49E-06	1.224E-01	8.67E-03	1.221E-01	8.67E-03
phalaborwa-1_11.im_ROI_3	3.49E-05	3.49E-06	1.219E-01	8.63E-03	1.216E-01	8.64E-03

phalaborwa-1_11.im_ROI_4	3.49E-05	3.49E-06	1.228E-01	8.64E-03	1.225E-01	8.64E-03
phalaborwa-1_11.im_ROI_5	3.49E-05	3.49E-06	1.159E-01	7.65E-03	1.155E-01	7.65E-03
phalaborwa-1_11.im_ROI_6	3.49E-05	3.49E-06	1.272E-01	8.13E-03	1.269E-01	8.14E-03
phalaborwa-1_11.im_ROI_7	3.49E-05	3.49E-06	1.232E-01	8.05E-03	1.229E-01	8.05E-03
phalaborwa-1_11.im_ROI_8	3.49E-05	3.49E-06	1.231E-01	7.99E-03	1.228E-01	8.00E-03
phalaborwa-1_11.im_ROI_9	3.49E-05	3.49E-06	1.291E-01	8.77E-03	1.288E-01	8.77E-03
phalaborwa-1_11.im_ROI_10	3.49E-05	3.49E-06	1.295E-01	8.95E-03	1.292E-01	8.95E-03
phalaborwa-1_11.im_ROI_11	3.49E-05	3.49E-06	1.153E-01	8.32E-03	1.150E-01	8.33E-03
phalaborwa-1_11.im_ROI_12	3.49E-05	3.49E-06	1.309E-01	8.11E-03	1.306E-01	8.11E-03
phalaborwa-1_11.im_ROI_13	3.49E-05	3.49E-06	1.241E-01	8.95E-03	1.238E-01	8.96E-03
phalaborwa-1_11.im_ROI_14	3.49E-05	3.49E-06	1.318E-01	7.69E-03	1.315E-01	7.70E-03
phalaborwa-1_11.im_ROI_15	3.49E-05	3.49E-06	1.328E-01	8.22E-03	1.325E-01	8.23E-03
phalaborwa-1_11.im_ROI_16	3.49E-05	3.49E-06	1.329E-01	9.54E-03	1.326E-01	9.55E-03
phalaborwa-1_11.im_ROI_17	3.49E-05	3.49E-06	1.179E-01	8.88E-03	1.176E-01	8.89E-03
phalaborwa-1_2.im_ROI_1	1.85E-05	1.85E-06	1.401E-01	7.83E-03	1.398E-01	7.84E-03
phalaborwa-1_2.im_ROI_2	1.85E-05	1.85E-06	1.339E-01	6.28E-03	1.336E-01	6.29E-03
phalaborwa-1_2.im_ROI_3	1.85E-05	1.85E-06	1.226E-01	5.66E-03	1.223E-01	5.66E-03
phalaborwa-1_2.im_ROI_4	1.85E-05	1.85E-06	1.183E-01	6.00E-03	1.180E-01	6.00E-03
phalaborwa-1_2.im_ROI_5	1.85E-05	1.85E-06	1.180E-01	6.19E-03	1.177E-01	6.19E-03
phalaborwa-1_2.im_ROI_6	1.85E-05	1.85E-06	1.191E-01	5.52E-03	1.188E-01	5.52E-03
phalaborwa-1_2.im_ROI_7	1.85E-05	1.85E-06	1.309E-01	5.85E-03	1.306E-01	5.85E-03
phalaborwa-1_2.im_ROI_8	1.85E-05	1.85E-06	1.282E-01	5.54E-03	1.279E-01	5.55E-03
phalaborwa-1_2.im_ROI_9	1.85E-05	1.85E-06	1.279E-01	5.73E-03	1.276E-01	5.74E-03
phalaborwa-1_2.im_ROI_10	1.85E-05	1.85E-06	1.183E-01	6.67E-03	1.180E-01	6.67E-03
phalaborwa-1_2.im_ROI_11	1.85E-05	1.85E-06	1.340E-01	5.80E-03	1.337E-01	5.81E-03
phalaborwa-1_2.im_ROI_12	1.85E-05	1.85E-06	1.297E-01	6.08E-03	1.294E-01	6.08E-03
phalaborwa-1_2.im_ROI_13	1.85E-05	1.85E-06	1.153E-01	5.52E-03	1.150E-01	5.53E-03
phalaborwa-1_2.im_ROI_14	1.85E-05	1.85E-06	1.234E-01	5.93E-03	1.231E-01	5.93E-03
phalaborwa-1_2.im_ROI_15	1.85E-05	1.85E-06	1.295E-01	5.62E-03	1.292E-01	5.63E-03
phalaborwa-1_2.im_ROI_16	1.85E-05	1.85E-06	1.201E-01	6.48E-03	1.198E-01	6.48E-03
phalaborwa-1_3.im_ROI_1	2.14E-05	2.14E-06	1.107E-01	6.78E-03	1.104E-01	6.78E-03
phalaborwa-1_3.im_ROI_2	2.14E-05	2.14E-06	1.223E-01	7.87E-03	1.220E-01	7.87E-03
phalaborwa-1_3.im_ROI_3	2.14E-05	2.14E-06	1.229E-01	6.11E-03	1.226E-01	6.11E-03
phalaborwa-1_3.im_ROI_4	2.14E-05	2.14E-06	1.271E-01	5.91E-03	1.268E-01	5.91E-03
phalaborwa-1_3.im_ROI_5	2.14E-05	2.14E-06	1.270E-01	6.43E-03	1.267E-01	6.44E-03
phalaborwa-1_3.im_ROI_6	2.14E-05	2.14E-06	1.193E-01	5.81E-03	1.190E-01	5.82E-03
phalaborwa-1_3.im_ROI_7	2.14E-05	2.14E-06	1.353E-01	6.81E-03	1.350E-01	6.81E-03
phalaborwa-1_3.im_ROI_8	2.14E-05	2.14E-06	1.320E-01	6.54E-03	1.317E-01	6.54E-03
phalaborwa-1_3.im_ROI_9	2.14E-05	2.14E-06	1.405E-01	6.59E-03	1.402E-01	6.60E-03
phalaborwa-1_3.im_ROI_10	2.14E-05	2.14E-06	1.351E-01	6.56E-03	1.348E-01	6.56E-03
phalaborwa-1_3.im_ROI_11	2.14E-05	2.14E-06	1.324E-01	7.68E-03	1.321E-01	7.68E-03

phalaborwa-1_3.im_ROI_12	2.14E-05	2.14E-06	1.255E-01	6.60E-03	1.252E-01	6.60E-03
phalaborwa-1_3.im_ROI_13	2.14E-05	2.14E-06	1.224E-01	5.85E-03	1.221E-01	5.85E-03
phalaborwa-1_3.im_ROI_14	2.14E-05	2.14E-06	1.251E-01	6.94E-03	1.248E-01	6.95E-03
phalaborwa-1_3.im_ROI_15	2.14E-05	2.14E-06	1.219E-01	6.34E-03	1.216E-01	6.34E-03
phalaborwa-1_3.im_ROI_16	2.14E-05	2.14E-06	1.142E-01	5.74E-03	1.139E-01	5.74E-03
phalaborwa-1_3.im_ROI_17	2.14E-05	2.14E-06	1.358E-01	6.48E-03	1.355E-01	6.48E-03
phalaborwa-1_4.im_ROI_1	2.79E-05	2.79E-06	1.365E-01	1.50E-02	1.362E-01	1.50E-02
phalaborwa-1_4.im_ROI_2	2.79E-05	2.79E-06	1.350E-01	1.24E-02	1.347E-01	1.24E-02
phalaborwa-1_4.im_ROI_3	2.79E-05	2.79E-06	1.347E-01	1.10E-02	1.344E-01	1.10E-02
phalaborwa-1_4.im_ROI_4	2.79E-05	2.79E-06	1.153E-01	8.37E-03	1.150E-01	8.37E-03
phalaborwa-1_4.im_ROI_5	2.79E-05	2.79E-06	1.215E-01	9.98E-03	1.212E-01	9.99E-03
phalaborwa-1_4.im_ROI_6	2.79E-05	2.79E-06	1.287E-01	8.68E-03	1.284E-01	8.68E-03
phalaborwa-1_4.im_ROI_7	2.79E-05	2.79E-06	1.282E-01	8.37E-03	1.279E-01	8.37E-03
phalaborwa-1_4.im_ROI_8	2.79E-05	2.79E-06	1.346E-01	8.26E-03	1.343E-01	8.27E-03
phalaborwa-1_4.im_ROI_9	2.79E-05	2.79E-06	1.142E-01	7.42E-03	1.139E-01	7.42E-03
phalaborwa-1_4.im_ROI_10	2.79E-05	2.79E-06	1.315E-01	7.48E-03	1.312E-01	7.48E-03
phalaborwa-1_4.im_ROI_11	2.79E-05	2.79E-06	1.314E-01	6.76E-03	1.311E-01	6.76E-03
phalaborwa-1_4.im_ROI_12	2.79E-05	2.79E-06	1.271E-01	6.08E-03	1.268E-01	6.08E-03
phalaborwa-1_4.im_ROI_13	2.79E-05	2.79E-06	1.208E-01	6.37E-03	1.205E-01	6.37E-03
phalaborwa-1_4.im_ROI_14	2.79E-05	2.79E-06	1.154E-01	5.09E-03	1.151E-01	5.09E-03
phalaborwa-1_4.im_ROI_15	2.79E-05	2.79E-06	1.379E-01	5.95E-03	1.376E-01	5.96E-03
phalaborwa-1_4.im_ROI_16	2.79E-05	2.79E-06	1.367E-01	6.27E-03	1.364E-01	6.27E-03
phalaborwa-1_5.im_ROI_1	2.03E-05	2.03E-06	1.299E-01	7.73E-03	1.296E-01	7.73E-03
phalaborwa-1_5.im_ROI_2	2.03E-05	2.03E-06	1.351E-01	6.11E-03	1.348E-01	6.11E-03
phalaborwa-1_5.im_ROI_3	2.03E-05	2.03E-06	1.378E-01	7.28E-03	1.375E-01	7.28E-03
phalaborwa-1_5.im_ROI_4	2.03E-05	2.03E-06	1.248E-01	6.45E-03	1.245E-01	6.45E-03
phalaborwa-1_5.im_ROI_5	2.03E-05	2.03E-06	1.298E-01	7.16E-03	1.295E-01	7.16E-03
phalaborwa-1_5.im_ROI_6	2.03E-05	2.03E-06	1.288E-01	5.93E-03	1.285E-01	5.93E-03
phalaborwa-1_5.im_ROI_7	2.03E-05	2.03E-06	1.225E-01	5.89E-03	1.222E-01	5.89E-03
phalaborwa-1_5.im_ROI_8	2.03E-05	2.03E-06	1.355E-01	5.84E-03	1.352E-01	5.85E-03
phalaborwa-1_5.im_ROI_9	2.03E-05	2.03E-06	1.285E-01	6.36E-03	1.282E-01	6.36E-03
phalaborwa-1_5.im_ROI_10	2.03E-05	2.03E-06	1.226E-01	5.94E-03	1.223E-01	5.95E-03
phalaborwa-1_5.im_ROI_11	2.03E-05	2.03E-06	1.259E-01	5.88E-03	1.255E-01	5.88E-03
phalaborwa-1_5.im_ROI_12	2.03E-05	2.03E-06	1.297E-01	6.79E-03	1.294E-01	6.79E-03
phalaborwa-1_5.im_ROI_13	2.03E-05	2.03E-06	1.332E-01	6.31E-03	1.329E-01	6.31E-03
phalaborwa-1_5.im_ROI_14	2.03E-05	2.03E-06	1.353E-01	6.79E-03	1.350E-01	6.79E-03
phalaborwa-1_5.im_ROI_15	2.03E-05	2.03E-06	1.309E-01	6.53E-03	1.306E-01	6.53E-03
phalaborwa-1_5.im_ROI_16	2.03E-05	2.03E-06	1.306E-01	5.95E-03	1.302E-01	5.95E-03
phalaborwa-1_5.im_ROI_17	2.03E-05	2.03E-06	1.282E-01	6.35E-03	1.279E-01	6.35E-03
phalaborwa-1_6.im_ROI_1	1.88E-05	1.88E-06	1.311E-01	6.58E-03	1.308E-01	6.58E-03
phalaborwa-1_6.im_ROI_2	1.88E-05	1.88E-06	1.288E-01	6.73E-03	1.285E-01	6.74E-03

phalaborwa-1_6.im_ROI_3	1.88E-05	1.88E-06	1.249E-01	7.10E-03	1.245E-01	7.10E-03
phalaborwa-1_6.im_ROI_4	1.88E-05	1.88E-06	1.385E-01	7.11E-03	1.382E-01	7.11E-03
phalaborwa-1_6.im_ROI_5	1.88E-05	1.88E-06	1.295E-01	6.03E-03	1.292E-01	6.03E-03
phalaborwa-1_6.im_ROI_6	1.88E-05	1.88E-06	1.246E-01	6.58E-03	1.243E-01	6.58E-03
phalaborwa-1_6.im_ROI_7	1.88E-05	1.88E-06	1.210E-01	5.31E-03	1.207E-01	5.31E-03
phalaborwa-1_6.im_ROI_8	1.88E-05	1.88E-06	1.354E-01	6.25E-03	1.351E-01	6.25E-03
phalaborwa-1_6.im_ROI_9	1.88E-05	1.88E-06	1.307E-01	5.56E-03	1.304E-01	5.56E-03
phalaborwa-1_6.im_ROI_10	1.88E-05	1.88E-06	1.269E-01	5.58E-03	1.266E-01	5.58E-03
phalaborwa-1_6.im_ROI_11	1.88E-05	1.88E-06	1.255E-01	5.63E-03	1.252E-01	5.63E-03
phalaborwa-1_6.im_ROI_12	1.88E-05	1.88E-06	1.289E-01	6.16E-03	1.286E-01	6.17E-03
phalaborwa-1_6.im_ROI_13	1.88E-05	1.88E-06	1.223E-01	5.58E-03	1.220E-01	5.58E-03
phalaborwa-1_6.im_ROI_14	1.88E-05	1.88E-06	1.334E-01	5.67E-03	1.331E-01	5.67E-03
phalaborwa-1_6.im_ROI_15	1.88E-05	1.88E-06	1.190E-01	5.23E-03	1.187E-01	5.23E-03
phalaborwa-1_6.im_ROI_16	1.88E-05	1.88E-06	1.240E-01	6.03E-03	1.237E-01	6.03E-03
phalaborwa-1_6.im_ROI_17	1.88E-05	1.88E-06	1.251E-01	5.76E-03	1.248E-01	5.76E-03
phalaborwa-1_7.im_ROI_1	1.97E-05	1.97E-06	1.378E-01	7.71E-03	1.375E-01	7.72E-03
phalaborwa-1_7.im_ROI_2	1.97E-05	1.97E-06	1.240E-01	7.03E-03	1.237E-01	7.03E-03
phalaborwa-1_7.im_ROI_3	1.97E-05	1.97E-06	1.309E-01	6.45E-03	1.306E-01	6.46E-03
phalaborwa-1_7.im_ROI_4	1.97E-05	1.97E-06	1.341E-01	6.48E-03	1.338E-01	6.48E-03
phalaborwa-1_7.im_ROI_5	1.97E-05	1.97E-06	1.212E-01	6.58E-03	1.209E-01	6.58E-03
phalaborwa-1_7.im_ROI_6	1.97E-05	1.97E-06	1.234E-01	7.44E-03	1.230E-01	7.44E-03
phalaborwa-1_7.im_ROI_7	1.97E-05	1.97E-06	1.310E-01	6.14E-03	1.307E-01	6.14E-03
phalaborwa-1_7.im_ROI_8	1.97E-05	1.97E-06	1.336E-01	5.64E-03	1.333E-01	5.64E-03
phalaborwa-1_7.im_ROI_9	1.97E-05	1.97E-06	1.231E-01	6.11E-03	1.228E-01	6.12E-03
phalaborwa-1_7.im_ROI_10	1.97E-05	1.97E-06	1.191E-01	5.76E-03	1.188E-01	5.76E-03
phalaborwa-1_7.im_ROI_11	1.97E-05	1.97E-06	1.261E-01	5.70E-03	1.258E-01	5.70E-03
phalaborwa-1_7.im_ROI_12	1.97E-05	1.97E-06	1.208E-01	5.97E-03	1.205E-01	5.97E-03
phalaborwa-1_7.im_ROI_13	1.97E-05	1.97E-06	1.283E-01	6.05E-03	1.280E-01	6.05E-03
phalaborwa-1_7.im_ROI_14	1.97E-05	1.97E-06	1.260E-01	6.65E-03	1.257E-01	6.65E-03
phalaborwa-1_7.im_ROI_15	1.97E-05	1.97E-06	1.257E-01	6.02E-03	1.254E-01	6.02E-03
phalaborwa-1_7.im_ROI_16	1.97E-05	1.97E-06	1.184E-01	6.10E-03	1.181E-01	6.10E-03
phalaborwa-1_7.im_ROI_17	1.97E-05	1.97E-06	1.244E-01	6.66E-03	1.241E-01	6.67E-03
phalaborwa-1_8.im_ROI_1	2.09E-05	2.09E-06	1.374E-01	6.83E-03	1.371E-01	6.83E-03
phalaborwa-1_8.im_ROI_2	2.09E-05	2.09E-06	1.224E-01	6.26E-03	1.221E-01	6.26E-03
phalaborwa-1_8.im_ROI_3	2.09E-05	2.09E-06	1.228E-01	6.77E-03	1.225E-01	6.77E-03
phalaborwa-1_8.im_ROI_4	2.09E-05	2.09E-06	1.204E-01	6.27E-03	1.201E-01	6.27E-03
phalaborwa-1_8.im_ROI_5	2.09E-05	2.09E-06	1.343E-01	6.27E-03	1.340E-01	6.27E-03
phalaborwa-1_8.im_ROI_6	2.09E-05	2.09E-06	1.179E-01	6.43E-03	1.176E-01	6.43E-03
phalaborwa-1_8.im_ROI_7	2.09E-05	2.09E-06	1.157E-01	6.56E-03	1.154E-01	6.57E-03
phalaborwa-1_8.im_ROI_8	2.09E-05	2.09E-06	1.181E-01	6.15E-03	1.178E-01	6.15E-03
phalaborwa-1_8.im_ROI_9	2.09E-05	2.09E-06	1.360E-01	6.58E-03	1.357E-01	6.58E-03

phalaborwa-1_8.im_ROI_10	2.09E-05	2.09E-06	1.299E-01	6.02E-03	1.296E-01	6.02E-03
phalaborwa-1_8.im_ROI_11	2.09E-05	2.09E-06	1.279E-01	7.05E-03	1.275E-01	7.05E-03
phalaborwa-1_8.im_ROI_12	2.09E-05	2.09E-06	1.268E-01	5.90E-03	1.265E-01	5.90E-03
phalaborwa-1_8.im_ROI_13	2.09E-05	2.09E-06	1.253E-01	6.15E-03	1.249E-01	6.15E-03
phalaborwa-1_8.im_ROI_14	2.09E-05	2.09E-06	1.274E-01	6.42E-03	1.271E-01	6.43E-03
phalaborwa-1_8.im_ROI_15	2.09E-05	2.09E-06	1.268E-01	6.57E-03	1.265E-01	6.57E-03
phalaborwa-1_8.im_ROI_16	2.09E-05	2.09E-06	1.261E-01	6.37E-03	1.258E-01	6.37E-03
phalaborwa-1_8.im_ROI_17	2.09E-05	2.09E-06	1.322E-01	6.47E-03	1.319E-01	6.47E-03
phalaborwa-1_9.im_ROI_1	3.05E-05	3.05E-06	1.266E-01	9.37E-03	1.263E-01	9.37E-03
phalaborwa-1_9.im_ROI_2	3.05E-05	3.05E-06	1.295E-01	8.30E-03	1.292E-01	8.30E-03
phalaborwa-1_9.im_ROI_3	3.05E-05	3.05E-06	1.279E-01	8.54E-03	1.276E-01	8.54E-03
phalaborwa-1_9.im_ROI_4	3.05E-05	3.05E-06	1.278E-01	8.38E-03	1.275E-01	8.39E-03
phalaborwa-1_9.im_ROI_5	3.05E-05	3.05E-06	1.180E-01	6.82E-03	1.176E-01	6.82E-03
phalaborwa-1_9.im_ROI_6	3.05E-05	3.05E-06	1.358E-01	8.32E-03	1.355E-01	8.32E-03
phalaborwa-1_9.im_ROI_7	3.05E-05	3.05E-06	1.361E-01	8.11E-03	1.358E-01	8.12E-03
phalaborwa-1_9.im_ROI_8	3.05E-05	3.05E-06	1.270E-01	7.48E-03	1.267E-01	7.48E-03
phalaborwa-1_9.im_ROI_9	3.05E-05	3.05E-06	1.237E-01	8.14E-03	1.234E-01	8.14E-03
phalaborwa-1_9.im_ROI_10	3.05E-05	3.05E-06	1.297E-01	8.42E-03	1.294E-01	8.42E-03
phalaborwa-1_9.im_ROI_11	3.05E-05	3.05E-06	1.284E-01	7.73E-03	1.281E-01	7.74E-03
phalaborwa-1_9.im_ROI_12	3.05E-05	3.05E-06	1.165E-01	7.65E-03	1.162E-01	7.66E-03
phalaborwa-1_9.im_ROI_13	3.05E-05	3.05E-06	1.274E-01	7.66E-03	1.271E-01	7.66E-03
phalaborwa-1_9.im_ROI_14	3.05E-05	3.05E-06	1.328E-01	7.94E-03	1.325E-01	7.94E-03
phalaborwa-1_9.im_ROI_15	3.05E-05	3.05E-06	1.342E-01	7.41E-03	1.338E-01	7.41E-03
M257_1_1	5.00E-06	5.00E-07	6.13E-02	3.64E-03	6.13E-02	3.64E-03
M257_1_2	5.00E-06	5.00E-07	5.40E-02	3.83E-03	5.40E-02	3.83E-03
M257_1_3	5.00E-06	5.00E-07	6.39E-02	3.58E-03	6.39E-02	3.58E-03
M257_1_4	5.00E-06	5.00E-07	5.70E-02	3.74E-03	5.70E-02	3.74E-03
M257_1_5	5.00E-06	5.00E-07	5.68E-02	3.72E-03	5.68E-02	3.72E-03
M257_1_6	5.00E-06	5.00E-07	5.61E-02	3.80E-03	5.61E-02	3.80E-03
M257_1_7	5.00E-06	5.00E-07	5.65E-02	3.62E-03	5.65E-02	3.62E-03
M257_1_8	5.00E-06	5.00E-07	5.60E-02	3.89E-03	5.60E-02	3.89E-03
M257_1_9	5.00E-06	5.00E-07	5.96E-02	4.03E-03	5.96E-02	4.03E-03
M257_1_10	5.00E-06	5.00E-07	5.65E-02	3.86E-03	5.65E-02	3.86E-03
M257_1_11	5.00E-06	5.00E-07	6.16E-02	3.96E-03	6.16E-02	3.96E-03
M257_1_12	5.00E-06	5.00E-07	5.43E-02	3.69E-03	5.43E-02	3.69E-03
M257_1_13	5.00E-06	5.00E-07	5.97E-02	3.74E-03	5.97E-02	3.74E-03
M257_1_14	5.00E-06	5.00E-07	6.80E-02	4.28E-03	6.80E-02	4.28E-03
M257_1_15	5.00E-06	5.00E-07	5.67E-02	3.87E-03	5.67E-02	3.87E-03
M257_1_16	5.00E-06	5.00E-07	5.95E-02	4.53E-03	5.95E-02	4.53E-03
M257_1_17	5.00E-06	5.00E-07	6.76E-02	5.24E-03	6.76E-02	5.24E-03
M257_2_1	7.06E-06	7.06E-07	5.77E-02	5.59E-03	5.77E-02	5.59E-03

M257_2_2	7.06E-06	7.06E-07	5.80E-02	4.61E-03	5.80E-02	4.61E-03
M257_2_3	7.06E-06	7.06E-07	5.63E-02	4.04E-03	5.63E-02	4.04E-03
M257_2_4	7.06E-06	7.06E-07	5.30E-02	4.59E-03	5.30E-02	4.59E-03
M257_2_5	7.06E-06	7.06E-07	5.40E-02	3.94E-03	5.40E-02	3.94E-03
M257_2_6	7.06E-06	7.06E-07	5.57E-02	4.43E-03	5.57E-02	4.43E-03
M257_2_7	7.06E-06	7.06E-07	5.89E-02	3.34E-03	5.89E-02	3.34E-03
M257_2_8	7.06E-06	7.06E-07	6.58E-02	4.49E-03	6.58E-02	4.49E-03
M257_2_9	7.06E-06	7.06E-07	6.17E-02	4.10E-03	6.17E-02	4.10E-03
M257_2_10	7.06E-06	7.06E-07	5.28E-02	4.03E-03	5.28E-02	4.03E-03
M257_2_11	7.06E-06	7.06E-07	5.36E-02	3.92E-03	5.36E-02	3.92E-03
M257_2_12	7.06E-06	7.06E-07	5.10E-02	3.43E-03	5.10E-02	3.43E-03
M257_2_13	7.06E-06	7.06E-07	5.80E-02	4.02E-03	5.80E-02	4.02E-03
M257_2_14	7.06E-06	7.06E-07	5.97E-02	4.45E-03	5.97E-02	4.45E-03
M257_2_15	7.06E-06	7.06E-07	5.76E-02	3.84E-03	5.76E-02	3.84E-03
M257_2_16	7.06E-06	7.06E-07	6.21E-02	4.09E-03	6.21E-02	4.09E-03
M257_2_17	7.06E-06	7.06E-07	6.38E-02	4.21E-03	6.38E-02	4.21E-03
M257_3_1	1.91E-05	1.91E-06	5.91E-02	3.71E-03	5.91E-02	3.71E-03
M257_3_2	1.91E-05	1.91E-06	6.02E-02	3.89E-03	6.02E-02	3.89E-03
M257_3_3	1.91E-05	1.91E-06	5.88E-02	3.40E-03	5.88E-02	3.40E-03
M257_3_4	1.91E-05	1.91E-06	5.57E-02	3.52E-03	5.57E-02	3.52E-03
M257_3_5	1.91E-05	1.91E-06	6.20E-02	3.10E-03	6.20E-02	3.10E-03
M257_3_6	1.91E-05	1.91E-06	5.85E-02	2.84E-03	5.85E-02	2.84E-03
M257_3_7	1.91E-05	1.91E-06	5.94E-02	3.30E-03	5.94E-02	3.30E-03
M257_3_8	1.91E-05	1.91E-06	5.93E-02	3.00E-03	5.93E-02	3.00E-03
M257_3_9	1.91E-05	1.91E-06	5.43E-02	2.76E-03	5.43E-02	2.76E-03
M257_3_10	1.91E-05	1.91E-06	6.04E-02	3.08E-03	6.04E-02	3.08E-03
M257_3_11	1.91E-05	1.91E-06	6.15E-02	3.29E-03	6.15E-02	3.29E-03
M257_3_12	1.91E-05	1.91E-06	5.66E-02	3.29E-03	5.66E-02	3.29E-03
M257_3_13	1.91E-05	1.91E-06	5.82E-02	2.96E-03	5.82E-02	2.96E-03
M257_3_14	1.91E-05	1.91E-06	5.64E-02	2.91E-03	5.64E-02	2.91E-03
M257_3_15	1.91E-05	1.91E-06	5.76E-02	3.01E-03	5.76E-02	3.01E-03
M257_3_16	1.91E-05	1.91E-06	5.57E-02	2.95E-03	5.57E-02	2.95E-03
M257_3_17	1.91E-05	1.91E-06	5.37E-02	2.97E-03	5.37E-02	2.97E-03
M257_4_2	1.95E-05	1.95E-06	6.57E-02	4.33E-03	6.57E-02	4.33E-03
M257_4_3	1.95E-05	1.95E-06	6.19E-02	3.59E-03	6.19E-02	3.59E-03
M257_4_4	1.95E-05	1.95E-06	5.73E-02	3.22E-03	5.73E-02	3.22E-03
M257_4_5	1.95E-05	1.95E-06	5.53E-02	2.89E-03	5.53E-02	2.89E-03
M257_4_6	1.95E-05	1.95E-06	6.06E-02	3.06E-03	6.06E-02	3.06E-03
M257_4_7	1.95E-05	1.95E-06	6.14E-02	3.21E-03	6.14E-02	3.21E-03
M257_4_8	1.95E-05	1.95E-06	5.68E-02	3.13E-03	5.68E-02	3.13E-03
M257_4_9	1.95E-05	1.95E-06	5.73E-02	3.06E-03	5.73E-02	3.06E-03

M257_4_10	1.95E-05	1.95E-06	5.84E-02	3.30E-03	5.84E-02	3.30E-03
M257_4_11	1.95E-05	1.95E-06	5.76E-02	2.84E-03	5.76E-02	2.84E-03
M257_4_12	1.95E-05	1.95E-06	6.28E-02	2.80E-03	6.28E-02	2.80E-03
M257_4_13	1.95E-05	1.95E-06	5.62E-02	2.95E-03	5.62E-02	2.95E-03
M257_4_14	1.95E-05	1.95E-06	6.07E-02	3.01E-03	6.07E-02	3.01E-03
M257_4_15	1.95E-05	1.95E-06	5.97E-02	2.95E-03	5.97E-02	2.95E-03
M257_4_16	1.95E-05	1.95E-06	5.56E-02	3.21E-03	5.56E-02	3.21E-03
M257_4_17	1.95E-05	1.95E-06	6.43E-02	3.72E-03	6.43E-02	3.72E-03
M257_5_1	1.24E-05	1.24E-06	6.13E-02	5.43E-03	6.13E-02	5.43E-03
M257_5_2	1.24E-05	1.24E-06	6.25E-02	3.74E-03	6.25E-02	3.74E-03
M257_5_3	1.24E-05	1.24E-06	5.37E-02	2.81E-03	5.37E-02	2.81E-03
M257_5_4	1.24E-05	1.24E-06	5.97E-02	3.02E-03	5.97E-02	3.02E-03
M257_5_5	1.24E-05	1.24E-06	5.66E-02	3.29E-03	5.66E-02	3.29E-03
M257_5_6	1.24E-05	1.24E-06	6.21E-02	3.44E-03	6.21E-02	3.44E-03
M257_5_7	1.24E-05	1.24E-06	5.58E-02	3.12E-03	5.58E-02	3.12E-03
M257_5_8	1.24E-05	1.24E-06	6.60E-02	3.08E-03	6.60E-02	3.08E-03
M257_5_9	1.24E-05	1.24E-06	5.71E-02	3.36E-03	5.71E-02	3.36E-03
M257_5_10	1.24E-05	1.24E-06	6.20E-02	3.52E-03	6.20E-02	3.52E-03
M257_5_11	1.24E-05	1.24E-06	6.38E-02	3.86E-03	6.38E-02	3.86E-03
M257_5_12	1.24E-05	1.24E-06	5.81E-02	3.25E-03	5.81E-02	3.25E-03
M257_5_13	1.24E-05	1.24E-06	5.60E-02	2.84E-03	5.60E-02	2.84E-03
M257_5_14	1.24E-05	1.24E-06	5.28E-02	2.78E-03	5.28E-02	2.78E-03
M257_5_15	1.24E-05	1.24E-06	6.16E-02	3.83E-03	6.16E-02	3.83E-03
M257_5_16	1.24E-05	1.24E-06	6.50E-02	3.56E-03	6.50E-02	3.56E-03
M257_5_17	1.24E-05	1.24E-06	6.13E-02	2.79E-03	6.13E-02	2.79E-03

(a) 204 corrcent use the total counts and the longterm backgound of EM

Table S5

U-Pb dating results of standard zircons (91500, M257) obtained using our method

Spot No.	Isotopic ratios						Age (Ma)					
	$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ
91500_U-Pb_1_1	0.0714	0.006	1.7097	0.154	0.1737	0.0050	968	165.1	1012.2	59.4	1032.7	27.5
91500_U-Pb_1_2	0.0712	0.005	1.9134	0.153	0.1948	0.0056	964.4	145.3	1085.8	54.8	1147.3	30.2
91500_U-Pb_1_3	0.0815	0.005	1.9481	0.136	0.1734	0.0050	1232.6	120.1	1097.8	48	1031.1	27.4
91500_U-Pb_1_4	0.0693	0.005	1.6977	0.138	0.1775	0.0051	909.1	149.5	1007.7	53.4	1053.6	28
91500_U-Pb_2_1	0.0698	0.007	1.6444	0.176	0.1709	0.0050	922.5	199.1	987.4	70.1	1016.9	27.1
91500_U-Pb_2_2	0.0822	0.008	1.974	0.193	0.1743	0.0051	1249.4	173.4	1106.7	68.5	1035.5	27.9
91500_U-Pb_2_3	0.0822	0.008	1.974	0.193	0.1743	0.0051	1249.4	173.4	1106.7	68.5	1035.5	27.9
91500_U-Pb_2_4	0.0822	0.008	1.974	0.193	0.1743	0.0051	1249.4	173.4	1106.7	68.5	1035.5	27.9
91500_U-Pb_3_1	0.0794	0.008	1.9001	0.198	0.1737	0.0050	1181.1	186.1	1081.1	71.8	1032.2	27.4
91500_U-Pb_3_2	0.0745	0.007	1.9484	0.195	0.1897	0.0055	1054.8	182.2	1097.9	69.6	1119.8	29.6
91500_U-Pb_3_3	0.0722	0.005	1.7942	0.142	0.1802	0.0052	992.3	143	1043.4	52.9	1067.9	28.3
91500_U-Pb_3_4	0.0778	0.006	1.8634	0.157	0.1737	0.0050	1142.3	149.4	1068.2	57.1	1032.2	27.5
91500_U-Pb_4_1	0.0703	0.007	1.7251	0.181	0.1781	0.0052	936	193.6	1017.9	69.6	1056.4	28.5
91500_U-Pb_4_2	0.0671	0.006	1.7393	0.163	0.1879	0.0054	842.2	176.2	1023.2	62.6	1109.9	29.3
91500_U-Pb_4_3	0.0756	0.006	1.8829	0.153	0.1807	0.0052	1084	144.5	1075.1	55.1	1070.7	28.4
91500_U-Pb_4_4	0.0772	0.007	1.8781	0.173	0.1765	0.0051	1125.4	165.2	1073.4	62.9	1047.9	27.8
M257_U-Pb_1_1	0.0575	0.002	0.7288	0.030	0.092	0.0027	509.5	62.6	555.9	17.7	567.3	15.7
M257_U-Pb_1_2	0.0562	0.002	0.713	0.031	0.0919	0.0027	462.2	73.5	546.5	19	566.9	15.6
M257_U-Pb_1_3	0.0586	0.002	0.7245	0.032	0.0897	0.0026	551.1	71.6	553.3	19	553.8	15.3
M257_U-Pb_1_4	0.0609	0.003	0.7371	0.038	0.0878	0.0025	635.1	89.3	560.7	22.4	542.5	15
M257_U-Pb_2_1	0.0552	0.002	0.707	0.034	0.0929	0.0027	420.2	84.3	542.9	20.5	572.6	15.8
M257_U-Pb_2_2	0.0594	0.002	0.7562	0.038	0.0924	0.0027	580.4	85.7	571.8	22	569.6	15.8
M257_U-Pb_2_3	0.0544	0.002	0.6993	0.034	0.0933	0.0027	385.7	87.5	538.4	20.9	575.1	16
M257_U-Pb_2_4	0.0601	0.002	0.7779	0.036	0.0938	0.0027	608.6	75.3	584.3	20.6	578	16
M257_U-Pb_3_1	0.0583	0.002	0.7338	0.030	0.0913	0.0026	539.8	61.6	558.8	17.6	563.4	15.5
M257_U-Pb_3_2	0.0582	0.002	0.7349	0.029	0.0916	0.0027	536.8	58	559.4	17.1	565	15.5
M257_U-Pb_3_3	0.0587	0.002	0.7515	0.029	0.0929	0.0027	555.6	57.8	569.1	17.3	572.4	15.8
M257_U-Pb_3_4	0.0561	0.001	0.7197	0.028	0.093	0.0027	457.9	56.8	550.5	16.6	573.1	15.8
M257_U-Pb_4_1	0.0593	0.002	0.7511	0.033	0.0919	0.0027	578	71.5	568.9	19.5	566.6	15.7
M257_U-Pb_4_2	0.0591	0.002	0.7641	0.031	0.0937	0.0027	572.5	63.7	576.4	18.4	577.4	15.9
M257_U-Pb_4_3	0.0579	0.002	0.7597	0.030	0.0952	0.0028	525	59.8	573.8	17.7	586.2	16.2

M257_U-Pb_4_4	0.0595	0.002	0.7701	0.030	0.0938	0.0027	586.3	56.7	579.8	17.6	578.1	16.1
M257_U-Pb_5_1	0.0614	0.002	0.7722	0.033	0.0912	0.0026	653.8	65.9	581	19	562.6	15.6
M257_U-Pb_5_2	0.0582	0.002	0.737	0.029	0.0918	0.0027	537.5	60.3	560.6	17.6	566.3	15.8
M257_U-Pb_5_3	0.0578	0.002	0.7445	0.030	0.0934	0.0027	523	59	565	17.4	575.5	15.9
M257_U-Pb_5_4	0.0604	0.002	0.7958	0.031	0.0956	0.0028	617.4	56.7	594.5	17.8	588.5	16.2

Table. S6

The Pb-Pb age results of Zirconolite grains on NWA8127 measured in this work

Image ROI No.	ROI X	ROI Y	Area	204pb/206pb	$207Pb/206Pb_m$	1σ(%)	Pb/UO2	1σ(%)	pb/ZrO	$t_{207/206}$ (Ma)	1σ
20201119_NWA8127-CaTiZrO4_1_1	28	38	2399	< 0.00001	0.2526	1.6	2.33	1.7	0.069	*3201*	*25*
20201119_NWA8127-CaTiZrO4_2_1	36	0	863	< 0.00001	0.2432	0.8	2.53	1.0	0.219	*3141*	*12*
20201119_NWA8127-CaTiZrO4_2_2	65	72	345	< 0.00001	0.2495	1.3	2.56	1.6	0.168	*3182*	*21*
20201119_NWA8127-CaTiZrO4_2_3	32	1	3363	0.000019	0.2488	0.6	2.44	0.9	0.117	*3177*	*9*
20201119_NWA8127-CaTiZrO4_2_4	32	1	5940	0.000014	0.2484	0.4	2.46	0.6	0.137	*3174*	*6*
20201119_NWA8127-CaTiZrO4_3_1	40	43	1587	< 0.00001	0.2477	0.9	2.57	1.3	0.103	*3170*	*14*

(b) The relative coordinates of the ROIs in the ions image. (b) The size of the ROIs.