Supplementary Materials: Matrix-Matched Iron-Oxide Laser Ablation ICP-MS U-Pb Geochronology Using Mixed Solution Standards

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Supplementary Text File S1. Additional analytical procedures for calculating and certifying the Pb/U ratios.

The mixed solution standard was made from single natural U and Pb solutions. The concentrations of these two solutions were calibrated using Q-ICP-MS at Adelaide Microscopy.

- Q-ICP-MS results: *Pb concentration of the mother bottle* = 9985 ppb; *U concentration of the mother bottle* = 9994 ppb.

The Pb isotope ratios were analyzed by MC-ICP-MS at Nanjing University.

- MC-ICP-MS results: $^{206}Pb/^{204}Pb$ = 17.9895 ± 0.0005; $^{207}Pb/^{204}Pb$ = 15.5847 ± 0.0005; $^{208}Pb/^{204}Pb$ = 38.0495 ± 0.0013; $^{207}Pb/^{206}Pb$ = 0.86632 ± 0.00004.

The constant $^{238}U/^{235}U$ (137.88), in combination with the Pb isotope ratio results, allows us to calculate $^{206}Pb/^{238}U$.

To achieve this, we must calculate the atomic weight of the Pb and U solution standards:

X = Proportion of isotopes; M = Mass of isotope

- Pb atomic weight = $X^{204} \times M^{204} + X^{206} \times M^{206} + X^{207} \times M^{207} + X^{208} \times M^{208}$
- U atomic weight = $X^{235} \times M^{235} + X^{238} \times M^{238}$

To then calculate the ratio of ^{206}Pb and ^{238}U, the correct amount of Pb and U standard solution to create a concentration compatible with the sample to be analyzed must be weighed.

Con = Concentration of element; W = Weight of solution

$$\frac{Pb_{206}}{U_{238}} = \frac{\frac{Con_{pb} \times W_{Pb-sol}}{Pb_{atomic\ weight}} \times X_{206}}{\frac{Con_{U} \times W_{U}}{U_{atomic\ weight}} \times X_{238}} \quad (1)$$

$$\frac{Pb_{207}}{U_{235}} = \frac{\frac{Con_{pb} \times W_{Pb-sol}}{Pb_{atomic\ weight}} \times X_{207}}{\frac{Con_{U} \times W_{U}}{U_{atomic\ weight}} \times X_{235}} \quad (2)$$

$^{207}Pb/^{206}Pb$ = 0.86632 ± 0.00004 (measured by MC-ICP-MS)

$^{206}Pb/^{238}U$ = 0.286356

The following tables contain the Pb isotope ratios and U-Pb concentrations.

Table S1. Pb isotope ratios of Pb standard solution.

Name	$Pb^{206/204}$	$Pb^{206/204}$ SE (abs)	$Pb^{207/204}$	$Pb^{207/204}$ SE (abs)	$Pb^{208/204}$	$Pb^{208/204}$ SE (abs)
NIST987-01	16.939	0.001	15.488	0.001	36.693	0.002
NIST987-02	16.937	0.001	15.487	0.001	36.690	0.002
Pb-1	17.990	0.001	15.585	0.001	38.049	0.001
Pb-2	17.991	0.001	15.586	0.001	38.052	0.001
Pb-3	17.988	0.000	15.583	0.000	38.047	0.001
NIST987-03	16.938	0.001	15.488	0.001	36.692	0.002
Average of Samples	17.990	0.001	15.585	0.001	38.050	0.001

Table S2. U and Pb concentration of standard solutions. Conc. = Concentration.

Type	Sample Name	^{204}Pb		^{206}Pb		^{207}Pb		^{208}Pb		^{235}U		^{238}U		^{115}In (ISTD)			Average Pb		Average U		Pb/U
		Conc.	Conc. RSD	Conc.	Conc. RSD	Conc.	Conc. RSD	Conc.	Conc. RSD	Conc.	Conc. RSD	Conc.	Conc. RSD	Conc.	Conc. RSD	ISTD Recovery %	Conc.	Conc. RSD	Conc.	Conc. RSD	
CalBlk	Blank	0.00	N/A	0.00	N/A	0.00	N/A	0.00	N/A	0.00	N/A	0.00	N/A	-	-	100	-	-	-	-	-
CalStd	Standard-1 ppb	0.98	8.07	0.95	2.34	0.96	4.70	0.95	2.01	0.98	17.39	1.00	1.95	-	-	99	0.95	0.19	0.99	1.84	0.96
CalStd	Standard-2 ppb	1.97	6.05	1.97	1.74	1.96	3.03	2.00	1.88	2.04	6.45	2.02	0.84	-	-	97	1.98	1.14	2.03	0.40	0.97
CalStd	Standard-5 ppb	5.06	3.76	5.01	1.92	4.98	2.46	5.07	2.24	4.95	5.22	5.11	2.66	-	-	100	5.02	0.86	5.03	2.31	1.00
CalStd	Standard-10 ppb	9.89	4.49	9.91	3.38	9.90	3.82	10.02	3.97	9.85	4.14	9.99	3.18	-	-	103	9.94	0.65	9.92	1.02	1.00
CalStd	Standard-20 ppb	19.42	2.66	19.63	2.47	19.58	2.62	19.98	2.17	19.34	3.52	19.97	1.80	-	-	106	19.73	1.09	19.65	2.29	1.00
CalStd	Standard-50 ppb	50.25	1.82	50.17	2.09	50.19	2.63	51.55	2.91	50.30	2.23	51.82	2.48	-	-	104	50.64	1.56	51.06	2.11	0.99
Sample	Blank	<0.000	N/A	<0.000	N/A	<0.000	N/A	<0.000	N/A	<0.000	N/A	<0.000	N/A	-	-	103	-	-	-	-	-
Sample	1	1.17	12.14	1.04	5.38	1.03	4.95	1.04	5.54	1.01	14.29	0.99	5.38	-	-	105	1.03	0.78	1.00	1.98	1.04
Sample	2	4.50	4.97	4.07	2.91	3.95	2.33	4.11	2.89	3.64	4.42	3.77	1.29	-	-	115	4.04	5.95	3.71	2.50	1.09
Sample	3	11.80	2.90	11.88	2.78	11.79	1.75	12.05	2.11	11.37	4.19	11.76	2.39	-	-	111	11.91	1.09	11.56	2.41	1.03
Sample	4	43.61	1.65	44.42	2.10	44.09	2.21	44.97	2.38	38.70	3.25	40.39	2.95	-	-	108	44.50	1.00	39.54	3.01	1.13

Table S3. Relation coefficient of standards.

Tune Step	Mass	Name	Relation Coefficient	Detection Limit
2	204	Pb	0.99990	0.10246
2	206	Pb	0.99996	0.06304
2	207	Pb	0.99995	0.07154
2	208	Pb	0.99999	0.06215
2	235	U	0.99987	0.09124
2	238	U	0.99998	0.03269