

Table S1. Operating parameters for laser ablation inductively coupled plasma mass spectrometer at University of Tokyo.

Laser ablation	
Model	Light Conversion Carbide
Laser type	Femtosecond laser
Pulse width	290 fs
Wave length	257 nm
Energy density	3.7 J/cm ²
Spot size	10 µm
Sampling mode	Multi-spot (galvano mirror system used)
Repetition rate	100 Hz
Laser ablated area	35 µm x 35 µm
Duration of laser ablation	10 s
Carrier gas (He)	0.60 L/min
ICP-MS	
Model	Thermo Fisher Scientific iCAP TM TQ ICP-MS
ICP-MS type	Quadrupole
Operation mode	Single Quadrupole (SQ) mode
Scanning mode	KED mode (He gas was used, 4 mL/min)
RF power	1550 W
Make-up gas (Ar)	0.90 L/min
ThO ⁺ /Th (oxide ratio)	<1%
Data acquisition protocol	Time-resolved analysis
Data acquisition	25 s (15 s gas blank, 10 s ablation)
Monitor isotopes	²⁹ Si (ZFT&U-Pb), ⁴³ Ca (AFT), ²⁰² Hg, ²⁰⁴ Pb, ²⁰⁶ Pb, ²⁰⁷ Pb, ²⁰⁸ Pb, ²³² Th, ²³⁸ U
Dwell time	0.2 s for ²⁰⁶ , ²⁰⁷ Pb, 0.1 s for others
Standards	
Primary standard (U-Pb)	Nancy 91500 ^{*1}
Secondary standard (U-Pb)	OD-3 ^{*2-4} , Plešovice ^{*5} , GJ-1 ^{*6}
Primary standards (ZFT)	Fish Canyon Tuff ^{*7,8} , Tardree Rhyolite ^{*7,8}
Primary standards (AFT)	Fish Canyon Tuff ^{*7,8} , Durango ^{*7,8}