GSA Data Repository 2017026

Tracing crustal evolution by U-Th-Pb, Sm-Nd, and Lu-Hf isotopes in detrital monazite and zircon from modern rivers

Xiao-Chi Liu et al.

DR1. Analytical methods and tables

1. Monazite and zircon sediment sampling and processing

The two modern river sediment samples that were used in this study were collected from the Yangtze River (sample 11CJ02) and the Hanjiang River (sample 11HJ04). Approximately, 5 kg of sediment was collected from each locality. In order to avoid contamination of sand from potentially locally derived bank materials, the samples were collected from ~20 cm depth. After the samples were collected, they were washed to remove any silt or clay and then after drying were processed using standard heavy liquid and magnetic techniques before final hand picking under a binocular microscope.

2. Monazite and zircon morphology

Grains of monazite and zircon were selected for this study from all recognizable populations (based on size, crystal morphology, and color). In order to characterize internal structures and choose potential target sites for in situ microanalysis analysis, cathodoluminescence (CL) images were obtained for zircon crystals prior to analysis, using a CAMECA SX-50 Electron Microprobe at the Institute of Geology and Geophysics, Chinese Academy of Sciences in Beijing. Back-scattered electron (BSE) images for monazites were obtained on a JEOL JXA-8230 electron probe at Key Laboratory of Metallogeny and Mineral Assessment, Institute of Mineral Resources, Chinese Academy of Geological Sciences, Bejing, China. The working conditions during the CL imaging was 20 kV accelerating potential and a 12 nA beam current and during the BSE imaging was 15 kV accelerating potential and a 10 nA beam current.

3. LA-ICPMS zircon U-Pb dating

U-Pb geochronology analysis of zircon was done by laser ablation-inductively coupled plasma mass spectrometer (LA-ICPMS) at the State Key Laboratory of

Geological Processes and Mineral Resources (GPMR), China University of Geosciences, Wuhan. Detailed operating conditions for the laser ablation system and the ICP-MS instrument and data reduction protocol are the same as described in Liu et al. (2010). Laser sampling was done using a GeoLas 193 nm excimer ArF laser ablation system. An Agilent 7500a ICP-MS instrument was used to acquire ion-signal intensities. Helium was used as a carrier gas. A laser spot size of 32 μm diameter and a 6 Hz repetition rate were used for analysis. The energy density of laser ablation was 5.3 J/cm^2. Zircon reference material 91500 (Wiedenbeck et al., 1995) was used as external standard for U-Pb dating, and was analyzed twice every 6 analyses. Each analysis incorporated a background acquisition of approximately 20 s followed by 50 s data acquisition from the sample. U-Th-Pb isotopic ratios used for 91500 are from Wiedenbeck et al. (1995). Uncertainty of the external standard 91500 was propagated to the ultimate results of unknown analysis. We have calculated the concordance as: (Concordance)=(^{207}Pb/^{206}Pb age)/(^{206}Pb/^{238}U age)×100% when ^{206}Pb/^{238}U age>1000 Ma and Conc.=(^{207}Pb/^{235}U age)/(^{206}Pb/^{238}U age)×100% when ^{206}Pb/^{238}U age<1000 Ma. The data were selected with concordance of 90%~110%. ^{206}Pb/^{238}U ages are used for zircons younger than 1000 Ma, while ^{207}Pb/^{206}Pb ages were used for older grains.

4. In situ Hf isotope analysis of zircon by LA-MC-ICPMS

The zircon Hf isotope analyses were done on the same location, or as close as possible, as the previous U-Pb age analyzed regions in the zircon crystals, except some grains are small and can not be used for Lu-Hf analysis. The Hf analyses were done using a Neptune Plus MC-ICPMS (Thermo Fisher Scientific, Germany) in combination with the Geolas 193 nm excimer ArF laser ablation system at the GPMR, China University of Geosciences, Wuhan. A laser spot size of 44 μm in diameter and a 8 Hz repetition rate were used for analysis. The energy density of laser ablation was 5.3 J/ cm^2. Helium was used as the carrier gas within the ablation cell and was merged with argon after the ablation cell before being introduced into the ICPMS. All data were acquired on zircon in single spot ablation mode with a spot size of 44 μm. Each measurement was consisted of 20 s of acquisition of the background signal followed by 50 s of ablated zircon signal acquisition. External standard calibration of Lu-Hf was done using the zircon 91500 (Wiedenbeck et al., 1995). Zircon GJ-1 was used as the secondary standard (Elhlou et al., 2006). Detailed operating conditions for the laser ablation system and the MC-ICPMS instrument and analytical method were the

same as the description by Hu et al. (2012).

The $^{179}Hf/^{177}Hf$ and $^{173}Yb/^{171}Yb$ ratios were used to calculate the mass bias of Hf (β_{Hf}) and Yb (β_{Yb}), which were normalized to $^{179}Hf/^{177}Hf$=0.7325 and $^{173}Yb/^{171}Yb$=1.1248 (Blichert-Toft and Albarède, 1997) using an exponential correction for mass bias. Interference of ^{176}Yb on ^{176}Hf was corrected by measuring the interference-free ^{173}Yb isotope and using $^{176}Yb/^{173}Yb$=0.7876 (McCulloch et al., 1977) to calculate $^{176}Yb/^{177}Hf$. Similarly, the relatively minor interference of ^{176}Lu on ^{176}Hf was corrected by measuring the intensity of the interference-free ^{175}Lu isotope and using the recommended $^{176}Lu/^{175}Lu$=0.02656 (Blichert-Toft and Albarède, 1997) to calculate $^{176}Lu/^{177}Hf$. We used the mass bias of Yb (β_{Yb}) to calculate the mass fractionation of Lu because of their similar physicochemical properties.

The calculation of the $^{176}Hf/^{177}Hf$ at a given time used the ^{176}Lu decay constant of 1.867×10^{-11} yr^{-1} (Söderlund et al., 2004). The present-day chondritic parameters are $^{176}Lu/^{177}Hf$=0.0336, and $^{176}Hf/^{177}Hf$=0.282785 (Bouvier et al., 2008). To estimate the mean mantle-extraction age of the source materials of the zircon samples analyzed, we calculate two-stage model ages (T_{DM2}) relative to the depleted mantle with present-day $^{176}Lu/^{177}Hf$ and $^{176}Hf/^{177}Hf$ ratios of 0.03933 and 0.283294 (Blichert-Toft and Puchtel, 2010) assuming a mean $^{176}Lu/^{177}Hf$ value of 0.015 for the average continental crust (Griffin et al., 2002).

5. Simultaneous determination of U-Th-Pb ages and Sm-Nd isotope compositions of monazite by LA-MC-ICPMS

U-Th-Pb dating and Sm-Nd isotope analyses of monazite were done simultaneously using the "laser ablatation split stream" (LASS) method at Memorial University of Newfoundland in the MicroAnalysis Facility of the Bruneau Centre for Research and Innovation discussed Goudie et al. (2014). The method used a ThermoFinnigan NEPTUNE MC-ICPMS and a ThermoFinnigan ELEMENT XR high-resolution magnetic-sector inductively coupled plasma mass spectrometer (HR-ICPMS) coupled to a Geolas 193 nm excimer ArF laser ablation system. Ablated material was transported to both ICPMS instruments using He as a carrier gas, with Ar added to the Tygon transport tubing just prior to introduction into the ICPMS instruments. The gas background was measured for 30 s prior to ablation, and the mean background intensity of each mass was subtracted from the intensity of the same mass measured for each measurement cycle. The beam was held stationary on the

sample surface and ablation was conducted at a frequency of 4–6 Hz with an energy density of ~5 J/cm^2. Samples and reference materials were ablated for 60 s. All unknowns and the U-Th-Pb and Nd isotope reference material Trebilcock monazite (Tomascak et al., 1998) were ablated using a laser-spot size of 20 μm, which allows for a relatively high degree of spatial resolution to target specific growth domains in BSE greatly minimizes the chance of mixing isotope signatures while at the same time maintaining sufficient signal intensity for precise isotopic measurements, which are only slightly degraded in comparison to separate U-Th-Pb or Sm-Nd analyses of the same material (Goudie et al., 2014). The Trebilcock monazite was used as an external standard for both U-Th-Pb dating as well as for calibration of $^{143}Nd/^{144}Nd$. Trebilcock monazite was taken from a large single crystal (~7 mm diameter) from the ca. 272 Ma Trebilcock pegmatite originally described by Tomascak et al. (1998). Calibration of Sm-Nd was done using a synthetic LREE glass as described by Fisher et al. (2011). The LREE glass required using a 90 μm spot due to lower concentrations of target elements relative to natural monazite. Both the mass bias and mass interference corrections were calculated for each measurement cycle to account for potential time-dependent mass bias and mass interference changes. The uncertainty was calculated based on the interference and mass bias corrected ratios. Off-line data reduction, including the corrections of baseline, instrumental drift, mass bias and down-hole fractionation (in the case of U-Th-Pb) was done using the Iolite software (Paton et al., 2011). In this study we present $^{208}Pb/^{232}Th$ ages, as these ages are less likely to be affected by the presence of common Pb, which is observed in many of the monazite grains analyzed. In addition, we have calculated ^{207}Pb corrected- $^{206}Pb/^{238}U$ ages for each grain using a common Pb $^{207}Pb/^{206}Pb$ composition of 0.83. The concordance of these two age systems is excellent (figure 1 below), and thus any discrepancy in age will have a negligible effect on the calculated $\varepsilon_{Nd(t)}$. Further details of the operating conditions for the laser ablation system and the MC-ICPMS instrument, along with data reduction protocols are described in detail by Goudie et al. (2014). We have chosen parameters similar to the model of Goldstein et al. (1984) for the T_{DM} and ε_{Nd} values reported here ($\varepsilon_{DM}(0)$=+10, ε_{DM}(4.5 Ga)=0, $^{143}Nd/^{144}Nd_{DM}(0)$=0.51315, $^{147}Sm/^{144}Nd_{DM}(0)$=0.2137). The present-day chondritic parameters are $^{143}Nd/^{144}Nd$=0.512630, and $^{147}Sm/^{144}Nd$=0.1960 (Bouvier et al., 2008). We assumed $^{147}Sm/^{144}Nd$=0.118 for evolution in an assumed crustal reservoir prior to monazite crystallization (Jahn and Condie, 2005).

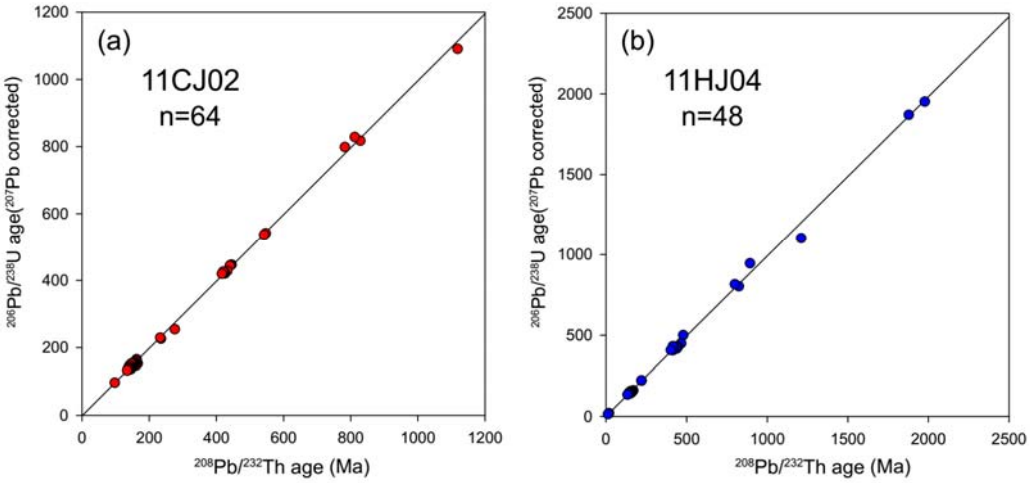


Figure 1. Comparison of ^{208}Pb/^{232}Th ages and ^{207}Pb corrected- ^{206}Pb/^{238}U ages for monazite samples presented in this study.

References:

Blichert-Toft, J., and Albarède, F., 1997, The Lu-Hf isotope geochemistry of chondrites and the evolution of the mantle-crust system: Earth and Planetary Science Letters, v. 148, p. 243-258.

Blichert-Toft, J., and Puchtel, I. S., 2010, Depleted mantle sources through time: Evidence from Lu–Hf and Sm–Nd isotope systematics of Archean komatiites: Earth and Planetary Science Letters, v. 297, p. 598-606.

Bouvier, A., Vervoort, J.D., and Patchett, P.J., 2008, The Lu-Hf and Sm-Nd isotopic composition of CHUR: Constraints from unequilibrated chondrites and implications for the bulk composition of terrestrial planets: Earth and Planetary Science Letters, v. 273, p. 48-57.

Elhlou, S., Belousova, E., Griffin, W., Pearson, N., and O'Reilly, S.Y., 2006, Trace element and isotopic composition of GJ-red zircon standard by laser ablation: Geochimica et Cosmochimica Acta, v. 70, p. A158.

Fisher, C.M., McFarlane, C.R. M., Hanchar, J.M., Schmitz, M.D., Sylvester, P.J., Lam, R., and Longerich, H.P., 2011, Sm–Nd isotope systematics by laser ablation-multicollector-inductively coupled plasma mass spectrometry: Methods

and potential natural and synthetic reference materials: Chemical Geology, v. 284, p. 1-20.

Griffin, W.L., Wang, X., Jackson, S.E., Pearson, N.J., O'Reilly, S.Y., Xu, X.S., and Zhou, X.M., 2002, Zircon chemistry and magma mixing, SE China: In-situ analysis of Hf isotopes, Tonglu and Pingtan igneous complexes: Lithos, v. 61, p. 237-269.

Goldstein, S.L., O'Nions, R.K., and Hamilton, P.J., 1984, A Sm-Nd isotopic study of atmospheric dusts and particulates from major river systems: Earth and Planetary Science Letters, v. 70, p. 221-236.

Goudie, D.J., Fisher, C.M., Hanchar, J.M., Crowley, J.L., and Ayers, J.C., 2014, Simultaneous in situ determination of U-Pb and Sm-Nd isotopes in monazite by laser ablation ICP-MS: Geochemistry Geophysics Geosystems, v. 15, p. 2575-2600.

Hu, Z.C., Liu, Y.S., Gao, S., Liu, W.G., Zhang, W., Tong, X.R., Lin, L., Zong, K.Q., Li, M., Chen, H.H., Zhou, L., and Yang, L., 2012, Improved in situ Hf isotope ratio analysis of zircon using newly designed X skimmer cone and jet sample cone in combination with the addition of nitrogen by laser ablation multiple collector ICP-MS: Journal of Analytical Atomic Spectrometry, v. 27, p. 1391-1399.

Jahn, B.-M., and Condie, K. C., 1995, Evolution of the Kaapvaal Craton as viewed from geochemical and Sm-Nd isotopic analyses of intracratonic pelites: Geochimica et Cosmochimica Acta, v. 59, p. 2239-2258.

Liu, Y.S., Hu, Z.C., Zong, K.Q., Gao, C.G., Gao, S., Xu, J.A., and Chen, H.H., 2010, Reappraisement and refinement of zircon U-Pb isotope and trace element analyses by LA-ICP-MS: Chinese Science Bulletin, v. 55, p. 1535-1546.

McCulloch, M.T., Rosman, K.J.R., and De Laeter, J.R., 1977, The isotopic and elemental abundance of ytterbium in meteorites and terrestrial samples: Geochimica et Cosmochimica Acta, v. 41, p. 1703-1707.

Tomascak, P.B., Krogstad, E.J., and Walker, R.J., 1998, Sm-Nd isotope systematics and the derivation of granitic pegmatites in southwestern Maine: The Canadian Mineralogist, v. 36, p. 327-337.

Paton, C., Hellstrom, J., Paul, B., Woodhead, J., and Hergt, J., 2011, Iolite: Freeware for the visualisation and processing of mass spectrometric data: Journal of Analytical Atomic Spectrometry, v. 26, p. 2508-2518.

Söderlund, U., Patchett, P.J., Vervoort, J.D., and Isachsen, C.E., 2004, The ^{176}Lu decay

188 constant determined by Lu–Hf and U–Pb isotope systematics of Precambrian
189 mafic intrusions: Earth and Planetary Science Letters, v. 219, p. 311-324.
190 Wiedenbeck, M., Allé, P., Corfu, F., Griffin, W.L., Meier, M., Oberli, F., Von Quadt,
191 A., Roddick, J.C., and Spiegel, W., 1995, Three natural zircon standards for
192 U-Th-Pb, Lu-Hf, trace element and REE analyses: Geostandards Newsletter, v. 19,
193 p. 1-23.

Table DR1 LA-ICPMS zircon U-Pb ages of the sand samples from Yangtze and Hanjiang rivers

Spot	Th	U	Th/U	Isotopic ratios							Isotopic ages (Ma)						Conc.*	Preferred
	ppm	ppm		$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	rho	$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ		age (Ma)
Sample 11CJ02																		
47	127	485	0.26	0.2858	0.0056	27.6310	0.6209	0.6943	0.0085	0.5431	3395	30	3406	22	3399	32	100%	3395
2	184	432	0.42	0.2739	0.0054	23.4714	0.4653	0.6171	0.0057	0.4621	3329	31	3247	19	3098	23	107%	3329
25	220	352	0.63	0.1710	0.0032	11.5713	0.2464	0.4856	0.0063	0.6085	2569	32	2570	20	2552	27	101%	2569
48	278	399	0.70	0.1630	0.0041	11.1379	0.3030	0.4917	0.0063	0.4746	2487	43	2535	25	2578	27	96%	2487
33	754	543	1.39	0.1553	0.0033	9.3406	0.2330	0.4319	0.0064	0.5960	2405	36	2372	23	2314	29	104%	2405
40	753	642	1.17	0.1526	0.0033	8.6327	0.2245	0.4086	0.0073	0.6825	2376	37	2300	24	2208	33	108%	2376
17	136.2	472	0.29	0.1489	0.0031	8.9210	0.1826	0.4300	0.0041	0.4633	2344	35	2330	19	2306	18	102%	2344
52	85.4	203	0.42	0.1318	0.0031	6.8968	0.1576	0.3803	0.0053	0.6109	2122	41	2098	20	2078	25	102%	2122
15	51.9	94	0.56	0.1239	0.0038	5.8644	0.1755	0.3417	0.0058	0.5642	2013	60	1956	26	1895	28	106%	2013
32	197	401	0.49	0.1216	0.0033	5.9978	0.1669	0.3602	0.0070	0.6937	1980	48	1976	24	1983	33	100%	1980
6	154	328	0.47	0.1179	0.0028	5.3403	0.1594	0.3236	0.0064	0.6624	1926	43	1875	26	1807	31	107%	1926
54	63.6	159	0.40	0.1168	0.0031	5.7636	0.1506	0.3552	0.0047	0.5037	1909	46	1941	23	1959	22	97%	1909
23	409	412	0.99	0.1133	0.0033	4.7870	0.1417	0.3074	0.0048	0.5321	1854	52	1783	25	1728	24	107%	1854
39	53.5	164	0.33	0.1133	0.0028	5.2675	0.1325	0.3350	0.0045	0.5395	1854	44	1864	21	1862	22	100%	1854
28	2380	2033	1.17	0.1085	0.0022	4.2834	0.0894	0.2841	0.0024	0.4077	1776	37	1690	17	1612	12	110%	1776
24	34.9	66.8	0.52	0.1066	0.0038	4.3218	0.1696	0.2895	0.0051	0.4526	1743	65	1698	32	1639	26	106%	1743
67	464	701	0.66	0.1001	0.0025	3.9928	0.1079	0.2864	0.0044	0.5737	1626	42	1633	22	1623	22	100%	1626
66	224	383	0.58	0.0958	0.0026	3.5024	0.1006	0.2657	0.0047	0.6096	1543	52	1528	23	1519	24	102%	1543
20	198	334	0.59	0.0805	0.0022	2.1923	0.0593	0.1961	0.0024	0.4505	1209	54	1179	19	1155	13	105%	1209
64	408	2214	0.18	0.0753	0.0017	1.8527	0.0425	0.1763	0.0019	0.4633	1077	45	1064	15	1047	10	103%	1077
56	165	296	0.56	0.0742	0.0022	1.7989	0.0533	0.1727	0.0021	0.4026	1056	59	1045	19	1027	11	103%	1056
11	267	286	0.93	0.0725	0.0025	1.6355	0.0516	0.1661	0.0029	0.5561	998	69	984	20	990	16	101%	990
34	106	1540	0.07	0.0720	0.0014	1.7074	0.0338	0.1696	0.0016	0.4893	987	41	1011	13	1010	9	98%	987
57	785	604	1.30	0.0720	0.0026	1.6284	0.0567	0.1639	0.0024	0.4236	987	68	981	22	979	13	101%	987
19	27.1	184	0.15	0.0709	0.0022	1.5898	0.0478	0.1631	0.0026	0.5265	954	64	966	19	974	14	98%	974
10	117	785	0.15	0.0710	0.0017	1.5848	0.0389	0.1602	0.0016	0.4165	959	49	964	15	958	9	100%	958
59	689	1789	0.39	0.0708	0.0015	1.6843	0.0393	0.1705	0.0019	0.4674	950	44	1003	15	1015	10	94%	950
13	155	271	0.57	0.0701	0.0030	1.5079	0.0633	0.1567	0.0025	0.3829	931	87	934	26	939	14	99%	939
35	76.1	121	0.63	0.0704	0.0023	1.7676	0.0567	0.1818	0.0023	0.3953	939	67	1034	21	1077	13	87%	939
68	261	312	0.84	0.0681	0.0028	1.3342	0.0552	0.1432	0.0022	0.3662	872	86	861	24	863	12	101%	863
3	190	239	0.80	0.0707	0.0023	1.3617	0.0427	0.1396	0.0016	0.3584	950	65	873	18	843	9	113%	843

37	544	960	0.57	0.0674	0.0020	1.2501	0.0361	0.1348	0.0019	0.4790	850	62	823	16	815	11	104%	815
18	247	160	1.54	0.0663	0.0028	0.9142	0.0385	0.0991	0.0015	0.3612	817	87	659	20	609	9	134%	609
16	100	332	0.30	0.0614	0.0022	0.7622	0.0271	0.0909	0.0018	0.5566	654	78	575	16	561	11	117%	561
63	186	184	1.01	0.0681	0.0044	0.7716	0.0520	0.0853	0.0029	0.5080	872	133	581	30	528	17	165%	528
62	405	2583	0.16	0.0578	0.0016	0.6733	0.0177	0.0846	0.0011	0.5018	524	61	523	11	523	7	100%	523
51	120	1864	0.06	0.0589	0.0014	0.6898	0.0240	0.0836	0.0016	0.5439	561	54	533	14	518	9	108%	518
49	191	2651	0.07	0.0574	0.0015	0.6430	0.0170	0.0810	0.0011	0.5205	509	57	504	11	502	7	101%	502
44	202	336	0.60	0.0600	0.0026	0.6355	0.0260	0.0803	0.0050	0.6000	606	96	500	16	498	30	122%	498
8	2044	2466	0.83	0.0638	0.0020	0.7004	0.0218	0.0795	0.0010	0.4080	744	233	539	13	493	6	151%	493
26	101	210	0.48	0.0617	0.0035	0.6676	0.0355	0.0794	0.0014	0.3336	665	94	519	22	492	8	135%	492
36	694	998	0.70	0.0575	0.0023	0.6220	0.0234	0.0792	0.0014	0.4660	509	89	491	15	491	8	104%	491
30	254	727	0.35	0.0635	0.0029	0.6888	0.0306	0.0787	0.0010	0.2817	726	94	532	18	489	6	148%	489
38	57	351	0.16	0.0553	0.0020	0.5906	0.0212	0.0774	0.0009	0.3170	433	80	471	14	481	5	90%	481
50	428	1346	0.32	0.0569	0.0017	0.6105	0.0178	0.0774	0.0008	0.3497	500	60	484	11	481	5	104%	481
9	261	531	0.49	0.0623	0.0021	0.6621	0.0221	0.0768	0.0009	0.3333	683	79	516	13	477	5	143%	477
12	106	220	0.48	0.0577	0.0027	0.6096	0.0278	0.0768	0.0011	0.3008	520	102	483	18	477	6	109%	477
7	156	301	0.52	0.0616	0.0024	0.6415	0.0291	0.0741	0.0014	0.4188	661	85	503	18	461	8	143%	461
55	216	446	0.48	0.0599	0.0028	0.6161	0.0280	0.0742	0.0012	0.3536	611	100	487	18	461	7	133%	461
53	784	3369	0.23	0.0575	0.0014	0.5928	0.0151	0.0740	0.0006	0.3378	509	56	473	10	460	4	111%	460
61	321	805	0.40	0.0543	0.0015	0.5526	0.0157	0.0739	0.0009	0.4082	383	63	447	10	460	5	83%	460
14	192	373	0.52	0.0564	0.0020	0.5729	0.0205	0.0737	0.0009	0.3391	478	78	460	13	459	5	104%	459
69	866	3212	0.27	0.0553	0.0013	0.5662	0.0133	0.0738	0.0009	0.4919	433	54	456	9	459	5	94%	459
58	208	743	0.28	0.0546	0.0017	0.5494	0.0164	0.0721	0.0008	0.3878	394	70	445	11	449	5	88%	449
5	168	504	0.33	0.0542	0.0017	0.5332	0.0170	0.0710	0.0010	0.4581	389	75	434	11	442	6	88%	442
31	217	641	0.34	0.0570	0.0025	0.5432	0.0241	0.0690	0.0009	0.3023	500	96	441	16	430	6	116%	430
41	370	894	0.41	0.0624	0.0023	0.5932	0.0216	0.0688	0.0009	0.3505	689	78	473	14	429	5	161%	429
1	512	1969	0.26	0.0566	0.0018	0.5347	0.0165	0.0680	0.0007	0.3280	476	38	435	11	424	4	112%	424
22	868	1462	0.59	0.0583	0.0014	0.5488	0.0148	0.0678	0.0008	0.4398	539	54	444	10	423	5	127%	423
42	947	1696	0.56	0.0556	0.0017	0.5197	0.0149	0.0678	0.0008	0.4156	439	67	425	10	423	5	104%	423
46	173	251	0.69	0.0564	0.0025	0.5273	0.0219	0.0678	0.0009	0.3187	478	98	430	15	423	5	113%	423
27	634	712	0.89	0.0546	0.0023	0.5002	0.0205	0.0663	0.0008	0.2989	398	101	412	14	414	5	96%	414
4	480	823	0.58	0.0553	0.0015	0.4993	0.0132	0.0648	0.0006	0.3360	433	59	411	9	405	3	107%	405
43	856	1829	0.47	0.0527	0.0021	0.2761	0.0106	0.0382	0.0012	0.8057	317	117	248	8	242	7	131%	242
60	735	2282	0.32	0.0506	0.0017	0.2706	0.0102	0.0383	0.0007	0.4765	220	76	243	8	242	4	91%	242
21	474	1560	0.30	0.0524	0.0017	0.2597	0.0079	0.0359	0.0004	0.4034	306	74	234	6	227	3	135%	227
45	680	2117	0.32	0.0529	0.0015	0.2640	0.0073	0.0358	0.0004	0.3775	324	63	238	6	227	2	143%	227

70	930	1720	0.54	0.0540	0.0021	0.2110	0.0079	0.0284	0.0004	0.3754	369	91	194	7	181	3	204%	181
29	517	996	0.52	0.0519	0.0030	0.1874	0.0105	0.0260	0.0004	0.3028	280	133	174	9	166	3	169%	166
65	595	1449	0.41	0.0520	0.0026	0.1824	0.0089	0.0256	0.0003	0.2714	287	111	170	8	163	2	176%	163
The grains below were not included in Lu-Hf analysis																		
94	279	563	0.50	0.1783	0.0035	11.6076	0.2335	0.4682	0.0047	0.5001	2639	32	2573	19	2476	21	107%	2639
93	321	630	0.51	0.1776	0.0033	11.3883	0.2229	0.4594	0.0048	0.5356	2631	31	2555	18	2437	21	108%	2631
90	243	573	0.42	0.1628	0.0035	10.1304	0.2257	0.4485	0.0046	0.4603	2485	36	2447	21	2389	20	104%	2485
86	199	1266	0.16	0.1586	0.0040	9.7642	0.2432	0.4435	0.0043	0.3875	2443	42	2413	23	2366	19	103%	2443
95	180	190	0.95	0.1552	0.0033	9.0302	0.1970	0.4193	0.0040	0.4339	2406	36	2341	20	2257	18	107%	2406
83	250	427	0.59	0.1528	0.0032	9.5026	0.2484	0.4451	0.0079	0.6770	2389	36	2388	24	2373	35	101%	2389
76	36	54.4	0.66	0.1450	0.0060	8.0576	0.3258	0.4124	0.0089	0.5357	2288	71	2238	37	2226	41	103%	2288
75	115	130	0.88	0.1277	0.0052	6.5890	0.2827	0.3757	0.0079	0.4931	2066	73	2058	38	2056	37	100%	2066
74	315	1978	0.16	0.1129	0.0022	5.3685	0.1201	0.3416	0.0046	0.6011	1847	35	1880	19	1894	22	98%	1847
73	349	728	0.48	0.1100	0.0028	4.9001	0.1283	0.3213	0.0052	0.6170	1798	45	1802	22	1796	25	100%	1798
81	669	623	1.07	0.0962	0.0023	3.7188	0.0898	0.2770	0.0032	0.4726	1554	46	1575	19	1576	16	99%	1554
97	314	382	0.82	0.0850	0.0024	2.5852	0.0708	0.2186	0.0023	0.3884	1317	54	1296	20	1274	12	103%	1317
72	747	2149	0.35	0.0664	0.0020	1.6308	0.0480	0.1785	0.0033	0.6262	820	64	982	19	1059	18	77%	1059
98	353	939	0.38	0.0719	0.0015	1.5901	0.0328	0.1587	0.0015	0.4555	983	47	966	13	949	8	104%	949
82	70.5	484	0.15	0.0686	0.0017	1.4966	0.0393	0.1564	0.0019	0.4565	887	52	929	16	937	10	95%	937
78	792	1095	0.72	0.0673	0.0017	1.5983	0.0394	0.1710	0.0017	0.4043	848	52	970	15	1017	9	83%	848
79	248	2482	0.10	0.0646	0.0015	1.2555	0.0275	0.1395	0.0012	0.4074	761	44	826	12	842	7	90%	842
89	445	739	0.60	0.0651	0.0021	1.2241	0.0416	0.1354	0.0019	0.4030	789	73	812	19	819	11	96%	819
80	2326	3516	0.66	0.0750	0.0018	1.3792	0.0326	0.1316	0.0015	0.4766	1133	48	880	14	797	8	142%	797
71	111	1340	0.08	0.0593	0.0014	0.9675	0.0227	0.1175	0.0013	0.4677	576	54	687	12	716	7	80%	716
88	71.1	150	0.48	0.0602	0.0031	0.8059	0.0476	0.0955	0.0020	0.3546	613	113	600	27	588	12	104%	588
87	252	734	0.34	0.0584	0.0015	0.7252	0.0190	0.0898	0.0013	0.5518	546	62	554	11	554	8	99%	554
91	2802	7981	0.35	0.0633	0.0013	0.7299	0.0153	0.0826	0.0008	0.4624	720	45	556	9	512	5	141%	512
77	447	1011	0.44	0.0559	0.0023	0.5924	0.0244	0.0767	0.0012	0.3683	450	86	472	16	476	7	95%	476
84	377	625	0.60	0.0550	0.0017	0.5337	0.0163	0.0700	0.0009	0.3981	409	70	434	11	436	5	94%	436
85	207	692	0.30	0.0541	0.0016	0.5164	0.0153	0.0697	0.0010	0.4752	376	69	423	10	434	6	87%	434
92	185	443	0.42	0.0601	0.0019	0.5597	0.0168	0.0675	0.0008	0.3825	609	67	451	11	421	5	145%	421
96	172	2232	0.08	0.0594	0.0016	0.5525	0.0149	0.0666	0.0006	0.3439	589	59	447	10	415	4	142%	415
Analyses with greater than ±10% discordance; not considered																		
~~99~~	~~81.5~~	~~425~~	~~0.19~~	~~0.1191~~	~~0.0028~~	~~4.7940~~	~~0.1181~~	~~0.2887~~	~~0.0039~~	~~0.5428~~	~~1944~~	~~42~~	~~1784~~	~~21~~	~~1635~~	~~19~~	~~119%~~	
~~100~~	~~138~~	~~179~~	~~0.77~~	~~0.1565~~	~~0.0046~~	~~8.4811~~	~~0.2623~~	~~0.3935~~	~~0.0065~~	~~0.5307~~	~~2418~~	~~49~~	~~2284~~	~~28~~	~~2139~~	~~30~~	~~113%~~	

101	1047	930	1.13	0.1560	0.0035	8.4505	0.2507	0.3870	0.0078	0.6791	2413	37	2281	27	2109	36	114%
102	566	798	0.71	0.1340	0.0026	6.0024	0.1165	0.3214	0.0027	0.4307	2152	34	1976	17	1797	13	120%
103	3322	3043	1.09	0.0900	0.0056	0.4677	0.0245	0.0378	0.0004	0.2028	1426	120	390	17	239	2	163%
104	179	547	0.33	0.2125	0.0057	9.6790	0.4411	0.3189	0.0108	0.7418	2925	43	2405	42	1784	53	164%
105	318	673	0.47	0.0700	0.0047	0.2723	0.0181	0.0283	0.0006	0.3181	928	139	245	14	180	4	136%
106	130	472	0.27	0.0682	0.0020	0.7590	0.0233	0.0801	0.0012	0.4986	874	60	573	13	497	7	115%
107	338	128	2.63	0.1104	0.0077	0.6805	0.0608	0.0433	0.0011	0.2804	1806	126	527	37	273	7	193%
108	127	278	0.46	0.0704	0.0023	0.9944	0.0386	0.1015	0.0026	0.6476	939	66	701	20	623	15	112%
109	101	129	0.78	0.1145	0.0072	0.4016	0.0235	0.0268	0.0008	0.4818	1872	113	343	17	171	5	201%
110	378	1124	0.34	0.0703	0.0020	0.7284	0.0243	0.0736	0.0011	0.4306	939	60	556	14	458	6	121%
111	125	114	1.10	0.0860	0.0030	1.6842	0.0571	0.1437	0.0027	0.5484	1339	64	1003	22	866	15	116%
112	152	262	0.58	0.0764	0.0046	0.2971	0.0175	0.0290	0.0006	0.3513	1106	116	264	14	185	4	143%
113	202	402	0.50	0.1416	0.0144	1.1351	0.1423	0.0455	0.0014	0.2482	2247	177	770	68	287	9	268%
114	4655	4304	1.08	0.1134	0.0040	0.3590	0.0127	0.0228	0.0002	0.2895	1854	64	311	9	146	1	214%
115	282	357	0.79	0.0716	0.0024	0.8802	0.0291	0.0898	0.0015	0.5101	976	70	641	16	554	9	116%
116	3390	23796	0.14	0.0743	0.0019	0.3107	0.0079	0.0301	0.0003	0.4051	1050	50	275	6	191	2	144%
117	1709	2429	0.70	0.1018	0.0044	0.5037	0.0226	0.0358	0.0004	0.2795	1657	81	414	15	227	3	183%
118	880	1904	0.46	0.1530	0.0035	4.7305	0.1377	0.2230	0.0045	0.6870	2380	38	1773	24	1297	23	183%
119	1701	4054	0.42	0.0958	0.0027	0.5024	0.0146	0.0376	0.0004	0.3414	1544	49	413	10	238	2	174%
120	170	221	0.77	0.2626	0.0132	1.8722	0.1149	0.0517	0.0019	0.5843	3263	79	1071	41	325	11	330%
121	786	1621	0.48	0.0615	0.0030	0.2034	0.0096	0.0242	0.0003	0.2758	657	110	188	8	154	2	122%
122	417	679	0.61	0.1409	0.0079	1.7165	0.1083	0.0850	0.0013	0.2459	2239	97	1015	41	526	8	193%
123	445	831	0.54	0.0653	0.0044	0.2728	0.0206	0.0298	0.0008	0.3457	787	143	245	16	189	5	129%
124	640	2757	0.23	0.1127	0.0046	1.0791	0.0380	0.0698	0.0009	0.3803	1844	74	743	19	435	6	171%
125	322	432	0.75	0.1877	0.0249	1.7924	0.3796	0.0384	0.0027	0.3370	2722	220	1043	139	243	17	430%
126	1921	3438	0.56	0.0630	0.0018	0.3376	0.0096	0.0386	0.0004	0.3623	709	56	295	7	244	2	121%
127	1379	3593	0.38	0.0688	0.0022	0.3346	0.0108	0.0350	0.0004	0.3308	894	68	293	8	222	2	132%
128	131	582	0.22	0.0670	0.0021	0.6862	0.0206	0.0740	0.0008	0.3602	839	65	531	12	460	5	115%
129	142	128	1.11	0.1696	0.0047	9.0663	0.2618	0.3858	0.0047	0.4223	2553	46	2345	26	2103	22	121%
130	79.4	128	0.62	0.0848	0.0034	1.6308	0.0624	0.1412	0.0027	0.5015	1322	77	982	24	851	15	115%
131	143	1379	0.10	0.0643	0.0019	0.5829	0.0170	0.0655	0.0007	0.3649	752	63	466	11	409	4	114%
132	126	475	0.27	0.0940	0.0051	0.3182	0.0182	0.0243	0.0004	0.3096	1509	98	281	14	155	3	181%
133	342	1472	0.23	0.0688	0.0018	0.6582	0.0186	0.0686	0.0009	0.4549	892	54	514	11	428	5	120%
134	59.1	114	0.52	0.1158	0.0079	0.5819	0.0362	0.0376	0.0010	0.4172	1892	123	466	23	238	6	196%
135	520	1649	0.32	0.0939	0.0027	0.8638	0.0273	0.0655	0.0007	0.3298	1506	56	632	15	409	4	155%

Sample 11HJ04

2	50.1	1603	0.03	0.2860	0.0067	26.8424	0.6452	0.6743	0.0067	0.4129	3396	37	3378	24	3322	26	102%	3396
18	193	709	0.27	0.2090	0.0064	16.3515	0.6628	0.5453	0.0100	0.4507	2898	50	2898	39	2806	42	103%	2898
14	72.8	423	0.17	0.2061	0.0046	17.0093	0.4082	0.5905	0.0094	0.6627	2875	36	2935	23	2991	38	96%	2875
53	127	352	0.36	0.1884	0.0039	13.6246	0.2706	0.5165	0.0051	0.4971	2729	34	2724	19	2684	22	102%	2729
75	116	237	0.49	0.1811	0.0046	14.8143	0.3687	0.5864	0.0059	0.4017	2665	42	2803	24	2975	24	90%	2665
43	230	291	0.79	0.1664	0.0040	11.2339	0.2768	0.4824	0.0048	0.4057	2522	40	2543	23	2538	21	99%	2522
24	221	159	1.39	0.1647	0.0039	11.1370	0.2794	0.4873	0.0063	0.5146	2506	39	2535	23	2559	27	102%	2506
37	144	472	0.31	0.1647	0.0041	10.6753	0.2665	0.4655	0.0045	0.3867	2506	42	2495	23	2464	20	98%	2506
15	371	456	0.81	0.1550	0.0037	9.9084	0.2303	0.4544	0.0055	0.5212	2402	41	2426	21	2415	24	99%	2402
26	113	172	0.66	0.1437	0.0044	8.4327	0.2680	0.4200	0.0049	0.3638	2273	53	2279	29	2260	22	101%	2273
23	159	148	1.07	0.1294	0.0036	6.4045	0.1871	0.3559	0.0057	0.5499	2100	48	2033	26	1962	27	107%	2100
41	83	69.1	1.20	0.1301	0.0049	6.7474	0.2498	0.3772	0.0064	0.4575	2100	66	2079	33	2063	30	102%	2100
29	96.2	377	0.25	0.1200	0.0032	5.3200	0.1350	0.3185	0.0042	0.5205	1967	48	1872	22	1782	21	110%	1967
73	41.5	315	0.13	0.1200	0.0029	6.0538	0.1664	0.3626	0.0066	0.6588	1967	38	1984	24	1995	31	99%	1967
7	151	344	0.44	0.1177	0.0030	5.5716	0.1322	0.3432	0.0039	0.4833	1922	46	1912	20	1902	19	101%	1922
17	136	315	0.43	0.1103	0.0028	5.5023	0.1382	0.3594	0.0039	0.4284	1803	42	1901	22	1979	18	91%	1803
54	39.1	484	0.08	0.1065	0.0023	4.8715	0.1200	0.3258	0.0047	0.5877	1740	44	1797	21	1818	23	96%	1740
42	71.1	121	0.59	0.1025	0.0030	3.8133	0.1081	0.2690	0.0040	0.5275	1672	54	1596	23	1536	20	109%	1672
20	218	424	0.51	0.0981	0.0027	3.8821	0.1076	0.2865	0.0035	0.4389	1591	52	1610	22	1624	17	98%	1591
36	40.6	75.9	0.53	0.0850	0.0036	2.5736	0.1016	0.2231	0.0037	0.4169	1317	81	1293	29	1298	19	101%	1317
3	390	420	0.93	0.0776	0.0024	2.1272	0.0684	0.1968	0.0027	0.4310	1139	62	1158	22	1158	15	127%	1139
52	163	140	1.16	0.0757	0.0033	1.6928	0.0777	0.1699	0.0093	0.6000	1087	87	1006	29	1012	51	127%	1087
9	163	182	0.89	0.0744	0.0026	1.8422	0.0604	0.1787	0.0024	0.4136	1054	70	1061	22	1060	13	98%	1054
46	237	641	0.37	0.0733	0.0019	1.7514	0.0463	0.1710	0.0022	0.4905	1022	52	1028	17	1018	12	132%	1022
4	89.9	223	0.40	0.0724	0.0026	1.6711	0.0576	0.1678	0.0027	0.4614	998	106	998	22	1000	15	107%	998
6	160	228	0.70	0.0724	0.0024	1.7011	0.0540	0.1703	0.0027	0.5027	998	67	1009	20	1014	15	111%	998
45	83.1	204	0.41	0.0710	0.0027	1.6383	0.0588	0.1668	0.0021	0.3470	967	77	985	23	995	11	133%	995
71	160	227	0.70	0.0828	0.0025	1.9154	0.0592	0.1670	0.0024	0.4672	1265	61	1086	21	995	13	99%	995
33	272	424	0.64	0.0718	0.0020	1.6158	0.0465	0.1626	0.0023	0.4952	989	57	976	18	971	13	108%	971
58	82.7	110	0.75	0.0754	0.0033	1.6758	0.0708	0.1626	0.0024	0.3508	1080	89	999	27	971	13	100%	971
59	63.3	165	0.38	0.0738	0.0027	1.5940	0.0529	0.1602	0.0029	0.5399	1037	74	968	21	958	16	113%	958
10	206	540	0.38	0.0671	0.0019	1.4970	0.0416	0.1598	0.0017	0.3929	843	60	929	17	956	10	107%	956
44	529	783	0.68	0.0726	0.0018	1.5863	0.0410	0.1566	0.0020	0.4911	1006	50	965	16	938	11	100%	938
28	92.1	210	0.44	0.0706	0.0026	1.5389	0.0565	0.1564	0.0021	0.3711	946	70	946	23	937	12	98%	937
64	112	193	0.58	0.0797	0.0030	1.7177	0.0602	0.1565	0.0022	0.3956	1191	74	1015	23	937	12	120%	937

32	87.9	257	0.34	0.0689	0.0021	1.4607	0.0445	0.1531	0.0018	0.3757	896	64	914	18	918	10	102%	918
47	137	469	0.29	0.0731	0.0019	1.5311	0.0378	0.1505	0.0016	0.4397	1017	86	943	15	904	9	97%	904
8	112	1307	0.09	0.0682	0.0018	1.3873	0.0357	0.1455	0.0017	0.4535	876	55	884	15	876	10	124%	876
76	133	297	0.45	0.0768	0.0022	1.4849	0.0430	0.1406	0.0036	0.8768	1117	58	924	18	848	20	101%	848
61	81.9	164	0.50	0.0670	0.0025	1.2747	0.0448	0.1370	0.0016	0.3292	839	81	835	20	828	9	117%	828
63	31.4	103	0.31	0.0723	0.0039	1.3737	0.0720	0.1370	0.0029	0.4028	994	109	878	31	828	16	98%	828
25	114	172	0.66	0.0673	0.0027	1.2751	0.0507	0.1368	0.0018	0.3244	856	84	835	23	827	10	120%	827
50	71.5	70.5	1.01	0.0681	0.0036	1.2740	0.0673	0.1357	0.0026	0.3670	872	111	834	30	820	15	100%	820
55	66.8	243	0.27	0.0669	0.0023	1.2563	0.0411	0.1357	0.0019	0.4304	835	71	826	18	820	11	106%	820
62	106	700	0.15	0.0742	0.0019	1.3534	0.0341	0.1307	0.0014	0.4191	1056	52	869	15	792	8	111%	792
65	205	374	0.55	0.0713	0.0024	1.2708	0.0422	0.1283	0.0016	0.3689	965	70	833	19	778	9	104%	778
22	157	151	1.04	0.0672	0.0027	1.1828	0.0447	0.1271	0.0016	0.3300	856	81	793	21	771	9	88%	771
49	128	117	1.09	0.0688	0.0030	1.2131	0.0555	0.1271	0.0019	0.3288	900	95	807	25	771	11	101%	771
77	62.6	253	0.25	0.0688	0.0025	1.1706	0.0418	0.1231	0.0017	0.3793	894	74	787	20	748	10	102%	748
19	82.7	127	0.65	0.0636	0.0030	1.0251	0.0501	0.1179	0.0021	0.3698	728	100	716	25	719	12	141%	719
57	98.8	858	0.12	0.0623	0.0016	0.9698	0.0256	0.1122	0.0013	0.4520	683	56	688	13	685	8	119%	685
5	230	436	0.53	0.0610	0.0021	0.9292	0.0301	0.1098	0.0015	0.4093	639	79	667	16	672	8	101%	672
51	53	139	0.38	0.0610	0.0030	0.8773	0.0410	0.1045	0.0017	0.3466	640	106	640	22	641	10	128%	641
39	58.5	141	0.41	0.0645	0.0033	0.9351	0.0477	0.1044	0.0018	0.3297	761	106	670	25	640	10	140%	640
34	58.7	933	0.06	0.0605	0.0016	0.8738	0.0245	0.1036	0.0011	0.3846	620	56	638	13	636	7	208%	636
27	93.3	164	0.57	0.0630	0.0035	0.7759	0.0374	0.0901	0.0013	0.2944	709	117	583	21	556	8	100%	556
11	160	156	1.02	0.0647	0.0032	0.7887	0.0374	0.0881	0.0015	0.3479	765	103	590	21	544	9	152%	544
72	538	598	0.90	0.0574	0.0020	0.7045	0.0246	0.0880	0.0010	0.3411	506	78	541	15	544	6	156%	544
70	115	432	0.27	0.0624	0.0029	0.6881	0.0333	0.0793	0.0012	0.3018	687	97	532	20	492	7	100%	492
16	75.6	341	0.22	0.0577	0.0024	0.5959	0.0237	0.0747	0.0010	0.3428	517	86	475	15	465	6	95%	465
31	104	224	0.46	0.0572	0.0025	0.5927	0.0269	0.0748	0.0012	0.3436	502	64	473	17	465	7	97%	465
1	72.6	131	0.55	0.0564	0.0029	0.5752	0.0284	0.0743	0.0013	0.3648	478	118	461	18	462	8	136%	462
56	115	360	0.32	0.0587	0.0030	0.5967	0.0296	0.0733	0.0010	0.2717	567	113	475	19	456	6	124%	456
12	293	823	0.36	0.0590	0.0019	0.5910	0.0190	0.0719	0.0008	0.3275	565	70	471	12	448	5	126%	448
48	200	685	0.29	0.0526	0.0019	0.5246	0.0184	0.0719	0.0011	0.4273	309	81	428	12	448	6	111%	448
69	132	267	0.49	0.0537	0.0022	0.5398	0.0229	0.0719	0.0010	0.3339	367	94	438	15	448	6	93%	448
40	381	1051	0.36	0.0553	0.0014	0.5531	0.0147	0.0718	0.0009	0.4627	433	57	447	10	447	5	108%	447
60	103	293	0.35	0.0530	0.0024	0.5260	0.0227	0.0717	0.0010	0.3209	328	100	429	15	447	6	103%	447
21	58.3	332	0.18	0.0559	0.0025	0.5412	0.0231	0.0709	0.0009	0.2907	450	100	439	15	442	5	105%	442
30	177	190	0.93	0.0556	0.0030	0.5387	0.0284	0.0703	0.0012	0.3159	435	120	438	19	438	7	102%	438
35	113	296	0.38	0.0561	0.0028	0.5289	0.0247	0.0695	0.0012	0.3578	454	111	431	16	433	7	99%	433

68	186	273	0.68	0.0612	0.0029	0.5918	0.0285	0.0693	0.0009	0.2832	656	104	472	18	432	6	97%	432
67	248	316	0.78	0.0590	0.0030	0.5463	0.0263	0.0670	0.0009	0.2870	569	111	443	17	418	6	82%	418
74	80.3	391	0.21	0.0611	0.0024	0.5579	0.0222	0.0659	0.0009	0.3490	643	86	450	14	411	6	142%	411
66	137	148	0.92	0.0623	0.0044	0.4268	0.0272	0.0522	0.0011	0.3272	683	150	361	19	328	7	73%	328
13	487	952	0.51	0.0533	0.0021	0.2805	0.0105	0.0380	0.0005	0.3346	343	89	251	8	241	3	69%	241
38	178	423	0.42	0.0502	0.0033	0.1987	0.0129	0.0289	0.0005	0.2872	206	147	184	11	184	3	112%	184
The grains below were not included in Lu-Hf analysis																		
93	44.2	62.1	0.71	0.1625	0.0049	10.4534	0.3411	0.4639	0.0098	0.6498	2483	50	2476	30	2457	43	101%	2483
97	223	257	0.87	0.1585	0.0037	10.6822	0.2584	0.4835	0.0057	0.4853	2439	40	2496	22	2542	25	96%	2439
106	112	504	0.22	0.1492	0.0043	10.1790	0.4896	0.4645	0.0141	0.6309	2339	49	2451	44	2459	62	95%	2339
99	113	199	0.57	0.1410	0.0031	9.1824	0.2104	0.4683	0.0048	0.4494	2240	34	2356	21	2476	21	90%	2240
105	99.9	229	0.44	0.1279	0.0032	6.2411	0.1710	0.3495	0.0056	0.5813	2069	49	2010	24	1932	27	107%	2069
103	71.6	162	0.44	0.1229	0.0034	6.0916	0.1668	0.3571	0.0044	0.4538	1999	50	1989	24	1969	21	102%	1999
80	70.6	442	0.16	0.1184	0.0031	5.7978	0.1464	0.3511	0.0046	0.5135	1932	47	1946	22	1940	22	100%	1932
90	76.6	162	0.47	0.1172	0.0029	5.8661	0.1453	0.3606	0.0040	0.4449	1914	13	1956	21	1985	19	96%	1914
79	136	417	0.33	0.1139	0.0023	5.2145	0.1109	0.3298	0.0032	0.4619	1863	37	1855	18	1837	16	101%	1863
82	126	373	0.34	0.1137	0.0029	5.2226	0.1295	0.3326	0.0048	0.5846	1861	46	1856	21	1851	23	101%	1861
101	258	474	0.55	0.1130	0.0027	5.6382	0.1429	0.3592	0.0039	0.4298	1848	43	1922	22	1978	19	93%	1848
95	227	540	0.42	0.0997	0.0023	4.3706	0.1028	0.3142	0.0039	0.5235	1620	42	1707	19	1761	19	92%	1620
94	436	1122	0.39	0.0964	0.0023	3.6690	0.0883	0.2730	0.0026	0.3892	1567	45	1565	19	1556	13	101%	1567
102	129	844	0.15	0.0949	0.0019	3.7465	0.0750	0.2835	0.0027	0.4709	1528	38	1581	16	1609	13	95%	1528
85	134	238	0.56	0.0865	0.0024	3.4222	0.0939	0.2845	0.0041	0.5256	1350	58	1510	22	1614	21	84%	1350
89	124	344	0.36	0.0847	0.0024	2.5937	0.0729	0.2206	0.0032	0.5198	1309	55	1299	21	1285	17	102%	1309
81	133	257	0.52	0.0760	0.0020	1.9599	0.0543	0.1853	0.0020	0.3868	1094	54	1102	19	1096	11	100%	1094
96	182	287	0.64	0.0747	0.0023	2.1171	0.0643	0.2042	0.0025	0.3987	1061	61	1154	21	1198	13	89%	1061
110	127	108	1.18	0.0719	0.0037	1.6395	0.0810	0.1653	0.0030	0.3658	983	104	986	31	986	17	100%	986
104	113	300	0.38	0.0753	0.0023	1.6363	0.0497	0.1579	0.0028	0.5927	1076	63	984	19	945	16	114%	945
92	11.4	1073	0.01	0.0687	0.0016	1.4512	0.0326	0.1518	0.0015	0.4297	900	79	910	13	911	8	99%	911
87	125	164	0.76	0.0686	0.0024	1.3392	0.0450	0.1410	0.0017	0.3656	887	75	863	20	850	10	104%	850
98	208	159	1.30	0.0668	0.0027	1.2362	0.0484	0.1344	0.0017	0.3234	831	88	817	22	813	10	102%	813
78	113	515	0.22	0.0608	0.0020	0.7594	0.0255	0.0903	0.0011	0.3605	635	70	574	15	558	6	114%	558
108	127	975	0.13	0.0638	0.0024	0.7744	0.0339	0.0869	0.0019	0.4910	744	81	582	19	537	11	139%	537
86	54.8	370	0.15	0.0563	0.0022	0.6484	0.0256	0.0823	0.0012	0.3829	465	87	508	16	510	7	91%	510
107	159	770	0.21	0.0613	0.0023	0.6431	0.0250	0.0751	0.0011	0.3681	650	80	504	15	467	6	139%	467
84	169	484	0.35	0.0540	0.0017	0.5525	0.0175	0.0741	0.0013	0.5361	372	72	447	11	461	8	81%	461
111	151	594	0.26	0.0559	0.0020	0.5606	0.0189	0.0721	0.0008	0.3483	456	78	452	12	449	5	102%	449

83	179	713	0.25	0.0545	0.0019	0.5172	0.0177	0.0682	0.0010	0.4307	391	78	423	12	426	6	92%	426
88	83.1	675	0.12	0.0552	0.0018	0.5190	0.0158	0.0677	0.0008	0.3688	420	77	424	11	422	5	100%	422
100	252	827	0.30	0.0489	0.0018	0.2667	0.0098	0.0395	0.0005	0.3284	143	87	240	8	250	3	57%	250
109	376	952	0.39	0.0547	0.0020	0.2942	0.0107	0.0387	0.0006	0.3950	398	81	262	8	245	3	162%	245
91	663	3073	0.22	0.0508	0.0014	0.2209	0.0060	0.0314	0.0003	0.3296	228	68	203	5	199	2	115%	199

Analyses with greater than ±10% discordance; not considered

~~112~~	~~84.6~~	~~829~~	~~0.10~~	~~0.1200~~	~~0.0025~~	~~5.0972~~	~~0.1153~~	~~0.3046~~	~~0.0038~~	~~0.5571~~	~~1967~~	~~37~~	~~1836~~	~~19~~	~~1714~~	~~19~~	115%	
~~113~~	~~100~~	~~165~~	~~0.61~~	~~0.2085~~	~~0.0052~~	~~13.6426~~	~~0.3616~~	~~0.4660~~	~~0.0069~~	~~0.5594~~	~~2894~~	~~40~~	~~2725~~	~~25~~	~~2466~~	~~30~~	117%	
~~114~~	~~38.8~~	~~83.5~~	~~0.46~~	~~0.2101~~	~~0.0065~~	~~14.1203~~	~~0.4803~~	~~0.4850~~	~~0.0102~~	~~0.6191~~	~~2906~~	~~55~~	~~2758~~	~~32~~	~~2549~~	~~44~~	114%	
~~115~~	~~297~~	~~236~~	~~1.26~~	~~0.1257~~	~~0.0033~~	~~5.3713~~	~~0.1394~~	~~0.3070~~	~~0.0032~~	~~0.3966~~	~~2039~~	~~47~~	~~1880~~	~~22~~	~~1726~~	~~16~~	118%	
~~116~~	~~77.1~~	~~468~~	~~0.16~~	~~0.1160~~	~~0.0026~~	~~4.5345~~	~~0.0992~~	~~0.2803~~	~~0.0028~~	~~0.4606~~	~~1896~~	~~41~~	~~1737~~	~~18~~	~~1593~~	~~14~~	119%	
~~117~~	~~375~~	~~754~~	~~0.50~~	~~0.2416~~	~~0.0045~~	~~17.5070~~	~~0.3219~~	~~0.5193~~	~~0.0049~~	~~0.5106~~	~~3131~~	~~30~~	~~2963~~	~~18~~	~~2696~~	~~21~~	116%	
~~118~~	~~140~~	~~702~~	~~0.20~~	~~0.0879~~	~~0.0026~~	~~2.3529~~	~~0.0657~~	~~0.1907~~	~~0.0023~~	~~0.4388~~	~~1380~~	~~56~~	~~1228~~	~~20~~	~~1125~~	~~13~~	123%	
~~119~~	~~58.3~~	~~124~~	~~0.47~~	~~0.1266~~	~~0.0084~~	~~0.6382~~	~~0.0443~~	~~0.0364~~	~~0.0010~~	~~0.4134~~	~~2051~~	~~118~~	~~501~~	~~27~~	~~231~~	~~6~~	888%	
~~120~~	~~647~~	~~2404~~	~~0.27~~	~~0.0650~~	~~0.0017~~	~~0.3100~~	~~0.0086~~	~~0.0343~~	~~0.0003~~	~~0.3432~~	~~776~~	~~56~~	~~274~~	~~7~~	~~217~~	~~2~~	358%	
~~121~~	~~1111~~	~~1811~~	~~0.61~~	~~0.0768~~	~~0.0030~~	~~0.3806~~	~~0.0137~~	~~0.0360~~	~~0.0004~~	~~0.2796~~	~~1117~~	~~77~~	~~327~~	~~10~~	~~228~~	~~2~~	490%	
~~122~~	~~107~~	~~187~~	~~0.57~~	~~0.0728~~	~~0.0044~~	~~0.5649~~	~~0.0348~~	~~0.0563~~	~~0.0013~~	~~0.3718~~	~~1009~~	~~123~~	~~455~~	~~23~~	~~353~~	~~8~~	286%	
~~123~~	~~44.9~~	~~71.7~~	~~0.63~~	~~0.3445~~	~~0.0172~~	~~24.1402~~	~~2.2825~~	~~0.4390~~	~~0.0177~~	~~0.4256~~	~~3683~~	~~76~~	~~3274~~	~~92~~	~~2346~~	~~79~~	157%	
~~124~~	~~151~~	~~715~~	~~0.21~~	~~0.0688~~	~~0.0027~~	~~0.7075~~	~~0.0293~~	~~0.0737~~	~~0.0010~~	~~0.3186~~	~~894~~	~~81~~	~~543~~	~~17~~	~~458~~	~~6~~	195%	
~~125~~	~~95.9~~	~~217~~	~~0.44~~	~~0.0598~~	~~0.0045~~	~~0.2143~~	~~0.0143~~	~~0.0267~~	~~0.0005~~	~~0.3069~~	~~594~~	~~165~~	~~197~~	~~12~~	~~170~~	~~3~~	349%	
~~126~~	~~150~~	~~239~~	~~0.63~~	~~0.0740~~	~~0.0053~~	~~0.2628~~	~~0.0170~~	~~0.0272~~	~~0.0006~~	~~0.3263~~	~~1043~~	~~140~~	~~237~~	~~14~~	~~173~~	4	603%	
~~127~~	~~533~~	~~1149~~	~~0.46~~	~~0.0876~~	~~0.0035~~	~~0.4788~~	~~0.0213~~	~~0.0385~~	~~0.0005~~	~~0.3034~~	~~1373~~	~~78~~	~~397~~	~~15~~	~~244~~	~~3~~	563%	
~~128~~	~~196~~	~~295~~	~~0.66~~	~~0.0784~~	~~0.0037~~	~~0.5585~~	~~0.0289~~	~~0.0513~~	~~0.0012~~	~~0.4572~~	~~1167~~	~~94~~	~~451~~	~~19~~	~~323~~	~~7~~	361%	
~~129~~	~~735~~	~~865~~	~~0.85~~	~~0.0827~~	~~0.0028~~	~~0.4374~~	~~0.0160~~	~~0.0378~~	~~0.0006~~	~~0.4260~~	~~1263~~	~~66~~	~~368~~	~~11~~	~~239~~	~~4~~	528%	
~~130~~	~~587~~	~~1222~~	~~0.48~~	~~0.0883~~	~~0.0025~~	~~1.9572~~	~~0.0611~~	~~0.1586~~	~~0.0025~~	~~0.5025~~	~~1391~~	~~54~~	~~1101~~	~~21~~	~~949~~	~~14~~	147%	
~~131~~	~~134~~	~~170~~	~~0.79~~	~~0.2163~~	~~0.0103~~	~~5.7416~~	~~0.3642~~	~~0.1765~~	~~0.0046~~	~~0.4092~~	~~2953~~	~~76~~	~~1938~~	~~55~~	~~1048~~	~~25~~	282%	
~~132~~	~~496~~	~~2502~~	~~0.20~~	~~0.0663~~	~~0.0017~~	~~0.3198~~	~~0.0085~~	~~0.0347~~	~~0.0005~~	~~0.5210~~	~~817~~	~~58~~	~~282~~	~~7~~	~~220~~	~~3~~	371%	
~~133~~	~~72.6~~	~~359~~	~~0.20~~	~~0.1010~~	~~0.0048~~	~~1.2711~~	~~0.0666~~	~~0.0905~~	~~0.0019~~	~~0.4027~~	~~1643~~	~~89~~	~~833~~	~~30~~	~~558~~	~~11~~	294%	
~~134~~	~~556~~	~~1990~~	~~0.28~~	~~0.0622~~	~~0.0019~~	~~0.3263~~	~~0.0099~~	~~0.0377~~	~~0.0004~~	~~0.3542~~	~~680~~	~~67~~	~~287~~	~~8~~	~~239~~	~~3~~	285%	
~~135~~	~~1337~~	~~1697~~	~~0.79~~	~~0.1114~~	~~0.0045~~	~~0.6202~~	~~0.0232~~	~~0.0406~~	~~0.0006~~	~~0.4179~~	~~1833~~	~~73~~	~~490~~	~~15~~	~~257~~	4	713%	
~~136~~	~~1136~~	~~1727~~	~~0.66~~	~~0.0627~~	~~0.0017~~	~~0.5755~~	~~0.0156~~	~~0.0658~~	~~0.0007~~	~~0.3873~~	~~698~~	~~57~~	~~462~~	~~10~~	~~411~~	4	170%	
~~137~~	~~272~~	~~1331~~	~~0.20~~	~~0.0594~~	~~0.0019~~	~~0.3615~~	~~0.0121~~	~~0.0438~~	~~0.0007~~	~~0.4920~~	~~583~~	~~64~~	~~313~~	~~9~~	~~276~~	4	211%	
~~138~~	~~113~~	~~160~~	~~0.71~~	~~0.0874~~	~~0.0052~~	~~0.6103~~	~~0.0375~~	~~0.0511~~	~~0.0011~~	~~0.3520~~	~~1369~~	~~115~~	~~484~~	~~24~~	~~321~~	~~7~~	426%	
~~139~~	~~226~~	~~841~~	~~0.27~~	~~0.0733~~	~~0.0029~~	~~0.9111~~	~~0.0467~~	~~0.0857~~	~~0.0019~~	~~0.4351~~	~~1020~~	~~80~~	~~658~~	~~25~~	~~530~~	~~11~~	192%	
~~140~~	~~1528~~	~~2047~~	~~0.75~~	~~0.0885~~	~~0.0026~~	~~0.4649~~	~~0.0133~~	~~0.0376~~	~~0.0004~~	~~0.3747~~	~~1394~~	~~56~~	~~388~~	~~9~~	~~238~~	~~3~~	586%	

~~141~~	~~532~~	~~955~~	~~0.56~~	~~0.0921~~	~~0.0021~~	~~2.3672~~	~~0.0527~~	~~0.1846~~	~~0.0019~~	~~0.4516~~	~~1470~~	~~47~~	~~1233~~	~~16~~	~~1092~~	~~10~~	135%
~~142~~	~~208~~	~~959~~	~~0.22~~	~~0.0579~~	~~0.0024~~	~~0.2356~~	~~0.0094~~	~~0.0295~~	~~0.0005~~	~~0.3929~~	~~528~~	~~91~~	~~215~~	~~8~~	~~187~~	~~3~~	282%
~~143~~	~~65.3~~	~~141~~	~~0.46~~	~~0.1214~~	~~0.0100~~	~~1.5022~~	~~0.1324~~	~~0.0933~~	~~0.0037~~	~~0.4496~~	~~1977~~	~~142~~	~~931~~	~~54~~	~~575~~	~~22~~	344%
~~144~~	~~875~~	~~1427~~	~~0.61~~	~~0.0693~~	~~0.0037~~	~~0.3115~~	~~0.0171~~	~~0.0318~~	~~0.0005~~	~~0.3105~~	~~909~~	~~109~~	~~275~~	~~13~~	~~202~~	~~3~~	450%
~~145~~	~~134~~	~~194~~	~~0.69~~	~~0.0871~~	~~0.0062~~	~~0.3927~~	~~0.0324~~	~~0.0320~~	~~0.0012~~	~~0.4469~~	~~1363~~	~~138~~	~~336~~	~~24~~	~~203~~	~~7~~	671%

*Note: Conc. (Concordance)= ($^{207}Pb/^{206}Pb$ age)/($^{206}Pb/^{238}U$ age)×100%. Preferred age is based on the $^{207}Pb/^{206}Pb$ when $^{206}Pb/^{238}U$ age>1000 Ma and the $^{206}Pb/^{238}U$ when $^{206}Pb/^{238}U$ age<1000 Ma. 57 analyses ($^{206}Pb/^{238}U$ age<1000 Ma) that fall outside of the ±10 % concordance are not rejected since the counting statistics with $^{207}Pb/^{206}Pb$ determinations of the young grains that increase the individual uncertainties that the may be large enough to obscure the true agreement. The table is ordered by decreasing preferred age within each grouping.

Table DR2 LA-MC-ICPMS Lu-Hf data for zircons from the Yangtze and Hanjiang rivers

Spot	$^{176}Hf/^{177}Hf$	2σ	$^{176}Lu/^{177}Hf$	2σ	$^{176}Yb/^{177}Hf$	2σ	$\varepsilon_{Hf}(0)$*	Age (Ma)	$\varepsilon_{Hf}(t)$	2σ	T_{DM1}	T_{DM2}
Sample 11CJ02												
47	0.280472	0.000028	0.000328	0.000006	0.012131	0.000386	-81.8	3395	-4.8	1.0	3742	4099
2	0.280646	0.000030	0.000745	0.000030	0.029355	0.001054	-75.6	3329	-1.1	1.1	3555	3817
25	0.280927	0.000028	0.000579	0.000004	0.025077	0.000374	-65.7	2569	-8.4	1.0	3176	3651
48	0.281133	0.000020	0.000971	0.000032	0.038478	0.001592	-58.4	2487	-3.6	0.7	2936	3290
33	0.281135	0.000028	0.000561	0.000004	0.023655	0.000144	-58.3	2405	-4.7	1.0	2903	3293
40	0.281001	0.000032	0.001068	0.000192	0.043535	0.007624	-63.1	2376	-11.0	1.1	3117	3657
17	0.281275	0.000032	0.000375	0.000002	0.014197	0.000170	-53.4	2344	-0.8	1.1	2707	3004
52	0.281438	0.000026	0.000554	0.000024	0.021000	0.001022	-47.6	2122	-0.4	0.9	2504	2801
15	0.281553	0.000028	0.000325	0.000006	0.013532	0.000380	-43.6	2013	1.5	1.0	2339	2595
32	0.281431	0.000028	0.000703	0.000020	0.027431	0.000468	-47.9	1980	-4.1	1.0	2523	2916
6	0.281472	0.000028	0.001217	0.000012	0.053597	0.000520	-46.4	1926	-4.5	1.0	2501	2900
54	0.281596	0.000026	0.000252	0.000002	0.009746	0.000154	-42.0	1909	0.7	0.9	2278	2560
23	0.281364	0.000028	0.000035	0.000004	0.002065	0.000292	-50.3	1854	-8.5	1.0	2568	3089
39	0.281271	0.000022	0.000092	0.000010	0.003971	0.000444	-53.5	1854	-11.9	0.8	2693	3298
28	0.281754	0.000032	0.001319	0.000050	0.055941	0.001466	-36.5	1776	2.0	1.1	2127	2375
24	0.281494	0.000036	0.000183	0.000008	0.008145	0.000234	-45.7	1743	-6.6	1.3	2408	2884
67	0.281864	0.000028	0.000792	0.000026	0.031211	0.000934	-32.6	1626	3.2	1.0	1951	2184
66	0.281988	0.000026	0.000794	0.000018	0.031058	0.000526	-28.2	1543	5.7	0.9	1785	1961
20	0.281965	0.000032	0.000289	0.000012	0.011165	0.000466	-29.0	1209	-2.1	1.1	1793	2186
64	0.281739	0.000080	0.000642	0.000012	0.026410	0.000920	-37.0	1077	-13.3	2.8	2111	2781
56	0.282217	0.000026	0.000596	0.000016	0.023692	0.000766	-20.1	1056	3.2	0.9	1469	1740
11	0.282265	0.000028	0.000579	0.000006	0.022515	0.000258	-18.4	990	3.4	1.0	1404	1673
34	0.282249	0.000024	0.001022	0.000030	0.043990	0.000862	-19.0	987	2.5	0.9	1442	1728
57	0.282198	0.000034	0.001194	0.000026	0.048455	0.001184	-20.8	987	0.6	1.2	1518	1848
19	0.282223	0.000028	0.000285	0.000006	0.010472	0.000142	-19.9	974	1.7	1.0	1449	1763
10	0.282105	0.000024	0.000950	0.000028	0.039070	0.001358	-24.0	958	-3.2	0.9	1634	2059
59	0.281900	0.000024	0.000046	0.000000	0.002643	0.000046	-31.3	950	-10.1	0.9	1868	2480
13	0.282265	0.000028	0.000711	0.000002	0.030100	0.000344	-18.4	939	2.2	1.0	1408	1709
35	0.281801	0.000034	0.001245	0.000078	0.052053	0.002522	-34.8	939	-14.6	1.2	2060	2751
68	0.281914	0.000036	0.000486	0.000002	0.019586	0.000296	-30.8	863	-11.8	1.3	1870	2519
3	0.282430	0.000022	0.002076	0.000008	0.085279	0.001510	-12.6	843	5.1	0.8	1228	1451

37	0.281887	0.000030	0.000557	0.000008	0.023916	0.000182	-31.8	815	-13.9	1.1	1909	2610
18	0.282296	0.000030	0.000553	0.000006	0.022416	0.000482	-17.3	609	-3.9	1.1	1361	1833
16	0.282429	0.000026	0.001541	0.000108	0.065164	0.005278	-12.6	561	-0.7	0.9	1212	1592
63	0.282560	0.000028	0.000986	0.000008	0.035962	0.000536	-8.0	528	3.5	1.0	1016	1310
62	0.282378	0.000022	0.001367	0.000066	0.050544	0.002740	-14.4	523	-3.2	0.8	1277	1722
51	0.282437	0.000020	0.002968	0.000234	0.118444	0.010228	-12.3	518	-1.8	0.7	1248	1629
49	0.282469	0.000024	0.003402	0.000078	0.136357	0.005388	-11.2	502	-1.1	0.8	1216	1576
44	0.282620	0.000030	0.000159	0.000026	0.006134	0.000910	-5.8	498	5.2	1.1	914	1179
8	0.281916	0.000022	0.001475	0.000020	0.061663	0.000664	-30.7	493	-20.2	0.8	1915	2758
26	0.282371	0.000024	0.001198	0.000028	0.052427	0.000874	-14.6	492	-4.1	0.8	1281	1752
36	0.282192	0.000030	0.000422	0.000002	0.018027	0.000380	-21.0	491	-10.2	1.1	1496	2130
30	0.282391	0.000028	0.001012	0.000030	0.040709	0.000912	-13.9	489	-3.4	1.0	1248	1706
38	0.282266	0.000038	0.000857	0.000064	0.036659	0.003156	-18.4	481	-7.9	1.3	1412	1982
50	0.282334	0.000028	0.001121	0.000008	0.044719	0.000266	-15.9	481	-5.6	1.0	1329	1838
9	0.282225	0.000026	0.001471	0.000324	0.062063	0.013288	-19.8	477	-9.6	0.9	1491	2087
12	0.282433	0.000028	0.001008	0.000124	0.043081	0.005864	-12.4	477	-2.1	1.0	1190	1620
7	0.282820	0.000028	0.000813	0.000022	0.029614	0.001204	1.2	461	11.3	1.0	655	774
55	0.282406	0.000036	0.000537	0.000040	0.019291	0.001200	-13.4	461	-3.3	1.3	1212	1680
53	0.282447	0.000026	0.001305	0.000090	0.054268	0.003544	-12.0	460	-2.1	0.9	1180	1605
61	0.282365	0.000028	0.001252	0.000022	0.044680	0.000426	-14.9	460	-5.0	1.0	1291	1784
14	0.282358	0.000032	0.001198	0.000018	0.049845	0.000796	-15.1	459	-5.2	1.1	1299	1799
69	0.282386	0.000034	0.001135	0.000098	0.046484	0.004314	-14.1	459	-4.2	1.2	1258	1736
58	0.282378	0.000028	0.001344	0.000090	0.053838	0.003920	-14.4	449	-4.8	1.0	1276	1763
5	0.282335	0.000032	0.001004	0.000100	0.043735	0.004852	-15.9	442	-6.4	1.1	1324	1856
31	0.282352	0.000030	0.000910	0.000018	0.037133	0.000532	-15.3	430	-6.0	1.1	1297	1824
41	0.282330	0.000024	0.001182	0.000082	0.048870	0.003882	-16.1	429	-6.9	0.8	1337	1878
1	0.282359	0.000022	0.001072	0.000006	0.043108	0.000544	-15.1	424	-5.9	0.8	1293	1815
22	0.282574	0.000028	0.000639	0.000014	0.023874	0.000464	-7.5	423	1.8	1.0	988	1334
42	0.282301	0.000036	0.001326	0.000134	0.053825	0.005558	-17.1	423	-8.1	1.3	1382	1947
46	0.282456	0.000028	0.001437	0.000068	0.056678	0.003346	-11.6	423	-2.6	1.0	1172	1608
27	0.282499	0.000028	0.000656	0.000006	0.023707	0.000238	-10.1	414	-1.1	1.0	1090	1505
4	0.282384	0.000024	0.001266	0.000094	0.054924	0.004060	-14.2	405	-5.5	0.8	1265	1774
43	0.282500	0.000030	0.001060	0.000116	0.041969	0.004558	-10.1	242	-4.9	1.1	1100	1609
60	0.282626	0.000040	0.001379	0.000254	0.053771	0.009504	-5.6	242	-0.5	1.4	935	1335
21	0.282546	0.000030	0.001139	0.000050	0.045641	0.001910	-8.5	227	-3.6	1.1	1039	1517
45	0.282531	0.000032	0.001070	0.000038	0.041827	0.001820	-9.0	227	-4.1	1.1	1058	1549

70	0.282588	0.000030	0.001169	0.000016	0.048452	0.000830	-7.0	181	-3.1	1.1	982	1451
29	0.282602	0.000024	0.001263	0.000030	0.055373	0.001370	-6.5	166	-2.9	0.8	965	1430
65	0.282542	0.000030	0.000496	0.000006	0.019390	0.000428	-8.6	163	-5.0	1.1	1027	1558
Sample 11HJ04												
2	0.280669	0.000042	0.002689	0.000036	0.104414	0.002538	-74.8	3396	-3.3	1.5	3706	4005
18	0.280543	0.000080	0.000631	0.000110	0.025882	0.004962	-79.3	2898	-14.6	2.8	3678	4298
14	0.280850	0.000036	0.000768	0.000124	0.028306	0.004702	-68.4	2875	-4.4	1.3	3291	3653
53	0.280932	0.000030	0.000448	0.000000	0.017927	0.000200	-65.5	2729	-4.3	1.1	3159	3525
75	0.281165	0.000032	0.001616	0.000080	0.069593	0.002924	-57.3	2665	0.4	1.1	2941	3184
43	0.281143	0.000022	0.000510	0.000064	0.020577	0.002630	-58.1	2522	-1.7	0.8	2889	3197
24	0.281439	0.000122	0.001979	0.000714	0.096510	0.041038	-47.6	2506	6.0	4.3	2596	2711
37	0.281061	0.000032	0.000861	0.000004	0.034939	0.000378	-61.0	2506	-5.5	1.1	3022	3425
15	0.281139	0.000046	0.001514	0.000368	0.064066	0.015370	-58.2	2402	-6.2	1.6	2969	3382
26	0.281118	0.000028	0.000726	0.000042	0.028986	0.001938	-58.9	2273	-8.6	1.0	2937	3428
23	0.281172	0.000038	0.000517	0.000040	0.022039	0.002060	-57.0	2100	-10.3	1.4	2851	3397
41	0.281283	0.000032	0.000803	0.000014	0.035952	0.000644	-53.1	2100	-6.8	1.1	2725	3177
29	0.281401	0.000022	0.000189	0.000004	0.007694	0.000148	-48.9	1967	-4.8	0.8	2530	2948
73	0.281467	0.000032	0.001430	0.000088	0.060527	0.003478	-46.6	1967	-4.1	1.1	2522	2905
7	0.281488	0.000032	0.000967	0.000050	0.040670	0.002040	-45.9	1922	-3.7	1.1	2464	2847
17	0.281587	0.000036	0.000493	0.000002	0.020170	0.000298	-42.4	1803	-2.3	1.3	2304	2665
54	0.281561	0.000030	0.001565	0.000056	0.061474	0.001512	-43.3	1740	-5.9	1.1	2403	2839
42	0.281959	0.000034	0.001113	0.000010	0.047501	0.000290	-29.2	1672	7.2	1.2	1839	1970
20	0.281623	0.000034	0.000863	0.000036	0.035954	0.001232	-41.1	1591	-6.2	1.2	2278	2740
36	0.281669	0.000030	0.000256	0.000000	0.009130	0.000132	-39.5	1317	-10.1	1.1	2182	2769
3	0.281875	0.000030	0.000938	0.000038	0.040004	0.001382	-32.2	1139	-7.4	1.1	1944	2459
52	0.281816	0.000022	0.000302	0.000014	0.013715	0.000626	-34.3	1087	-10.2	0.8	1991	2590
9	0.281996	0.000044	0.000611	0.000098	0.025953	0.004086	-27.9	1054	-4.7	1.6	1766	2228
46	0.282048	0.000020	0.000521	0.000004	0.020965	0.000220	-26.1	1022	-3.5	0.7	1693	2129
4	0.282134	0.000036	0.000527	0.000004	0.020142	0.000212	-23.0	998	-1.0	1.3	1578	1954
6	0.282134	0.000040	0.001103	0.000150	0.047176	0.006798	-23.0	998	-1.4	1.4	1601	1978
45	0.281820	0.000030	0.000583	0.000022	0.024795	0.000806	-34.1	995	-12.3	1.1	2000	2650
71	0.281939	0.000038	0.000776	0.000076	0.033698	0.002930	-29.9	995	-8.2	1.3	1850	2396
33	0.282326	0.000028	0.000701	0.000010	0.026619	0.000234	-16.2	971	5.1	1.0	1326	1555
58	0.282090	0.000024	0.000863	0.000060	0.038533	0.002556	-24.6	971	-3.4	0.9	1651	2081
59	0.282413	0.000024	0.001091	0.000034	0.045450	0.001898	-13.2	958	7.6	0.9	1220	1387
10	0.282131	0.000034	0.000890	0.000122	0.039828	0.006326	-23.1	956	-2.3	1.2	1596	2001

44	0.281975	0.000032	0.001048	0.000012	0.044866	0.000534	-28.6	938	-8.3	1.1	1814	2361
28	0.282131	0.000026	0.000489	0.000008	0.020135	0.000456	-23.1	937	-2.5	0.9	1580	1997
64	0.281970	0.000018	0.000484	0.000010	0.019274	0.000590	-28.8	937	-8.2	0.6	1795	2351
32	0.282422	0.000024	0.000513	0.000116	0.021341	0.005096	-12.8	918	7.4	0.9	1190	1368
47	0.282447	0.000028	0.000969	0.000018	0.041207	0.001122	-12.0	904	7.7	1.0	1170	1339
8	0.282215	0.000046	0.001344	0.000144	0.053411	0.006584	-20.2	876	-1.4	1.6	1500	1880
76	0.282169	0.000024	0.000767	0.000008	0.030567	0.000218	-21.8	848	-3.3	0.9	1540	1977
61	0.281940	0.000032	0.000310	0.000002	0.011306	0.000246	-29.9	828	-11.6	1.1	1827	2477
63	0.282610	0.000030	0.000876	0.000040	0.029097	0.001128	-6.2	828	11.9	1.1	944	1021
25	0.281981	0.000036	0.000478	0.000046	0.019475	0.002122	-28.4	827	-10.2	1.3	1780	2393
50	0.282036	0.000032	0.000851	0.000006	0.035436	0.000386	-26.5	820	-8.6	1.1	1723	2289
55	0.282407	0.000028	0.001045	0.000046	0.042497	0.002466	-13.4	820	4.4	1.0	1227	1479
62	0.282040	0.000018	0.000411	0.000004	0.017505	0.000110	-26.3	792	-8.9	0.6	1699	2282
65	0.282370	0.000032	0.000693	0.000044	0.021803	0.001172	-14.7	778	2.4	1.1	1266	1573
22	0.282461	0.000040	0.000919	0.000038	0.034085	0.001008	-11.5	771	5.3	1.4	1149	1384
49	0.281978	0.000022	0.001747	0.000086	0.073383	0.003540	-28.5	771	-12.2	0.8	1843	2474
77	0.282495	0.000030	0.001053	0.000008	0.042061	0.000506	-10.3	748	5.9	1.1	1107	1327
19	0.282450	0.000030	0.000831	0.000050	0.029537	0.001998	-11.8	719	3.8	1.1	1162	1436
57	0.282463	0.000030	0.000927	0.000016	0.038019	0.000318	-11.4	685	3.5	1.1	1147	1431
5	0.282513	0.000038	0.000892	0.000050	0.035227	0.002526	-9.6	672	5.0	1.3	1077	1327
51	0.282081	0.000028	0.000031	0.000000	0.001391	0.000034	-24.9	641	-10.6	1.0	1628	2274
39	0.282317	0.000030	0.000248	0.000012	0.009364	0.000604	-16.5	640	-2.4	1.1	1323	1760
34	0.282517	0.000032	0.001153	0.000018	0.043198	0.000890	-9.5	636	4.2	1.1	1079	1346
27	0.282447	0.000026	0.000239	0.000000	0.009534	0.000124	-12.0	556	0.4	0.9	1148	1526
11	0.282057	0.000030	0.000354	0.000012	0.014929	0.000406	-25.7	544	-13.8	1.1	1674	2394
72	0.282155	0.000024	0.000475	0.000002	0.019995	0.000364	-22.3	544	-10.3	0.8	1548	2181
70	0.282305	0.000024	0.000645	0.000020	0.025095	0.001124	-17.0	492	-6.2	0.8	1352	1886
16	0.282245	0.000050	0.000642	0.000102	0.026884	0.003940	-19.1	465	-8.9	1.8	1433	2034
31	0.282310	0.000028	0.001048	0.000030	0.041854	0.001132	-16.8	465	-6.8	1.0	1359	1898
1	0.282322	0.000036	0.000908	0.000078	0.037046	0.002858	-16.4	462	-6.4	1.3	1338	1871
56	0.282328	0.000028	0.001683	0.000094	0.057765	0.002164	-16.2	456	-6.5	1.0	1357	1876
12	0.282282	0.000042	0.001096	0.000252	0.045398	0.010970	-17.8	448	-8.1	1.5	1399	1971
48	0.282282	0.000020	0.000924	0.000026	0.033201	0.001026	-17.8	448	-8.1	0.7	1393	1968
69	0.282335	0.000022	0.001371	0.000118	0.056123	0.004820	-15.9	448	-6.3	0.8	1336	1859
40	0.282276	0.000026	0.000973	0.000028	0.040621	0.001534	-18.0	447	-8.3	0.9	1403	1982
60	0.282426	0.000028	0.001624	0.000056	0.065904	0.001702	-12.7	447	-3.2	1.0	1219	1664

21	0.282329	0.000036	0.001414	0.000050	0.057507	0.001858	-16.1	442	-6.7	1.3	1346	1877
30	0.282661	0.000026	0.000156	0.000002	0.005489	0.000086	-4.4	438	5.3	0.9	859	1125
35	0.282280	0.000024	0.001197	0.000064	0.050246	0.002802	-17.9	433	-8.6	0.8	1406	1986
68	0.282508	0.000024	0.000751	0.000048	0.026816	0.002022	-9.8	432	-0.4	0.8	1080	1476
67	0.282539	0.000030	0.001193	0.000008	0.047570	0.000348	-8.7	418	0.3	1.1	1050	1424
74	0.282313	0.000036	0.001081	0.000084	0.041990	0.003282	-16.7	411	-7.8	1.3	1356	1924
66	0.282157	0.000020	0.001539	0.000058	0.056858	0.003126	-22.2	328	-15.3	0.7	1588	2321
13	0.282496	0.000036	0.000919	0.000120	0.034358	0.004830	-10.2	241	-5.0	1.3	1101	1617
38	0.282408	0.000022	0.000866	0.000076	0.035571	0.003528	-13.3	184	-9.4	0.8	1220	1843

*Note: $\varepsilon_{Hf(0)} = (({}^{176}Hf/{}^{177}Hf)_S/({}^{176}Hf/{}^{177}Hf)_{CHUR,0}-1)\times10000$; $\varepsilon_{Hf(t)} = (({}^{176}Hf/{}^{177}Hf)_S-({}^{176}Lu/{}^{177}Hf)_S\times(e^{\lambda t}-1))/(({}^{176}Hf/{}^{177}Hf)_{CHUR,0}-({}^{176}Lu/{}^{177}Hf)_{CHUR}\times(e^{\lambda t}-1))-1)\times10000$;

$({}^{176}Lu/{}^{177}Hf)_{CHUR} = 0.0336$ and $({}^{176}Hf/{}^{177}Hf)_{CHUR,0} = 0.282785$; $({}^{176}Lu/{}^{177}Hf)_{DM} = 0.03933$ and $({}^{176}Hf/{}^{177}Hf)_{DM} = 0.283294$, $\lambda^{176}Lu=1.867\times10^{-11}yr^{-1}$, and t = crystallization time of zircon

The table was ordered by decreasing preferred age within each grouping. The table is ordered by decreasing preferred age within each grouping.

Table DR3 LA-MC-ICPMS U-Th-Pb age and Sm-Nd isotopic data for monazites from the Yangtze and Hanjiang rivers

Spot	Isotope ratios								Isotope ages (Ma)								Isotope ratios				$\varepsilon_{Nd}(0)$*	$\varepsilon_{Nd}(t)$	2σ	T_{DM1}	T_{DM2}
	$^{207}Pb/^{206}Pb$	2σ	$^{207}Pb/^{235}U$	2σ	$^{206}Pb/^{238}U$	2σ	$^{208}Pb/^{232}Th$	2σ	$^{207}Pb/^{206}Pb$	2σ	$^{206}Pb/^{238}U$	2σ	$^{207}Pb/^{235}U$	2σ	$^{208}Pb/^{232}Th$	2σ	$^{206}Pb/^{238}U$*	$^{147}Sm/^{144}Nd$	2σ	$^{143}Nd/^{144}Nd$	2σ					
Sample 11CJ02																									
58	0.18420	0.00580	1.90200	0.06700	0.18420	0.00580	0.05690	0.00190	1070.1	19.5	1089.9	31.0	1080.7	24.0	1118.4	37.0	1090.9	0.115100	0.001300	0.512007	0.000024	-12.2	-0.6	0.5	1762	1792
31	0.13560	0.00430	1.27700	0.05500	0.13560	0.00430	0.04185	0.00170	883.7	42.3	819.1	24.0	835.0	25.0	828.5	32.0	817.6	0.108040	0.000520	0.512046	0.000016	-11.4	-2.1	0.3	1589	1677
45	0.15930	0.00570	3.89000	0.22000	0.15930	0.00570	0.04102	0.00160	2585.9	92.7	954.0	32.0	1607.0	46.0	812.0	30.0	828.4	0.073765	0.000058	0.512038	0.000022	-11.5	1.2	0.4	1210	1400
32	0.13370	0.00380	1.36200	0.04800	0.13370	0.00380	0.03948	0.00150	1100.3	44.6	808.4	22.0	871.0	21.0	782.6	29.0	798.5	0.110550	0.000980	0.512047	0.000036	-11.4	-2.8	0.7	1626	1701
23	0.08767	0.00270	0.70520	0.02900	0.08767	0.00270	0.02744	0.00110	551.5	32.4	541.7	16.0	541.7	17.0	547.2	22.0	541.6	0.117820	0.000620	0.511052	0.000022	-30.8	-25.3	0.4	3310	3351
28	0.08679	0.00270	0.69750	0.02900	0.08679	0.00270	0.02717	0.00110	539.6	31.5	536.4	16.0	536.7	17.0	542.2	22.0	536.5	0.112300	0.001500	0.511803	0.000024	-16.1	-10.3	0.5	2018	2120
19	0.07178	0.00230	0.56700	0.02600	0.07178	0.00230	0.02227	0.00090	476.0	54.7	446.8	14.0	455.6	17.0	445.1	18.0	446.5	0.123800	0.002300	0.512015	0.000023	-12.0	-7.9	0.4	1918	1840
56	0.07731	0.00250	1.21200	0.05400	0.07731	0.00250	0.02213	0.00075	1856.2	50.9	480.2	15.0	801.0	25.0	442.5	15.0	445.5	0.078710	0.000130	0.512036	0.000031	-11.6	-5.0	0.6	1257	1598
11	0.07131	0.00230	0.55400	0.02800	0.07131	0.00230	0.02201	0.00088	479.9	77.9	443.8	14.0	445.0	19.0	440.2	17.0	443.5	0.080540	0.000130	0.511910	0.000023	-14.0	-7.6	0.4	1417	1809
20	0.06886	0.00220	0.54400	0.02500	0.06886	0.00220	0.02163	0.00087	518.4	57.1	429.2	13.0	439.6	16.0	432.5	17.0	428.0	0.095600	0.001700	0.511882	0.000031	-14.6	-9.1	0.6	1633	1925
30	0.06752	0.00210	0.53080	0.02200	0.06752	0.00210	0.02126	0.00085	497.7	38.2	421.1	13.0	431.5	15.0	425.1	17.0	420.2	0.084462	0.000071	0.511996	0.000031	-12.4	-6.3	0.6	1359	1695
36	0.06938	0.00190	0.68800	0.02500	0.06938	0.00190	0.02119	0.00077	945.9	55.1	432.3	11.0	530.0	15.0	423.8	15.0	424.2	0.086160	0.000220	0.511913	0.000022	-14.0	-8.0	0.4	1476	1835
57	0.07010	0.00230	0.73600	0.03500	0.07010	0.00230	0.02103	0.00074	1071.2	69.6	436.6	14.0	558.0	21.0	420.6	15.0	426.0	0.104480	0.000780	0.511994	0.000028	-12.4	-7.5	0.5	1610	1788
48	0.07257	0.00230	1.12900	0.04600	0.07257	0.00230	0.02081	0.00070	1835.4	40.4	452.0	14.0	767.0	22.0	416.4	14.0	419.4	0.101600	0.000390	0.512051	0.000020	-11.3	-6.3	0.4	1492	1684
47	0.04043	0.00130	0.30490	0.01200	0.04043	0.00130	0.01376	0.00047	408.6	35.9	255.6	8.2	270.4	9.1	276.3	9.3	254.3	0.080900	0.001400	0.511994	0.000022	-12.4	-8.4	0.4	1325	1740
54	0.03985	0.00130	0.70200	0.03000	0.03985	0.00130	0.01169	0.00040	2124.7	42.5	251.8	7.9	537.0	17.0	234.9	8.0	226.1	0.085500	0.004300	0.512134	0.000020	-9.7	-6.4	0.4	1207	1543
6	0.03632	0.00110	0.26840	0.01200	0.03632	0.00110	0.01159	0.00046	337.3	51.1	230.1	7.1	241.2	9.5	232.9	9.3	229.3	0.096910	0.000670	0.511982	0.000029	-12.6	-9.7	0.6	1522	1815
40	0.04096	0.00120	2.10600	0.07100	0.04096	0.00120	0.00823	0.00030	3804.5	31.2	258.6	7.7	1150.0	24.0	165.7	6.1	152.6	0.086260	0.000240	0.512166	0.000031	-9.1	-6.7	0.6	1176	1517
1	0.02487	0.00078	0.16900	0.00740	0.02487	0.00078	0.00812	0.00033	156.4	47.6	158.3	4.9	158.3	6.4	163.4	6.5	158.4	0.104781	0.000045	0.512261	0.000030	-7.2	-5.3	0.6	1243	1398
16	0.02694	0.00093	0.27800	0.01900	0.02694	0.00093	0.00807	0.00032	1146.9	112.1	171.3	5.8	246.0	15.0	162.5	6.5	165.2	0.061240	0.000750	0.512065	0.000032	-11.0	-8.2	0.6	1084	1637
14	0.02819	0.00110	0.51300	0.03000	0.02819	0.00110	0.00798	0.00033	2122.1	82.4	179.2	6.7	421.0	19.0	160.6	6.7	160.5	0.091100	0.006100	0.512011	0.000028	-12.1	-9.9	0.5	1414	1775
8	0.02319	0.00076	0.16150	0.00680	0.02390	0.00075	0.00797	0.00032	328.8	81.3	152.3	4.7	151.8	5.9	160.4	6.4	147.0	0.117820	0.000970	0.511992	0.000022	-12.4	-10.8	0.4	1836	1850
9	0.02387	0.00077	0.16290	0.00760	0.02387	0.00077	0.00781	0.00031	190.3	65.3	152.1	4.8	152.6	6.6	157.2	6.2	151.9	0.117200	0.002200	0.512229	0.000030	-7.8	-6.2	0.6	1452	1470
15	0.02478	0.00080	0.18900	0.00900	0.02478	0.00080	0.00781	0.00032	468.1	58.9	157.8	5.0	175.1	7.6	157.2	6.3	156.4	0.091500	0.000330	0.512001	0.000030	-12.3	-10.2	0.6	1431	1792
39	0.02618	0.00077	0.40000	0.02700	0.02618	0.00077	0.00779	0.00028	1738.6	101.7	166.6	4.8	334.0	20.0	156.7	5.7	154.5	0.092540	0.000310	0.512125	0.000039	-9.9	-7.8	0.8	1288	1596
55	0.02508	0.00091	0.24900	0.01700	0.02508	0.00091	0.00774	0.00026	1011.2	125.1	159.6	5.7	219.0	14.0	155.9	5.3	154.9	0.078330	0.000400	0.512110	0.000034	-10.1	-7.8	0.7	1170	1597
18	0.02376	0.00075	0.17110	0.00780	0.02376	0.00075	0.00771	0.00031	289.8	57.0	151.4	4.7	160.1	6.7	155.2	6.2	150.8	0.161800	0.004200	0.512253	0.000029	-7.4	-6.7	0.6	2620	1504
62	0.02614	0.00096	0.45900	0.02900	0.02614	0.00096	0.00768	0.00006	2107.4	84.6	166.3	6.1	381.0	20.0	154.7	1.2	149.1	0.091450	0.000860	0.512085	0.000025	-10.6	-8.6	0.5	1326	1659
10	0.02468	0.00085	0.30600	0.01600	0.02468	0.00085	0.00762	0.00031	1417.0	68.3	157.1	5.3	271.6	12.0	153.4	6.3	149.1	0.090480	0.000120	0.512106	0.000035	-10.2	-8.2	0.7	1290	1624

51	0.02481	0.00093	0.21800	0.01800	0.02481	0.00093	0.00762	0.00026	809.5	161.4	157.9	5.9	195.0	15.0	153.4	5.3	154.6	0.141450	0.000470	0.512141	0.000027	-9.5	-8.5	0.5	2121	1650
59	0.02646	0.00095	0.39600	0.02400	0.02646	0.00095	0.00758	0.00005	1802.7	80.9	168.4	5.9	338.6	17.0	152.6	1.0	155.4	0.078100	0.001700	0.512081	0.000032	-10.7	-8.4	0.6	1201	1644
2	0.02289	0.00073	0.16360	0.00730	0.02289	0.00073	0.00756	0.00030	285.4	52.8	145.9	4.6	153.6	6.3	152.2	6.1	145.3	0.074465	0.000073	0.512017	0.000048	-12.0	-9.6	0.9	1239	1741
43	0.02653	0.00093	0.53400	0.03500	0.02653	0.00093	0.00754	0.00029	2262.6	106.2	168.8	5.8	430.0	23.0	151.7	5.8	148.7	0.074430	0.000500	0.512171	0.000030	-9.0	-6.6	0.6	1071	1495
22	0.02380	0.00077	0.22810	0.01200	0.02380	0.00077	0.00751	0.00031	931.3	73.2	151.6	4.8	207.2	10.0	151.3	6.1	147.6	0.109700	0.001700	0.511966	0.000033	-13.0	-11.3	0.6	1731	1879
17	0.02424	0.00077	0.18360	0.00860	0.02424	0.00077	0.00750	0.00030	358.5	63.0	154.4	4.9	170.9	7.3	151.1	6.1	153.5	0.131130	0.000540	0.512236	0.000028	-7.7	-6.4	0.5	1683	1481
4	0.02409	0.00079	0.19560	0.01000	0.02409	0.00079	0.00749	0.00030	559.7	77.9	153.4	5.0	181.4	8.6	150.7	6.0	151.6	0.089810	0.000920	0.512113	0.000035	-10.1	-8.0	0.7	1275	1612
13	0.02337	0.00074	0.16670	0.00740	0.02337	0.00074	0.00744	0.00030	285.4	48.4	148.9	4.6	156.5	6.4	149.8	6.0	148.4	0.102400	0.002300	0.511986	0.000032	-12.6	-10.8	0.6	1591	1835
44	0.02319	0.00063	0.18490	0.00600	0.02319	0.00063	0.00744	0.00027	548.5	44.8	147.9	4.0	172.4	5.2	149.8	5.4	146.0	0.129200	0.002300	0.512033	0.000026	-11.6	-10.4	0.5	2008	1802
34	0.02330	0.00065	0.17120	0.00630	0.02330	0.00065	0.00744	0.00027	395.9	61.6	148.4	4.1	160.0	5.5	149.7	5.5	147.4	0.081083	0.000096	0.512127	0.000023	-9.8	-7.6	0.4	1175	1577
5	0.02406	0.00082	0.18470	0.01200	0.02406	0.00082	0.00738	0.00030	436.4	116.1	153.2	5.2	171.9	9.9	148.7	5.9	152.0	0.065700	0.001800	0.512006	0.000032	-12.2	-9.7	0.6	1177	1747
53	0.02492	0.00087	0.31900	0.01700	0.02492	0.00087	0.00727	0.00026	1549.7	78.2	158.7	5.5	280.0	13.0	146.5	5.2	149.2	0.132240	0.000260	0.512106	0.000023	-10.2	-9.0	0.4	1947	1690
7	0.02390	0.00075	0.15630	0.00680	0.02256	0.00071	0.00727	0.00029	165.9	38.8	143.8	4.5	147.5	6.0	146.4	5.9	152.2	0.073311	0.000060	0.512045	0.000032	-11.4	-9.1	0.6	1199	1697
63	0.02241	0.00083	0.23600	0.01700	0.02241	0.00083	0.00726	0.00005	1118.6	111.6	142.8	5.2	215.1	14.0	146.1	0.9	137.8	0.074920	0.000230	0.512074	0.000021	-10.8	-8.6	0.4	1181	1653
29	0.02262	0.00072	0.16020	0.00700	0.02262	0.00072	0.00725	0.00029	254.3	49.3	144.2	4.6	150.7	6.2	145.9	5.8	143.8	0.091560	0.000910	0.511998	0.000021	-12.3	-10.4	0.4	1435	1800
33	0.02771	0.00086	0.73200	0.03600	0.02771	0.00086	0.00724	0.00026	2773.0	63.5	176.1	5.4	546.0	21.0	145.8	5.3	143.9	0.072920	0.000490	0.512107	0.000032	-10.2	-7.9	0.6	1129	1598
35	0.02267	0.00071	0.18910	0.01100	0.02267	0.00071	0.00721	0.00027	635.7	113.1	144.4	4.5	174.7	9.3	145.3	5.4	142.3	0.074980	0.000780	0.512132	0.000041	-9.7	-7.5	0.8	1118	1561
46	0.02272	0.00084	0.18130	0.01100	0.02272	0.00084	0.00718	0.00027	537.3	112.8	144.8	5.3	168.7	9.4	144.6	5.3	143.1	0.089599	0.000039	0.512079	0.000034	-10.7	-8.8	0.7	1314	1668
12	0.02229	0.00071	0.16120	0.00710	0.02229	0.00071	0.00717	0.00029	311.6	47.6	142.1	4.5	151.9	6.2	144.3	5.8	141.4	0.103600	0.001000	0.511977	0.000037	-12.7	-11.0	0.7	1620	1852
42	0.02194	0.00061	0.15460	0.00530	0.02194	0.00061	0.00712	0.00026	218.1	55.0	139.9	3.8	145.7	4.7	143.3	5.3	139.6	0.104740	0.000710	0.512153	0.000024	-9.3	-7.6	0.5	1393	1573
26	0.02278	0.00076	0.17570	0.01000	0.02278	0.00076	0.00711	0.00029	448.4	103.3	145.2	4.8	162.7	8.8	143.2	5.7	143.9	0.066420	0.000340	0.512123	0.000032	-9.9	-7.5	0.6	1063	1564
64	0.02367	0.00100	0.40800	0.03500	0.02367	0.00100	0.00709	0.00011	2065.2	136.8	150.8	6.4	347.0	25.0	142.8	2.2	135.7	0.067082	0.000058	0.512060	0.000027	-11.1	-8.8	0.5	1133	1666
37	0.02255	0.00061	0.17070	0.00590	0.02255	0.00061	0.00709	0.00026	400.0	57.3	143.7	3.9	159.5	5.1	142.7	5.2	142.7	0.090150	0.000280	0.512158	0.000030	-9.2	-7.3	0.6	1223	1543
49	0.02315	0.00078	0.20430	0.01100	0.02315	0.00078	0.00707	0.00024	725.0	93.5	147.6	4.9	186.4	9.4	142.4	4.8	144.8	0.071820	0.000850	0.512114	0.000031	-10.1	-7.8	0.6	1112	1587
41	0.02213	0.00065	0.16120	0.00770	0.02213	0.00065	0.00704	0.00026	307.2	99.8	141.1	4.1	151.2	6.8	141.8	5.2	140.5	0.085200	0.002600	0.512062	0.000034	-11.1	-9.1	0.7	1289	1690
60	0.02556	0.00110	0.54300	0.05600	0.02556	0.00110	0.00704	0.00010	2412.8	141.5	162.6	7.1	433.0	37.0	141.8	2.1	140.6	0.081920	0.000280	0.512112	0.000041	-10.1	-8.0	0.8	1200	1605
21	0.02225	0.00071	0.18920	0.00890	0.02225	0.00071	0.00702	0.00028	660.3	55.7	141.9	4.5	175.0	7.5	141.4	5.6	139.6	0.079197	0.000098	0.512133	0.000021	-9.7	-7.6	0.4	1152	1568
24	0.02330	0.00088	0.18690	0.01200	0.02330	0.00088	0.00700	0.00029	556.0	122.6	148.5	5.5	173.2	10.0	141.0	5.8	146.7	0.079970	0.000950	0.511973	0.000030	-12.8	-10.7	0.6	1340	1825
50	0.02220	0.00072	0.16700	0.00740	0.02220	0.00072	0.00695	0.00024	379.4	62.2	141.6	4.6	157.3	6.4	140.0	4.8	140.6	0.111040	0.000055	0.512092	0.000025	-10.5	-9.0	0.5	1568	1680
52	0.02132	0.00068	0.15210	0.00620	0.02132	0.00068	0.00689	0.00024	320.2	51.6	136.0	4.3	143.4	5.5	138.8	4.8	135.3	0.082120	0.000810	0.512108	0.000024	-10.2	-8.2	0.5	1206	1613
25	0.02236	0.00074	0.18140	0.00950	0.02236	0.00074	0.00687	0.00028	570.8	81.0	142.5	4.6	168.7	8.2	138.4	5.5	140.7	0.070780	0.000220	0.512056	0.000033	-11.2	-9.0	0.6	1166	1680
61	0.02244	0.00082	0.29200	0.02400	0.02244	0.00082	0.00680	0.00005	1473.6	125.4	143.0	5.2	254.0	18.0	137.1	1.1	135.2	0.087000	0.002400	0.512105	0.000031	-10.2	-8.3	0.6	1256	1625
27	0.02166	0.00069	0.16210	0.00800	0.02166	0.00069	0.00679	0.00027	395.9	69.8	138.2	4.3	152.8	6.9	136.7	5.5	137.1	0.066290	0.000100	0.512072	0.000030	-10.9	-8.6	0.6	1114	1648
38	0.02178	0.00087	0.26000	0.02300	0.02178	0.00087	0.00666	0.00027	1324.6	154.2	138.9	5.5	233.0	18.0	134.2	5.5	132.4	0.087620	0.000250	0.512086	0.000036	-10.6	-8.8	0.7	1285	1657
3	0.01509	0.00048	0.09890	0.00490	0.01509	0.00048	0.00482	0.00019	64.4	75.5	96.6	3.1	95.5	4.5	97.3	3.9	96.6	0.082680	0.000380	0.512452	0.000034	-3.5	-2.1	0.7	812	1079

Sample 11HJ04

34	0.11560	0.00430	5.58700	0.31000	0.35160	0.01200	0.10284	0.00060	1889.3	66.9	1941.0	59.0	1913.0	48.0	1978.0	11.0	1951.9	0.057790	0.000250	0.510887	0.000019	-34.0	1.1	0.4	2203	2363
28	0.10891	0.00380	5.02800	0.27000	0.33400	0.01200	0.09742	0.00059	1781.3	63.6	1857.0	56.0	1824.0	46.0	1879.0	11.0	1870.1	0.097930	0.000230	0.511173	0.000031	-28.4	-7.6	0.5	2589	2762
30	0.07960	0.00300	2.00700	0.11000	0.18530	0.00650	0.06172	0.00043	1187.1	74.4	1095.7	35.0	1117.3	37.0	1210.4	8.1	1090.8	0.104410	0.000990	0.511725	0.000033	-17.7	-3.5	0.6	1981	2104
3	0.07710	0.00200	1.68100	0.06700	0.15940	0.00600	0.04517	0.00210	1123.8	51.7	953.0	33.0	999.0	25.0	893.0	40.0	945.9	0.109900	0.001300	0.511973	0.000048	-12.8	-3.0	0.9	1724	1805
37	0.08320	0.00340	1.53900	0.08900	0.13570	0.00480	0.04159	0.00027	1273.9	79.7	820.1	27.0	947.0	36.0	823.6	5.3	802.8	0.108460	0.000540	0.512049	0.000023	-11.3	-2.1	0.4	1591	1677
13	0.08190	0.00470	1.52200	0.10000	0.13770	0.00480	0.04035	0.00190	1243.1	112.4	831.0	27.0	926.0	42.0	799.0	37.0	815.7	0.103000	0.001100	0.511984	0.000073	-12.6	-3.1	1.4	1602	1737
4	0.06190	0.00120	0.69500	0.02400	0.08114	0.00300	0.02398	0.00110	670.7	41.5	502.8	18.0	535.2	14.0	478.9	22.0	500.0	0.129400	0.001400	0.512041	0.000023	-11.5	-7.4	0.4	1998	1829
42	0.08930	0.00380	0.94200	0.05600	0.07540	0.00280	0.02334	0.00027	1410.6	81.4	468.3	17.0	672.0	29.0	466.4	5.3	449.1	0.100100	0.001600	0.512032	0.000041	-11.7	-6.0	0.8	1497	1699
38	0.08290	0.00390	0.81100	0.05000	0.07076	0.00260	0.02224	0.00023	1266.9	91.9	441.1	15.0	605.0	27.0	444.6	4.4	425.6	0.101800	0.001100	0.511984	0.000027	-12.6	-7.3	0.5	1585	1788
39	0.06620	0.00280	0.62300	0.03700	0.06991	0.00250	0.02207	0.00023	812.7	88.4	435.5	15.0	490.8	23.0	441.2	4.5	429.8	0.099500	0.001100	0.511975	0.000024	-12.8	-7.3	0.5	1565	1792
9	0.05780	0.00120	0.54700	0.01900	0.06914	0.00260	0.02203	0.00100	522.2	45.5	430.9	15.0	443.5	12.0	440.4	20.0	429.7	0.108550	0.000750	0.511794	0.000039	-16.3	-11.4	0.8	1959	2123
18	0.06930	0.00390	0.65400	0.04100	0.07040	0.00220	0.02192	0.00100	907.7	115.9	438.6	13.0	507.0	24.0	439.3	21.0	431.0	0.107600	0.001500	0.511977	0.000033	-12.7	-7.8	0.6	1681	1826
48	0.07340	0.00400	0.68500	0.04700	0.06840	0.00260	0.02193	0.00024	1025.0	110.3	426.6	16.0	525.0	28.0	438.4	4.7	416.8	0.115200	0.001900	0.511991	0.000031	-12.5	-7.9	0.6	1789	1839
36	0.11840	0.00930	1.21000	0.12000	0.07460	0.00290	0.02156	0.00027	1932.2	140.6	463.4	17.0	789.0	53.0	431.1	5.3	427.3	0.110700	0.001100	0.512004	0.000034	-12.2	-7.5	0.7	1692	1798
14	0.05700	0.00180	0.51400	0.02300	0.06519	0.00190	0.02074	0.00095	491.5	69.6	407.3	12.0	419.9	16.0	414.9	19.0	406.0	0.111800	0.002900	0.511959	0.000036	-13.1	-8.6	0.7	1777	1876
6	0.05590	0.00150	0.53900	0.02100	0.06923	0.00260	0.02072	0.00095	448.4	59.6	431.3	16.0	436.3	14.0	414.4	19.0	431.3	0.094600	0.001100	0.511856	0.000028	-15.1	-9.7	0.5	1652	1966
22	0.07720	0.00270	0.71500	0.03500	0.06715	0.00200	0.02009	0.00093	1126.4	69.7	418.8	12.0	546.0	21.0	402.0	18.0	407.3	0.111900	0.001900	0.512048	0.000030	-11.4	-11.7	0.6	1646	1735
27	0.05420	0.00230	0.25960	0.01500	0.03510	0.00120	0.01098	0.00007	379.4	95.4	222.4	7.7	234.6	12.0	220.7	1.4	221.4	0.097480	0.000400	0.512097	0.000025	-10.4	-8.9	0.4	1379	1635
19	0.05060	0.00160	0.24230	0.01100	0.03500	0.00100	0.01089	0.00050	222.6	73.1	221.7	6.3	218.9	9.1	219.0	10.0	221.8	0.094467	0.000052	0.512052	0.000034	-11.3	-8.4	0.7	1402	1700
41	0.08760	0.00570	0.31900	0.02400	0.02654	0.00100	0.00840	0.00010	1373.7	125.2	168.8	6.5	280.0	18.0	169.0	2.0	160.7	0.084700	0.000320	0.512037	0.000034	-11.6	-9.2	0.7	1314	1719
46	0.04990	0.00210	0.16790	0.00970	0.02452	0.00086	0.00803	0.00006	190.3	97.9	156.2	5.4	157.5	8.4	161.7	1.3	156.0	0.151660	0.000950	0.512270	0.000032	-7.0	-6.1	0.6	2154	1463
43	0.09200	0.00890	0.32000	0.03300	0.02537	0.00120	0.00800	0.00014	1467.4	183.7	161.4	7.6	282.0	24.0	161.1	2.8	152.7	0.077670	0.000560	0.512103	0.000051	-10.3	-7.9	1.0	1172	1605
45	0.18000	0.00750	0.70300	0.04100	0.02832	0.00100	0.00798	0.00008	2652.9	69.1	180.0	6.4	539.4	24.0	160.7	1.6	150.2	0.101290	0.000310	0.512121	0.000035	-9.9	-8.0	0.7	1393	1616
21	0.05230	0.00180	0.17210	0.00820	0.02411	0.00070	0.00790	0.00036	298.5	78.5	153.7	4.4	160.3	7.1	158.9	7.3	153.0	0.110380	0.000210	0.511942	0.000030	-13.4	-8.6	0.7	1777	1917
44	0.05350	0.00270	0.18100	0.01200	0.02454	0.00088	0.00783	0.00007	350.1	114.1	156.3	5.5	167.8	10.0	157.6	1.4	155.4	0.094750	0.000600	0.512122	0.000026	-9.9	-7.9	0.5	1316	1604
24	0.05250	0.00220	0.17570	0.00920	0.02420	0.00072	0.00780	0.00036	307.2	95.4	154.2	4.6	163.9	8.0	157.0	7.2	153.5	0.164895	0.000082	0.512254	0.000026	-7.3	-10.6	0.4	2782	1509
29	0.05590	0.00250	0.18150	0.01100	0.02396	0.00086	0.00772	0.00006	448.4	99.4	152.6	5.4	169.4	9.5	155.4	1.1	151.3	0.091900	0.000770	0.511984	0.000026	-12.6	-10.5	0.5	1457	1821
40	0.05250	0.00230	0.16770	0.01000	0.02351	0.00084	0.00772	0.00007	307.2	99.8	149.8	5.3	157.2	8.7	155.4	1.3	149.1	0.085070	0.000280	0.512008	0.000029	-12.1	-9.9	0.6	1352	1771
35	0.06150	0.00300	0.20270	0.01300	0.02393	0.00085	0.00768	0.00007	656.8	104.6	152.4	5.4	187.4	11.0	154.7	1.4	150.0	0.142700	0.000810	0.512139	0.000032	-9.6	-8.5	0.6	2162	1655
15	0.05600	0.00370	0.18000	0.01300	0.02373	0.00078	0.00764	0.00035	452.4	146.7	151.1	4.9	166.0	12.0	153.7	7.1	149.9	0.110000	0.001700	0.512172	0.000032	-8.9	-7.2	0.6	1435	1550
33	0.07970	0.00750	0.27100	0.02900	0.02559	0.00110	0.00762	0.00010	1189.6	185.8	162.8	7.0	239.0	23.0	153.5	2.0	156.6	0.067800	0.001300	0.511970	0.000040	-12.9	-10.4	0.8	1232	1805
31	0.05310	0.00250	0.16750	0.01000	0.02339	0.00083	0.00752	0.00006	333.1	106.7	149.0	5.2	157.9	9.1	151.5	1.1	148.3	0.094400	0.001600	0.512061	0.000029	-11.1	-9.1	0.6	1389	1703
25	0.05210	0.00130	0.15940	0.00670	0.02231	0.00063	0.00747	0.00035	289.8	57.0	142.3	4.0	150.1	5.9	150.5	6.9	141.7	0.111500	0.003300	0.512048	0.000032	-11.4	-8.2	0.5	1640	1750
23	0.06050	0.00480	0.18800	0.01600	0.02388	0.00086	0.00737	0.00034	621.5	171.2	152.0	5.4	171.0	14.0	148.4	6.8	149.9	0.069800	0.000840	0.512090	0.000023	-10.5	-7.0	0.6	1122	1619

47	0.08180	0.00490	0.27500	0.02000	0.02461	0.00089	0.00735	0.00005	1240.7	117.4	156.7	5.6	243.0	16.0	148.1	1.1	150.2	0.079720	0.000042	0.512003	0.000023	-12.2	-10.0	0.4	1303	1773
20	0.05840	0.00380	0.18100	0.01300	0.02296	0.00076	0.00728	0.00034	544.8	142.2	146.3	4.8	171.6	11.0	146.7	6.8	144.6	0.087710	0.000260	0.511996	0.000024	-12.4	-6.1	0.8	1394	1797
8	0.05430	0.00400	0.17200	0.01400	0.02362	0.00096	0.00728	0.00034	383.5	165.5	150.4	6.0	158.0	12.0	146.6	6.8	149.5	0.112700	0.001000	0.511959	0.000034	-13.1	-11.5	0.7	1793	1895
12	0.05420	0.00230	0.17280	0.00950	0.02323	0.00070	0.00728	0.00034	379.4	95.4	148.0	4.4	161.3	8.2	146.6	6.7	147.1	0.093520	0.000210	0.512031	0.000034	-11.7	-9.8	0.7	1417	1750
2	0.04940	0.00110	0.15760	0.00550	0.02313	0.00085	0.00728	0.00033	166.9	52.0	147.4	5.3	148.6	4.8	146.5	6.7	147.3	0.157370	0.000160	0.512228	0.000042	-7.8	-7.1	0.8	2482	1533
10	0.05210	0.00230	0.16430	0.00840	0.02288	0.00088	0.00725	0.00033	289.8	100.9	145.8	5.5	153.2	7.3	146.0	6.7	145.2	0.079030	0.000410	0.511980	0.000028	-12.7	-10.5	0.5	1323	1810
32	0.09720	0.00560	0.33200	0.02300	0.02470	0.00093	0.00724	0.00011	1571.1	107.9	157.3	5.9	290.0	18.0	145.8	2.2	147.7	0.089400	0.001500	0.512039	0.000028	-11.5	-9.5	0.5	1361	1732
26	0.07410	0.00430	0.23700	0.01700	0.02299	0.00081	0.00722	0.00005	1044.2	117.1	146.6	5.1	211.9	14.0	145.3	1.0	141.8	0.117420	0.000570	0.512044	0.000029	-11.4	-7.6	0.7	1746	1766
5	0.05250	0.00150	0.16310	0.00660	0.02236	0.00084	0.00703	0.00032	307.2	65.1	142.7	5.3	152.8	5.8	141.6	6.5	141.9	0.100420	0.000600	0.512082	0.000043	-10.7	-9.0	0.8	1435	1680
16	0.05060	0.00310	0.15540	0.01100	0.02264	0.00073	0.00702	0.00032	222.6	141.7	144.4	4.6	144.7	9.4	141.4	6.5	144.0	0.085590	0.000920	0.512042	0.000028	-11.5	-9.5	0.5	1317	1722
17	0.05200	0.00160	0.16180	0.00740	0.02232	0.00064	0.00696	0.00032	285.4	70.4	142.3	4.0	151.7	6.4	140.2	6.5	141.7	0.098100	0.001800	0.512035	0.000030	-11.6	-9.9	0.6	1468	1752
1	0.05000	0.00130	0.14620	0.00540	0.02116	0.00079	0.00660	0.00031	195.0	60.4	135.0	5.0	138.4	4.8	133.0	6.2	134.8	0.127840	0.000330	0.512108	0.000056	-10.2	-9.0	1.1	1844	1679
7	0.08210	0.00560	0.03640	0.00260	0.00332	0.00014	0.00093	0.00004	1247.9	133.5	21.4	0.9	36.4	2.5	18.8	0.9	20.4	0.102300	0.001900	0.512249	0.000045	-7.4	-7.2	0.9	1232	1436
11	0.11820	0.00890	0.03670	0.00270	0.00232	0.00011	0.00063	0.00003	1929.2	134.9	14.9	0.7	36.4	2.6	12.7	0.6	13.5	0.101000	0.002800	0.512245	0.000043	-7.5	-7.4	0.8	1223	1444

*Note: $\varepsilon_{Nd(0)} = ((^{143}Nd/^{144}Nd)_S/(^{143}Nd/^{144}Nd)_{CHUR,0}-1)\times10000$; $\varepsilon_{Nd(t)} = ((^{143}Nd/^{144}Nd)_S-(^{147}Sm/^{144}Nd)_S\times(e^{\lambda t}-1))/((^{143}Nd/^{144}Nd)_{CHUR,0}-(^{147}Sm/^{144}Nd)_{CHUR}\times(e^{\lambda t}-1))-1)\times10000$;

$(^{147}Sm/^{144}Nd)_{CHUR} = 0.1960$ and $(^{143}Nd/^{144}Nd)_{CHUR,0} = 0.512630$; $(^{147}Sm/^{144}Nd)_{DM} = 0.2137$ and $(^{143}Nd/^{144}Nd)_{DM} = 0.51315$, $\lambda^{147}Sm=6.54\times10^{-12}yr^{-1}$, and t = crystallization time of monazite;

The table is ordered by decreasing preferred $^{208}Pb/^{232}Th$ age within each grouping. $^{206}Pb/^{238}U$* is ^{207}Pb corrected $^{206}Pb/^{238}U$ age.

Table DR4 91500 standard for LA-ICPMS zircon U-Pb dating

Spot	Isotope ratios							Isotope ages (Ma)						Conc.*
	$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	rho	$^{207}Pb/^{206}Pb$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	
Z_91500std_01	0.0759	0.0030	1.8884	0.0770	0.1792	0.0028	0.3783	1100	80	1077	27	1062	15	104%
Z_91500std_02	0.0739	0.0033	1.8120	0.0782	0.1792	0.0040	0.5184	1039	91	1050	28	1062	22	98%
Z_91500std_03	0.0718	0.0030	1.7735	0.0737	0.1792	0.0038	0.5073	989	83	1036	27	1063	21	93%
Z_91500std_04	0.0780	0.0034	1.9269	0.0827	0.1791	0.0028	0.3699	1147	87	1090	29	1062	16	108%
Z_91500std_05	0.0757	0.0033	1.8674	0.0747	0.1792	0.0025	0.3430	1087	88	1070	26	1063	13	102%
Z_91500std_06	0.0741	0.0032	1.8330	0.0788	0.1791	0.0027	0.3474	1044	87	1057	28	1062	15	98%
Z_91500std_07	0.0717	0.0031	1.7790	0.0750	0.1792	0.0028	0.3755	989	81	1038	27	1063	16	93%
Z_91500std_08	0.0780	0.0036	1.9214	0.0853	0.1791	0.0028	0.3523	1148	91	1089	30	1062	15	108%
Z_91500std_09	0.0715	0.0028	1.7547	0.0652	0.1791	0.0021	0.3206	972	74	1029	24	1062	12	92%
Z_91500std_10	0.0783	0.0029	1.9457	0.0744	0.1792	0.0020	0.2960	1154	75	1097	26	1063	11	109%
Z_91500std_11	0.0730	0.0029	1.8082	0.0708	0.1792	0.0028	0.3945	1015	81	1048	26	1063	15	95%
Z_91500std_12	0.0767	0.0033	1.8922	0.0802	0.1791	0.0032	0.4213	1115	85	1078	28	1062	17	105%
Z_91500std_13	0.0736	0.0036	1.8308	0.0882	0.1794	0.0028	0.3297	1031	98	1057	32	1064	16	97%
Z_91500std_14	0.0762	0.0035	1.8696	0.0869	0.1789	0.0031	0.3698	1102	93	1070	31	1061	17	104%
Z_91500std_15	0.0718	0.0033	1.7721	0.0801	0.1792	0.0022	0.2744	989	93	1035	29	1063	12	93%
Z_91500std_16	0.0780	0.0034	1.9283	0.0829	0.1791	0.0022	0.2909	1146	87	1091	29	1062	12	108%
Z_91500std_17	0.0738	0.0030	1.8121	0.0747	0.1792	0.0028	0.3780	1035	83	1050	27	1063	15	97%
Z_91500std_18	0.0760	0.0031	1.8883	0.0810	0.1791	0.0026	0.3448	1094	83	1077	28	1062	14	103%
Z_91500std_19	0.0748	0.0034	1.8408	0.0822	0.1791	0.0031	0.3817	1065	93	1060	29	1062	17	100%
Z_91500std_20	0.0749	0.0035	1.8596	0.0870	0.1792	0.0029	0.3510	1066	99	1067	31	1063	16	100%
Z_91500std_21	0.0748	0.0034	1.8408	0.0822	0.1791	0.0031	0.3817	1065	93	1060	29	1062	17	100%
Z_91500std_22	0.0749	0.0035	1.8596	0.0870	0.1792	0.0029	0.3510	1066	99	1067	31	1063	16	100%
Z_91500std_23	0.0727	0.0031	1.7885	0.0735	0.1793	0.0032	0.4315	1006	92	1041	27	1063	17	95%
Z_91500std_24	0.0771	0.0033	1.9119	0.0829	0.1791	0.0025	0.3281	1124	86	1085	29	1062	14	106%
Z_91500std_25	0.0767	0.0033	1.8890	0.0782	0.1791	0.0025	0.3356	1122	82	1077	27	1062	14	106%
Z_91500std_26	0.0731	0.0031	1.8114	0.0805	0.1792	0.0025	0.3158	1017	87	1050	29	1063	14	96%
Z_91500std_27	0.0759	0.0032	1.8837	0.0765	0.1792	0.0026	0.3636	1092	84	1075	27	1063	14	103%
Z_91500std_28	0.0739	0.0032	1.8167	0.0710	0.1792	0.0029	0.4189	1039	87	1051	26	1062	16	98%
Z_91500std_29	0.0768	0.0028	1.8989	0.0659	0.1791	0.0025	0.4089	1117	72	1081	23	1062	14	105%
Z_91500std_30	0.0730	0.0029	1.8015	0.0693	0.1792	0.0025	0.3623	1013	81	1046	25	1063	14	95%

Z_91500std_31	0.0764	0.0031	1.8897	0.0729	0.1791	0.0025	0.3645	1106	77	1077	26	1062	14	104%
Z_91500std_32	0.0733	0.0028	1.8107	0.0670	0.1792	0.0030	0.4561	1033	77	1049	24	1063	17	97%
Z_91500std_33	0.0740	0.0032	1.8330	0.0800	0.1793	0.0025	0.3212	1043	87	1057	29	1063	14	98%
Z_91500std_34	0.0757	0.0036	1.8674	0.0864	0.1791	0.0026	0.3145	1087	97	1070	31	1062	14	102%
Z_91500std_35	0.0758	0.0033	1.8651	0.0772	0.1791	0.0028	0.3802	1100	81	1069	27	1062	15	104%
Z_91500std_36	0.0740	0.0029	1.8353	0.0739	0.1792	0.0027	0.3673	1040	77	1058	26	1063	14	98%
Z_91500std_37	0.0734	0.0030	1.8162	0.0722	0.1799	0.0025	0.3455	1033	83	1051	26	1067	13	97%
Z_91500std_38	0.0764	0.0031	1.8842	0.0770	0.1784	0.0026	0.3581	1106	81	1076	27	1058	14	104%
Z_91500std_39	0.0763	0.0034	1.8868	0.0829	0.1791	0.0030	0.3816	1106	89	1076	29	1062	16	104%
Z_91500std_40	0.0734	0.0031	1.8136	0.0713	0.1792	0.0027	0.3869	1026	85	1050	26	1063	15	97%
Z_91500std_41	0.0757	0.0033	1.8657	0.0796	0.1791	0.0027	0.3530	1087	87	1069	28	1062	15	102%
Z_91500std_42	0.0741	0.0032	1.8347	0.0785	0.1792	0.0030	0.3867	1044	88	1058	28	1063	16	98%
Z_91500std_43	0.0695	0.0032	1.7114	0.0757	0.1792	0.0027	0.3375	915	94	1013	28	1063	15	86%
Z_91500std_44	0.0735	0.0028	1.8284	0.0665	0.1791	0.0026	0.3922	1028	76	1056	24	1062	14	97%
Z_91500std_45	0.0763	0.0034	1.8720	0.0762	0.1792	0.0030	0.4069	1102	90	1071	27	1063	16	104%
Z_91500std_46	0.0763	0.0031	1.8922	0.0761	0.1793	0.0028	0.3844	1103	81	1078	27	1063	15	104%
Z_91500std_47	0.0735	0.0034	1.8082	0.0835	0.1791	0.0031	0.3766	1028	93	1048	30	1062	17	97%
Z_91500std_48	0.0735	0.0032	1.8186	0.0748	0.1791	0.0025	0.3442	1029	88	1052	27	1062	14	97%
Z_91500std_49	0.0762	0.0032	1.8818	0.0764	0.1792	0.0027	0.3664	1102	85	1075	27	1063	15	104%
Z_91500std_50	0.0763	0.0033	1.8860	0.0768	0.1793	0.0026	0.3496	1102	86	1076	27	1063	14	104%
Z_91500std_51	0.0735	0.0029	1.8144	0.0687	0.1791	0.0029	0.4262	1028	80	1051	25	1062	16	97%
Z_91500std_52	0.0752	0.0030	1.8530	0.0731	0.1791	0.0034	0.4803	1073	80	1065	26	1062	19	101%
Z_91500std_53	0.0746	0.0029	1.8474	0.0700	0.1792	0.0030	0.4361	1057	78	1062	25	1063	16	99%
Z_91500std_54	0.0756	0.0031	1.8651	0.0727	0.1792	0.0034	0.4907	1083	83	1069	26	1063	19	102%
Z_91500std_55	0.0742	0.0030	1.8353	0.0686	0.1791	0.0030	0.4460	1056	80	1058	25	1062	16	99%
Z_91500std_56	0.0705	0.0032	1.7300	0.0743	0.1791	0.0026	0.3385	944	94	1020	28	1062	14	89%
Z_91500std_57	0.0762	0.0032	1.8846	0.0753	0.1791	0.0024	0.3340	1099	84	1076	27	1062	13	103%
Z_91500std_58	0.0736	0.0031	1.8158	0.0720	0.1792	0.0025	0.3579	1031	86	1051	26	1063	14	97%
Z_91500std_59	0.0745	0.0031	1.8447	0.0798	0.1791	0.0026	0.3321	1054	88	1062	28	1062	14	99%
Z_91500std_60	0.0753	0.0029	1.8557	0.0734	0.1792	0.0027	0.3757	1076	77	1065	26	1063	15	101%
Z_91500std_61	0.0728	0.0030	1.7924	0.0751	0.1780	0.0026	0.3464	1009	89	1043	27	1056	14	96%
Z_91500std_62	0.0769	0.0032	1.9080	0.0792	0.1803	0.0026	0.3478	1120	116	1084	28	1069	14	105%
Z_91500std_63	0.0742	0.0034	1.8274	0.0771	0.1793	0.0030	0.3931	1056	97	1055	28	1063	16	99%
Z_91500std_64	0.0756	0.0036	1.8730	0.0822	0.1791	0.0026	0.3301	1084	102	1072	29	1062	14	102%
Z_91500std_65	0.0722	0.0029	1.7899	0.0671	0.1792	0.0025	0.3787	991	112	1042	24	1063	14	93%
Z_91500std_66	0.0776	0.0032	1.9105	0.0734	0.1791	0.0027	0.3893	1137	81	1085	26	1062	15	107%

Z_91500std_67	0.0758	0.0032	1.8724	0.0788	0.1791	0.0027	0.3609	1089	83	1071	28	1062	15	102%
Z_91500std_68	0.0740	0.0030	1.8280	0.0762	0.1792	0.0028	0.3754	1043	77	1056	27	1063	15	98%
Z_91500std_69	0.0723	0.0034	1.7773	0.0802	0.1791	0.0029	0.3575	994	97	1037	29	1062	16	94%
Z_91500std_70	0.0774	0.0034	1.9231	0.0845	0.1792	0.0029	0.3631	1132	88	1089	29	1063	16	107%

*Note: Conc. (Concordance)=($^{207}Pb/^{206}Pb$ age)/($^{206}Pb/^{238}U$ age)×100%

Table DR5 Trebilcock standard for LA-ICPMS monazite U-Th-Pb dating

Spot	Isotope ratios							Isotope ages (Ma)					
	$^{207}Pb/^{235}U$	2σ	$^{206}Pb/^{238}U$	2σ	rho	$^{208}Pb/^{232}Th$	2σ	$^{206}Pb/^{238}U$ age	2σ	$^{207}Pb/^{235}U$ age	2σ	$^{208}Pb/^{232}Th$	2σ
M_Trebil_1	0.3072	0.017	0.04339	0.00150	0.05	0.01354	0.00009	273.8	9.3	271.6	13.0	271.9	1.7
M_Trebil_2	0.3071	0.017	0.04290	0.00150	0.05	0.01338	0.00009	270.9	9.3	271.8	13.0	268.7	1.8
M_Trebil_3	0.3057	0.017	0.04289	0.00150	0.05	0.01354	0.00009	270.7	9.2	270.8	13.0	271.8	1.7
M_Trebil_4	0.3065	0.017	0.04320	0.00150	0.05	0.01353	0.00008	272.6	9.3	271.3	13.0	271.5	1.6
M_Trebil_5	0.3107	0.017	0.04326	0.00150	0.05	0.01353	0.00009	273.0	9.3	275.2	13.0	271.5	1.8
M_Trebil_6	0.3046	0.017	0.04305	0.00150	0.05	0.01345	0.00008	271.7	9.3	269.7	13.0	270.0	1.5
M_Trebil_7	0.3018	0.017	0.04280	0.00150	0.05	0.01349	0.00009	270.2	9.2	268.9	13.0	270.8	1.7
M_Trebil_8	0.3086	0.017	0.04330	0.00150	0.05	0.01359	0.00008	273.2	9.3	272.5	13.0	272.8	1.7
M_Trebil_9	0.3061	0.017	0.04294	0.00150	0.05	0.01340	0.00009	271.0	9.2	271.1	13.0	269.1	1.7
M_Trebil_10	0.3128	0.017	0.04358	0.00150	0.05	0.01357	0.00008	275.1	9.4	275.6	13.0	272.4	1.7
M_Trebil_11	0.3058	0.017	0.04295	0.00150	0.05	0.01359	0.00009	271.0	9.3	270.6	13.0	272.8	1.8
M_Trebil_12	0.3053	0.017	0.04310	0.00150	0.05	0.01342	0.00008	272.0	9.2	270.3	13.0	269.4	1.6
M_Trebil_13	0.3006	0.017	0.04271	0.00150	0.05	0.01343	0.00008	269.6	9.2	266.4	13.0	269.7	1.6
M_Trebil_14	0.3195	0.018	0.04382	0.00150	0.05	0.01364	0.00009	276.6	9.4	281.3	14.0	273.7	1.9
M_Trebil_15	0.2985	0.017	0.04278	0.00150	0.05	0.01345	0.00009	270.0	9.2	265.4	13.0	270.2	1.7
M_Trebil_16	0.3082	0.017	0.04318	0.00150	0.05	0.01347	0.00009	272.5	9.3	272.7	13.0	270.5	1.7
M_Trebil_17	0.3116	0.017	0.04318	0.00150	0.05	0.01354	0.00008	272.6	9.3	275.2	13.0	271.7	1.6
M_Trebil_18	0.3068	0.017	0.04316	0.00150	0.05	0.01359	0.00008	272.4	9.2	271.3	13.0	272.7	1.6
M_Trebil_19	0.3015	0.017	0.04310	0.00150	0.05	0.01339	0.00009	272.0	9.3	267.5	13.0	268.9	1.8
M_Trebil_20	0.3056	0.017	0.04277	0.00150	0.05	0.01345	0.00008	269.9	9.1	270.4	13.0	270.0	1.7
M_Trebil_21	0.3096	0.017	0.04377	0.00150	0.05	0.01364	0.00009	276.1	9.4	274.1	13.0	273.7	1.7
M_Trebil_22	0.3064	0.017	0.04280	0.00150	0.05	0.01343	0.00008	270.3	9.2	271.3	13.0	269.6	1.6

Table DR6 91500 standard for LA-MC-ICPMS zircon Lu-Hf analysis

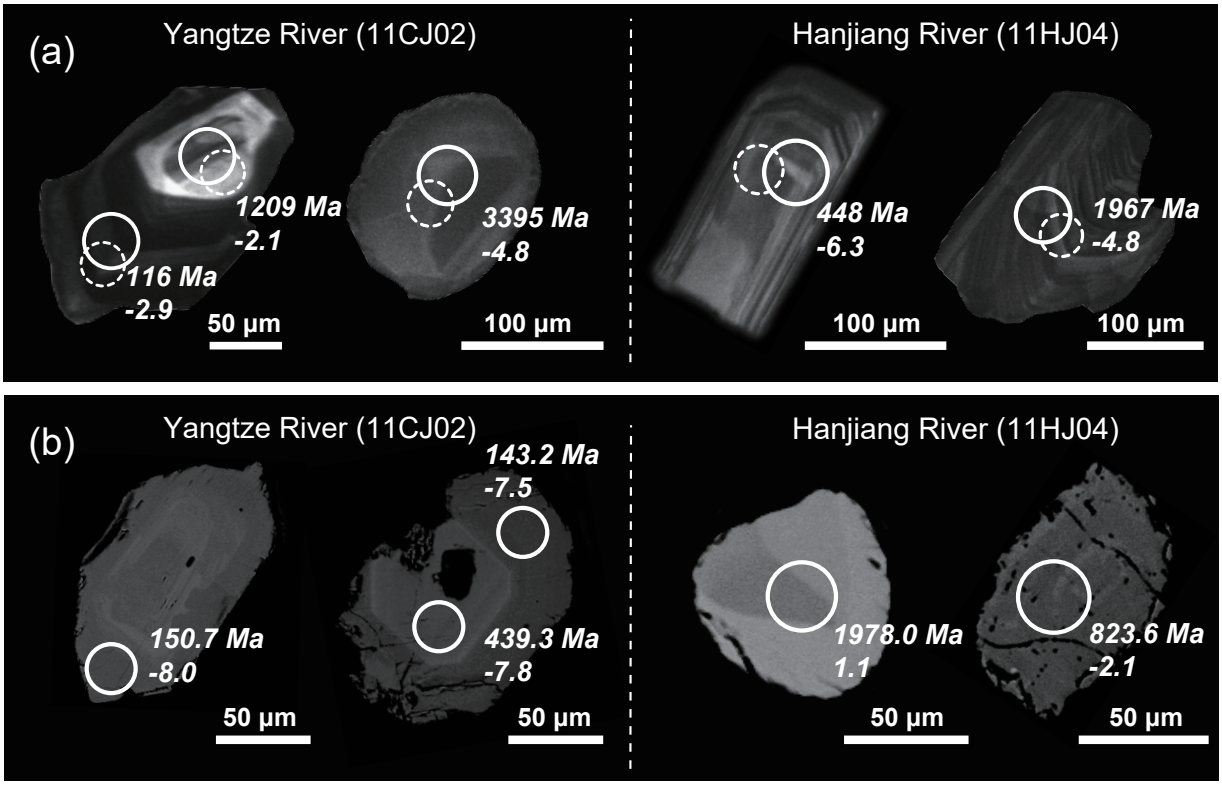
Spot	$^{176}Hf/^{177}Hf$	1σ	$^{176}Lu/^{177}Hf$	1σ	$^{176}Yb/^{177}Hf$	1σ
Z_91500st_01	0.282309	0.000017	0.000307	0.000000	0.011695	0.000044
Z_91500st_02	0.282302	0.000017	0.000307	0.000000	0.012037	0.000061
Z_91500st_03	0.282296	0.000016	0.000313	0.000000	0.011940	0.000040
Z_91500st_04	0.282299	0.000013	0.000239	0.000000	0.008371	0.000021
Z_91500st_05	0.282306	0.000012	0.000263	0.000000	0.009394	0.000021
Z_91500st_06	0.282301	0.000011	0.000276	0.000000	0.009799	0.000025
Z_91500st_07	0.282296	0.000011	0.000272	0.000000	0.009710	0.000041
Z_91500st_08	0.282298	0.000016	0.000268	0.000000	0.009565	0.000031
Z_91500st_09	0.282300	0.000011	0.000258	0.000000	0.009360	0.000049
Z_91500st_10	0.282297	0.000015	0.000268	0.000000	0.009635	0.000050
Z_91500st_11	0.282301	0.000014	0.000287	0.000000	0.010731	0.000052
Z_91500st_12	0.282301	0.000014	0.000284	0.000000	0.010744	0.000052
Z_91500st_13	0.282298	0.000014	0.000285	0.000001	0.010460	0.000057
Z_91500st_14	0.282297	0.000011	0.000285	0.000001	0.010940	0.000046
Z_91500st_15	0.282299	0.000016	0.000294	0.000000	0.011141	0.000045
Z_91500st_16	0.282296	0.000013	0.000276	0.000000	0.010259	0.000034
Z_91500st_17	0.282301	0.000014	0.000287	0.000001	0.010940	0.000017
Z_91500st_18	0.282298	0.000015	0.000245	0.000000	0.009277	0.000044
Z_91500st_19	0.282296	0.000013	0.000298	0.000001	0.011310	0.000028
Z_91500st_20	0.282301	0.000016	0.000267	0.000000	0.009998	0.000037
Z_91500st_21	0.282299	0.000014	0.000312	0.000000	0.011664	0.000054
Z_91500st_22	0.282301	0.000010	0.000266	0.000000	0.009647	0.000030
Z_91500st_23	0.282298	0.000014	0.000273	0.000000	0.010326	0.000043
Z_91500st_24	0.282295	0.000014	0.000286	0.000000	0.010867	0.000030
Z_91500st_25	0.282312	0.000014	0.000271	0.000000	0.010040	0.000023
Z_91500st_26	0.282311	0.000012	0.000283	0.000000	0.010609	0.000024
Z_91500st_27	0.282295	0.000013	0.000285	0.000000	0.010408	0.000053
Z_91500st_28	0.282302	0.000015	0.000284	0.000000	0.010316	0.000053
Z_91500st_29	0.282300	0.000011	0.000283	0.000000	0.010383	0.000043
Z_91500st_30	0.282297	0.000013	0.000285	0.000000	0.010341	0.000039
Z_91500st_31	0.282299	0.000016	0.000261	0.000000	0.009259	0.000044
Z_91500st_32	0.282298	0.000016	0.000308	0.000000	0.011464	0.000063
Z_91500st_33	0.282299	0.000011	0.000288	0.000000	0.010453	0.000052

Z_91500st_34	0.282298	0.000011	0.000280	0.000000	0.010270	0.000052
Z_91500st_35	0.282303	0.000012	0.000278	0.000000	0.010127	0.000050
Z_91500st_36	0.282294	0.000014	0.000290	0.000000	0.010596	0.000051
Z_91500st_37	0.282299	0.000013	0.000287	0.000000	0.010293	0.000043
Z_91500st_38	0.282298	0.000012	0.000281	0.000000	0.010430	0.000057
Z_91500st_39	0.282295	0.000011	0.000287	0.000000	0.010510	0.000100
Z_91500st_40	0.282302	0.000013	0.000281	0.000000	0.010213	0.000081
Z_91500st_41	0.282302	0.000011	0.000267	0.000001	0.009693	0.000035
Z_91500st_42	0.282295	0.000012	0.000301	0.000001	0.011031	0.000021
Z_91500st_43	0.282298	0.000016	0.000294	0.000001	0.010784	0.000043
Z_91500st_44	0.282299	0.000016	0.000275	0.000000	0.009939	0.000055
Z_91500st_45	0.282300	0.000013	0.000322	0.000000	0.011575	0.000043
Z_91500st_46	0.282297	0.000015	0.000301	0.000000	0.010509	0.000040
Z_91500st_47	0.282299	0.000012	0.000316	0.000000	0.011484	0.000058
Z_91500st_48	0.282295	0.000013	0.000311	0.000000	0.011309	0.000048
Z_91500st_49	0.282297	0.000015	0.000285	0.000000	0.010196	0.000044
Z_91500st_50	0.282297	0.000014	0.000334	0.000000	0.012006	0.000045
Z_91500st_51	0.282300	0.000014	0.000323	0.000001	0.011646	0.000036
Z_91500st_52	0.282294	0.000013	0.000296	0.000000	0.010556	0.000038

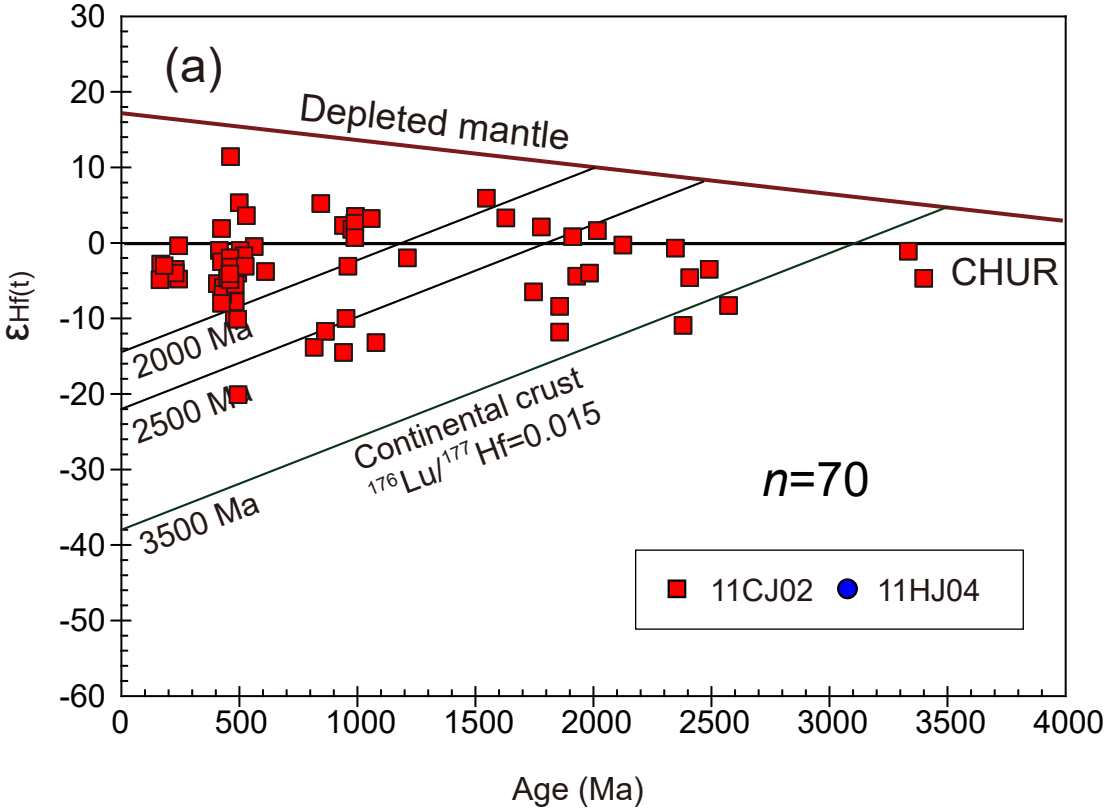
Table DR7 Synthetic LREE glass and Trebilcock standards for LA-MC-ICPMS monazite Sm-Nd analysis

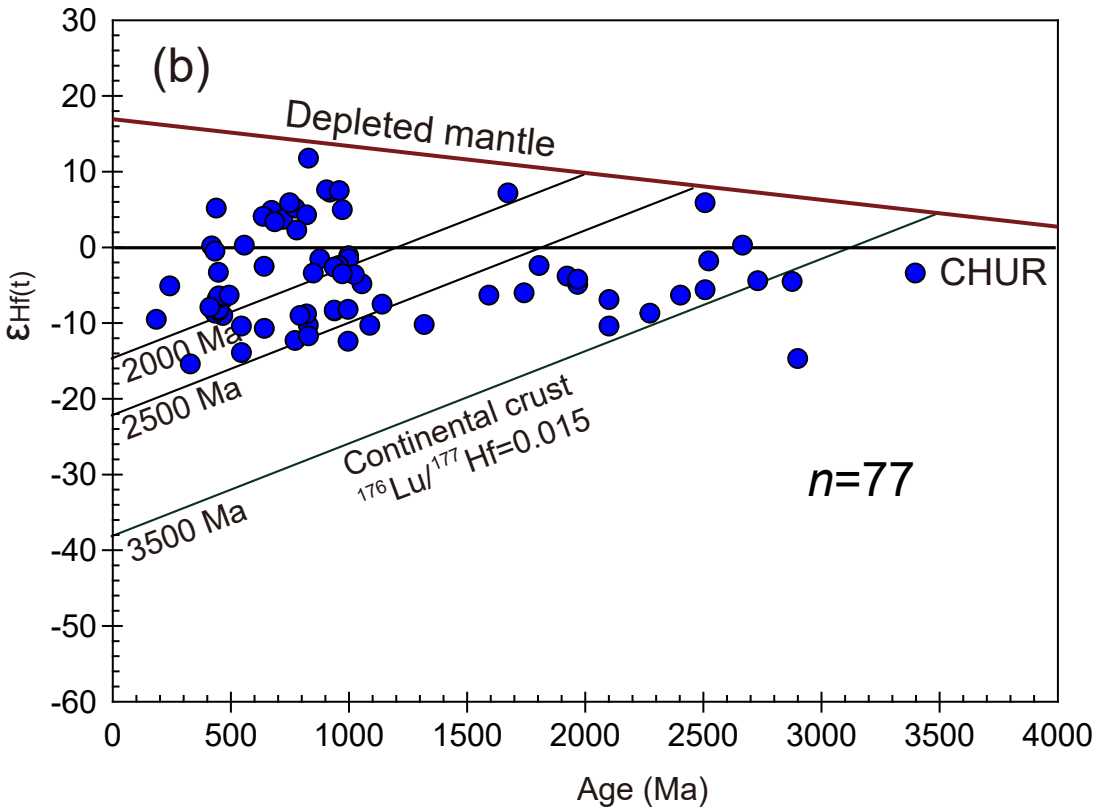
Spot	$^{147}Sm/^{144}Nd$	2σ	$^{143}Nd/^{144}Nd$	2σ	$^{145}Nd/^{144}Nd$	2σ
G_LREE_1	0.24506	0.00020	0.512090	0.000023	0.348419	0.000017
G_LREE_2	0.24519	0.00015	0.512091	0.000022	0.348431	0.000014
G_LREE_3	0.24489	0.00020	0.512088	0.000025	0.348425	0.000012
G_LREE_4	0.24510	0.00024	0.512106	0.000024	0.348423	0.000015
G_LREE_5	0.24535	0.00019	0.512113	0.000026	0.348416	0.000013
G_LREE_6	0.24479	0.00019	0.512105	0.000022	0.348420	0.000015
G_LREE_7	0.24523	0.00015	0.512073	0.000025	0.348415	0.000018
G_LREE_8	0.24507	0.00012	0.512112	0.000024	0.348431	0.000011
G_LREE_9	0.24532	0.00029	0.512085	0.000022	0.348419	0.000018
G_LREE_10	0.24492	0.00021	0.512089	0.000024	0.348425	0.000015
G_LREE_11	0.24508	0.00020	0.512092	0.000028	0.348421	0.000017
G_LREE_12	0.24526	0.00016	0.512127	0.000028	0.348418	0.000021
G_LREE_13	0.24482	0.00018	0.512103	0.000022	0.348420	0.000017
G_LREE_14	0.24532	0.00019	0.512104	0.000029	0.348414	0.000019
G_LREE_15	0.24499	0.00021	0.512082	0.000030	0.348417	0.000020
G_LREE_16	0.24510	0.00017	0.512093	0.000030	0.348432	0.000017
M_Trebil_1	0.21296	0.00006	0.512594	0.000029	0.348432	0.000027
M_Trebil_2	0.21268	0.00003	0.512616	0.000029	0.348443	0.000014
M_Trebil_3	0.21074	0.00003	0.512610	0.000022	0.348446	0.000015
M_Trebil_4	0.21093	0.00001	0.512600	0.000025	0.348464	0.000017
M_Trebil_5	0.21294	0.00008	0.512590	0.000025	0.348434	0.000021
M_Trebil_6	0.21375	0.00005	0.512606	0.000024	0.348425	0.000011
M_Trebil_7	0.21106	0.00003	0.512589	0.000019	0.348428	0.000017
M_Trebil_8	0.21629	0.00004	0.512603	0.000028	0.348462	0.000016
M_Trebil_9	0.21584	0.00004	0.512617	0.000031	0.348441	0.000022
M_Trebil_10	0.21672	0.00012	0.512611	0.000022	0.348441	0.000028
M_Trebil_11	0.21342	0.00005	0.512607	0.000026	0.348447	0.000020
M_Trebil_12	0.21606	0.00003	0.512588	0.000028	0.348441	0.000019
M_Trebil_13	0.21559	0.00006	0.512616	0.000043	0.348428	0.000014
M_Trebil_14	0.21642	0.00005	0.512611	0.000028	0.348434	0.000018
M_Trebil_15	0.21534	0.00013	0.512606	0.000024	0.348430	0.000018
M_Trebil_16	0.21589	0.00006	0.512590	0.000024	0.348434	0.000019

M_Trebil_17	0.21663	0.00005	0.512605	0.000030	0.348436	0.000019
M_Trebil_18	0.21719	0.00010	0.512602	0.000027	0.348428	0.000019
M_Trebil_19	0.21655	0.00004	0.512599	0.000030	0.348432	0.000014
M_Trebil_20	0.21164	0.00031	0.512618	0.000024	0.348442	0.000019
M_Trebil_21	0.21559	0.00010	0.512607	0.000024	0.348434	0.000020
M_Trebil_22	0.21580	0.00010	0.512584	0.000024	0.348431	0.000017

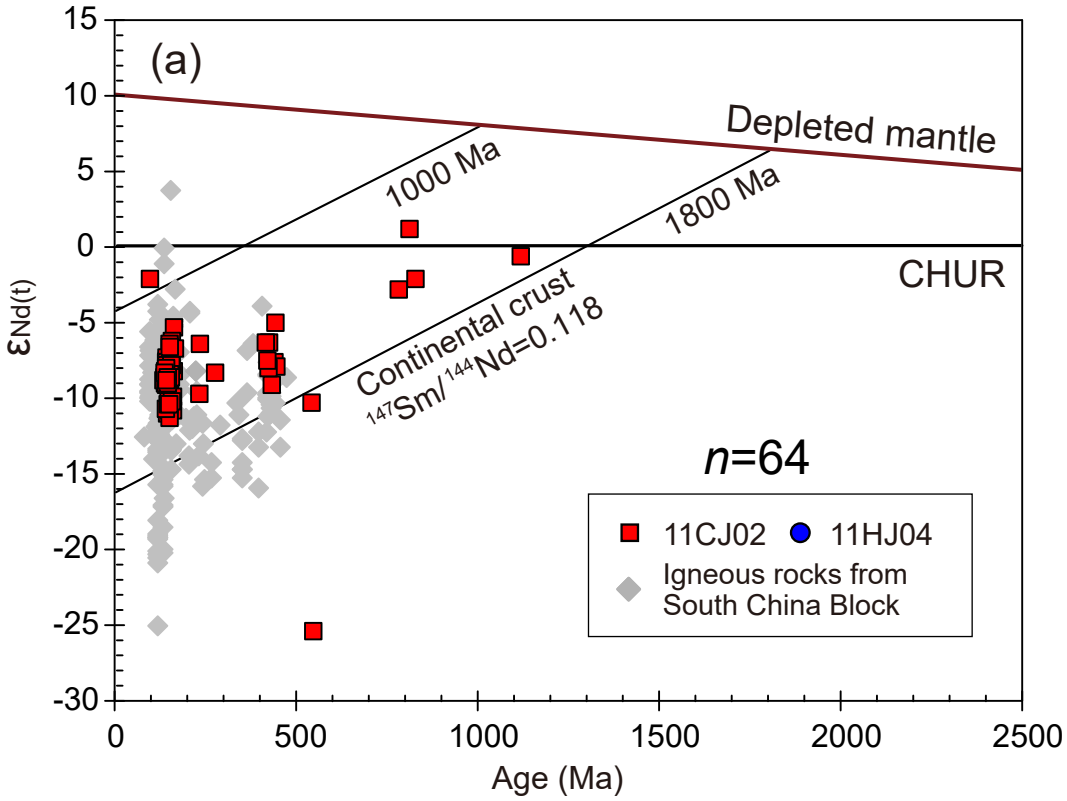


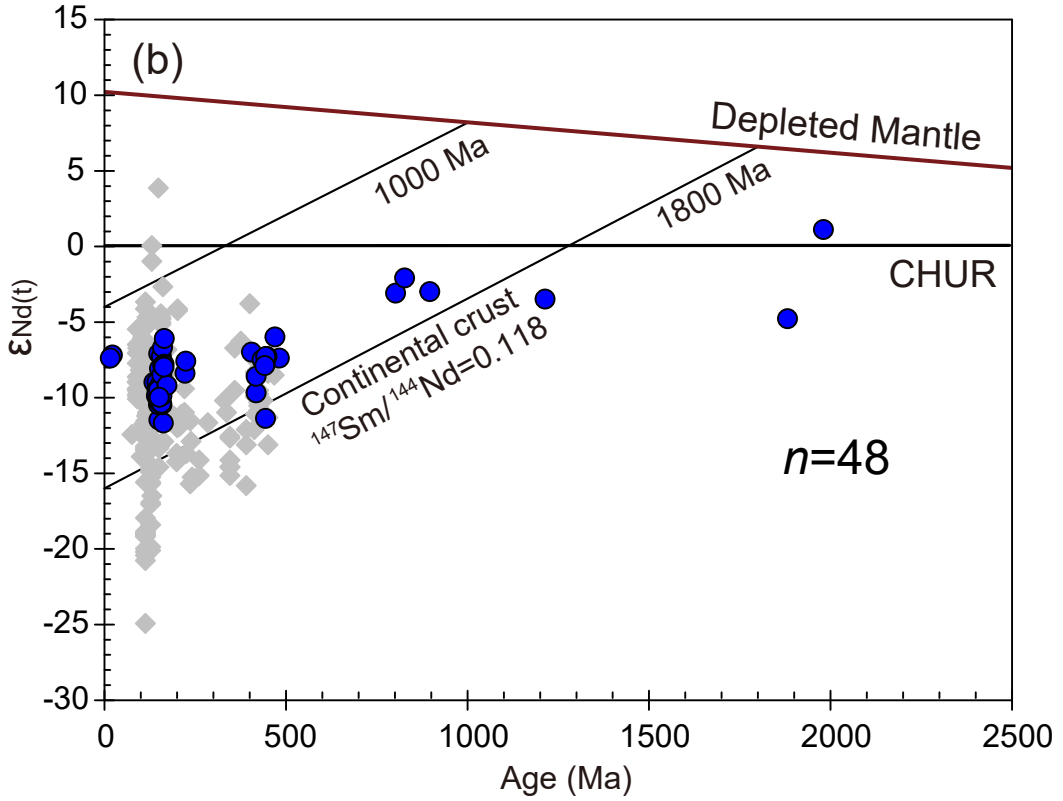
Liu et al., Figure DR1





Liu et al., Figure DR2





Liu et al., Figure DR3