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Supplemental Material

Table S1. Detail analytical methods

Table S2. Analytical results of major- and trace- element compositions of the Lower Ediacaran Sugetbrak basalts in the northwest Tarim Craton.

Table S3. Analytical results of Sr–Nd–Hf–Pb isotope compositions of the Lower Ediacaran Sugetbrak basalts in the northwest Tarim Craton.

Table S4. Laser-ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS) U-Pb data for detrital zircons in the Sugetbrak Formation sandstones.

Table S5. Compilation of zircon U-Pb dating data for the magmatic rocks from the Central Tianshan terrane.

Figure S1. Cathodoluminescence (CL) images of representative zircons with analyzed spots and preferred ages (in Ma).

Figure S2. Detrital zircon Th/U ratio versus age plot for two sandstone samples in this study.

TABLE S1. DETAIL ANALYTICAL METHODS.

4.1. Whole-rock major- and trace-elemental analyses

Twelve basaltic lava samples were selected for whole-rock major- and trace-element analyses. All samples were sawed into slabs, of which the central parts were used before powdered into a 200-mesh-size by using an agate mill. Major elements were determined using X-ray fluorescence spectrometry (ZSXPrimusII) at the Wuhan Sample Solution Analytical Technology Co., Ltd., China. Analytical precision was generally better than 1%. Trace elements were analyzed using Agilent 7700e ICP-MS at the Wuhan Sample Solution Analytical Technology Co., Ltd, China. The detailed sample-digesting procedure for ICP-MS analyses and analytical precision and accuracy for trace elements were the same as those described by Liu et al. (2008b).

References:

Liu, Y., Zong, K., Kelemen, P.B. and Gao, S., 2008b, Geochemistry and magmatic history of eclogites and ultramafic rocks from the Chinese continental scientific drill hole: Subduction and ultrahigh-pressure metamorphism of lower crustal cumulates: Chemical Geology, v. 247, p. 133-153, doi:10.1016/j.chemgeo.2007.10.016.

4.2. Whole-rock Sr-Nd-Pb-Hf isotope analyses

Four basaltic lava samples were selected for Sr, Nd, Pb and Hf isotope analyses at the Wuhan Sample Solution Analytical Technology Co., Ltd., China. About 50-200 mg rock powders have been completely dissolved in a mixture of HNO_3 + HCl + HF for Sr-Nd isotope analysis. Rb, Sr, Sm and Nd were separated using conventional ion exchange procedures and measured using a Neptune Plus MC-ICP-MS. The isotopic ratios were corrected for mass fractionation by normalizing to $^{88}Sr/^{86}Sr$ = 8.3752 and $^{146}Nd/^{144}Nd$ = 0.7219, respectively. The measured values for the GSB 04-3258-2015 standard yielded $^{143}Nd/^{144}Nd$ = 0.512439 ± 0.000030 (2σ, n = 8) (Li et al., 2016) and the NBS987 standard yielded $^{87}Sr/^{86}Sr$ = 0.710241 ± 0.000004 (2σ, n = 8), respectively (Thirlwall, 1991). USGS reference material BCR-2 and AGV-2 were measured to monitor the accuracy of the analytical procedures (Zhang and Hu, 2020). The BCR-2 yielded $^{143}Nd/^{144}Nd$ = 0.512644 ± 0.000006 and $^{87}Sr/^{86}Sr$ = 0.705012 ± 0.000008 (2σ, n = 1); and the AGV-2 yielded $^{143}Nd/^{144}Nd$ = 0.512801 ± 0.000006 and $^{87}Sr/^{86}Sr$ = 0.703966 ± 0.000007 (2σ, n = 1), respectively.

For Pb isotope determination, the whole rock powders were dissolved in Teflon vials with purified HF + HNO_3 at 190 °C for above 24 hours and then separated using anion-exchange columns with diluted HBr and HCl as elutant. The isotopic ratios were also performed on the Neptune Plus MC-ICP-MS. Repeated analyses of Pb isotope standard NBS981 yielded $^{208}Pb/^{204}Pb$ = 36.7264 ± 0.0008, $^{206}Pb/^{204}Pb$ = 16.9413 ± 0.0003 and $^{207}Pb/^{204}Pb$ = 15.4999 ± 0.0003 (2σ, n = 4) (Baker et al., 2004). The USGS reference materials BCR-2 yielded results of $^{208}Pb/^{204}Pb$ = 38.7413 ± 0.0017, $^{207}Pb/^{204}Pb$ = 15.6283 ± 0.0006, $^{206}Pb/^{204}Pb$ = 18.7600 ± 0.0007 (2σ, n = 1), and the AGV-2 yielded results of $^{208}Pb/^{204}Pb$ =

38.5446 ± 0.0015, $^{207}Pb/^{204}Pb$ = 15.6204 ± 0.0006, $^{206}Pb/^{204}Pb$ = 18.8673 ± 0.0007 (2σ, n = 1), respectively (Zhang and Hu, 2020).

For the Hf isotopic composition, about 50-200 mg rock powder were dissolved in Teflon vials with purified HF + HNO_3 at 190 °C for 24 hours and then separated using anion-exchange columns with diluted HCl and HF as elutant. Hf isotopes were determined using a Neptune Plus MC-ICP-MS. Repeated Hf isotopic analyses of laboratory internal standard AlfaHf during the period of sample analyses yielded a mean of $^{176}Hf/^{177}Hf$ = 0.282224 ± 0.000003 (2σ, n = 6), similar to the recommended value of 0.282224 ± 0.000015 (2σ). During the course of this study, basalt standards BCR-2 yield $^{176}Hf/^{177}Hf$ ratios of 0.282872 ± 0.000007, and AGV-2 yield $^{176}Hf/^{177}Hf$ ratios of 0.282982 ±0.000007 (2σ, n = 1) and ensured the accuracy of the analytical procedures.

References:

Baker, J., Peate, D., Waight, T., and Meyzen, C., 2004, Pb isotopic analysis of standards and samples using a 207Pb- 204Pb double spike and thallium to correct for mass bias with a double-focusing MC-ICP-MS: Chemical Geology, v. 211, p. 275-303, doi:10.1016/j.chemgeo.2004.06.030.

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4.3. Detrital zircon U-Pb dating

U-Pb ages of detrital zircons were obtained from two sandstone samples. Zircon grains were separated using heavy-liquid and magnetic techniques, and were then randomly selected, embedded in epoxy resin, and polished. After being photographed under reflected and transmitted light, the zircon samples were prepared for cathodoluminescence (CL) imaging. This process was finished at Langfang Chengxin Geological Service Co. Ltd, China. Zircon U-Pb dating was conducted at the La-ICP-MS laboratory in the School of Earth Science, Zhejiang University, China. Detailed operating conditions for the laser-ablation system and the ICP-MS instrument and data reduction are the same as described by Liu et al., 2008a and Liu et al., 2010. Laser sampling was performed using Cetea Analyte HE with a beam spot of 35μm in diameter. A Thermofisher iCAP RQ ICP-MS instrument was used to acquire ion-signal intensities. NIST610 and NIST612 were used as external standards for element correction, and zircon 91500 was used as the external standard for the U-Pb dating and was analyzed twice every five analyses (Jackson et al., 2004). Plešovice (337 Ma) were treated as quality control for geochronology. An in-house Excel-based software ICPMSDataCal (Ver. 11.8) was used to perform off-line selection and integration of background and analytic signals, as well as time-drift correction and quantitative calibration for trace element analysis and U-Pb dating (Liu et al., 2008b, Liu et al., 2010). Each sample was tested with 100 data points. Interpreted ages are based on $^{206}Pb/^{238}U$ for <1000 Ma grains and $^{206}Pb/^{207}Pb$ for >1000 Ma grains. Concordia diagrams were made using IsoplotR, and single-spot ages with 90-110% concordance are plotted as Kernel Density Estimation (KDE) diagrams using Density Plotter (Vermeesch, 2018).

References:

Liu, Y., Gao, S., Hu, Z., Gao, C., Zong, K. and Wang, D., 2010, Continental and Oceanic Crust Recycling-induced Melt-Peridotite Interactions in the Trans-North China Orogen: U–Pb Dating, Hf Isotopes and Trace Elements in Zircons from Mantle Xenoliths: Journal of Petrology, v. 51, p. 537-571, doi:10.1093/petrology/egp082.

Liu, Y., Hu, Z., Gao, S., Günther, D., Xu, J., Gao, C. and Chen, H., 2008a, In situ analysis of major and trace elements of anhydrous minerals by LA-ICP-MS without applying an internal standard: Chemical Geology, v. 257, p. 34-43, doi:10.1016/j.chemgeo.2008.08.004.

Jackson, S.E., Pearson, N.J., Griffin, W.L. and Belousova, E.A., 2004, The application of laser ablation-inductively coupled plasma-mass spectrometry to in situ U-Pb zircon geochronology: Chemical Geology, v. 211, p. 47-69, doi:10.1016/j.chemgeo.2004.06.017.

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TABLE S2. ANALYTICAL RESULTS OF MAJOR- AND TRACE- ELEMENT COMPOSITIONS OF THE LOWER EDIACARAN SUGETBRAK BASALTS IN THE NORTHWEST TARIM CRATON.

Sample No.	95AKS19			97AKS19	98AKS19			101AKS19		104AKS19		
	a	b	e	d	a	b	c	a	c	a	d	f
Major element data for bulk rocks (wt.%)												
SiO_2	46.05	44.32	44.49	47.27	43.54	47.10	46.57	45.98	45.36	48.00	45.70	45.45
TiO_2	3.17	3.03	3.19	3.04	2.34	2.41	2.44	2.90	2.81	2.82	2.78	2.82
Al_2O_3	15.19	15.47	15.20	14.62	16.76	17.23	17.10	17.29	16.95	17.55	16.77	16.76
TFe_2O_3	15.55	15.91	15.85	19.70	12.67	13.37	12.77	15.45	16.32	13.80	15.68	15.65
MnO	0.23	0.24	0.36	0.13	0.34	0.19	0.25	0.18	0.23	0.10	0.10	0.12
MgO	5.50	6.36	5.86	3.46	3.88	5.42	5.88	4.42	4.99	4.95	4.47	5.56
CaO	6.36	6.32	6.20	3.20	10.33	7.68	8.09	4.69	3.77	4.98	6.03	6.23
Na_2O	3.44	3.32	3.38	4.60	3.07	3.04	2.89	5.17	5.19	3.94	3.73	3.49
K_2O	1.08	1.03	1.43	1.40	0.57	0.77	0.73	0.48	0.72	0.47	0.38	0.50
P_2O_5	0.48	0.47	0.50	0.46	0.47	0.45	0.47	0.45	0.44	0.43	0.42	0.42
LOI	2.80	3.14	3.15	2.22	5.51	2.27	2.59	2.77	3.29	2.67	3.62	2.72
Sum	99.84	99.58	99.61	100.11	99.47	99.94	99.77	99.77	100.07	99.70	99.67	99.70
Mg#	41.20	44.19	42.28	25.79	37.76	44.52	47.70	36.20	37.74	41.54	36.09	41.29
Trace element data for bulk rocks (ppm)												
Li	24.94	28.94	26.02	12.82	13.01	32.36	24.30	16.85	24.97	22.77	23.08	21.58
Be	1.48	1.87	1.50	1.19	1.31	1.20	1.11	1.30	1.23	1.09	1.22	1.30
Sc	25.15	27.51	27.61	24.37	21.11	21.61	21.21	22.54	21.48	20.59	20.40	21.43
V	258.46	280.57	250.95	260.87	191.98	204.69	193.56	212.80	210.66	192.27	203.65	216.14
Cr	66.43	71.22	58.61	60.99	55.35	60.51	58.05	55.40	53.29	55.89	57.50	57.36
Co	49.59	50.76	52.23	29.99	50.38	46.11	59.47	51.32	49.61	53.12	52.31	50.80

Ni	86.21	88.24	87.10	57.84	127.60	129.19	134.72	149.99	144.12	130.41	138.45	145.38
Cu	185.83	920.37	443.15	40.45	60.07	131.24	73.56	86.48	114.01	68.61	34.97	27.89
Zn	139.70	151.43	142.64	86.13	117.76	121.94	119.49	124.86	120.17	86.11	118.40	169.24
Ga	23.62	24.80	26.07	22.24	22.42	22.51	22.61	22.36	21.74	22.39	21.61	22.82
Rb	13.00	13.35	14.99	21.54	7.93	11.80	4.79	5.26	10.86	5.60	5.12	7.41
Sr	329.98	348.62	348.52	449.21	527.99	517.44	442.61	486.18	514.87	520.24	441.47	482.76
Y	34.56	33.59	35.37	31.08	26.72	26.28	24.60	32.16	31.16	26.15	28.43	30.60
Zr	220.52	225.30	230.64	213.88	174.73	171.24	172.76	210.17	200.50	196.36	197.91	203.15
Nb	23.16	24.73	24.87	21.86	16.92	16.91	16.73	22.21	21.11	20.77	20.12	21.38
Sn	1.72	2.00	1.97	1.81	1.40	1.23	1.29	1.80	1.69	1.53	1.48	1.62
Cs	0.07	0.10	0.06	0.07	0.16	0.10	0.33	0.09	0.11	0.09	0.12	0.10
Ba	370.02	528.48	1086.45	514.79	557.08	611.55	278.70	200.45	216.31	436.89	304.79	369.52
La	26.77	26.79	27.41	26.32	26.32	24.69	26.54	26.67	25.57	25.19	23.24	24.45
Ce	58.50	58.65	61.28	56.00	54.82	52.83	53.82	56.48	55.06	53.74	50.61	53.00
Pr	7.35	7.45	7.85	7.09	6.80	6.49	6.73	7.13	7.04	6.55	6.40	6.86
Nd	32.42	32.55	34.33	31.29	29.44	28.30	28.86	30.76	30.08	28.53	27.79	29.50
Sm	7.48	7.28	7.83	6.81	5.99	6.00	5.84	6.53	6.57	5.85	5.78	6.31
Eu	2.49	2.53	2.64	2.30	2.28	2.22	2.15	2.32	2.34	2.10	2.12	2.22
Gd	7.22	7.05	7.46	6.58	5.97	5.66	5.59	6.79	6.66	5.84	6.27	6.61
Tb	1.15	1.17	1.23	1.10	0.94	0.88	0.89	1.09	1.07	0.91	0.95	1.04
Dy	6.65	6.66	6.90	6.20	5.18	5.17	5.10	6.30	6.18	5.42	5.72	6.13
Ho	1.24	1.21	1.29	1.12	0.95	0.94	0.90	1.14	1.12	0.98	1.05	1.06
Er	3.29	3.23	3.36	3.03	2.49	2.61	2.36	3.08	2.89	2.58	2.79	2.90
Tm	0.47	0.46	0.47	0.42	0.35	0.36	0.34	0.43	0.41	0.37	0.38	0.41
Yb	2.82	2.70	2.89	2.66	2.20	2.22	2.09	2.65	2.54	2.31	2.36	2.51
Lu	0.43	0.41	0.41	0.38	0.32	0.31	0.30	0.38	0.37	0.33	0.34	0.37

Hf	5.41	5.37	5.58	5.19	4.05	4.15	3.95	4.88	4.78	4.54	4.57	4.71
Ta	1.36	1.47	1.50	1.28	0.96	0.99	0.95	1.31	1.26	1.27	1.25	1.32
Tl	0.05	0.06	0.06	0.08	0.03	0.02	0.02	0.02	0.04	0.02	0.02	0.02
Pb	2.74	2.98	2.62	4.97	18.30	2.66	7.81	3.74	3.71	6.22	12.08	8.12
Th	2.26	2.14	2.31	2.22	1.78	1.67	1.75	2.17	2.11	2.04	2.00	2.12
U	0.57	0.57	0.58	0.92	0.40	0.41	0.41	0.54	0.56	0.49	0.48	0.49
Ti/Y	550	543	543	586	529	551	596	543	541	649	588	554
(La/Yb)N	6.81	7.12	6.81	7.09	8.58	7.99	8.38	7.23	7.22	7.82	7.06	6.99
(La/Sm)N	2.31	2.38	2.26	2.49	2.83	2.66	2.75	2.64	2.51	2.78	2.60	2.50
δEu	1.02	1.07	1.04	1.04	1.15	1.15	1.14	1.05	1.07	1.09	1.07	1.04

Mg# = [molar Mg/(Mg + Fe2+)]×100, assuming 10% of total iron oxide is ferric.

TABLE S3. ANALYTICAL RESULTS OF SR–ND–HF–PB ISOTOPE COMPOSITIONS OF THE LOWER EDIACARAN SUGETBRAK BASALTS IN THE NORTHWEST TARIM CRATON.

Sample	95AKS19a	97AKS19d	98AKS19b	104AKS19a
Rocks	aphyric basalt	aphyric basalt	feldspar-phyric basalt	aphyric basalt
Age (Ma)	615 Ma	615 Ma	615 Ma	615 Ma
Rb (ppm)	13.00	21.54	11.80	5.60
Sr (ppm)	329.98	449.21	517.43	520.24
$^{87}Rb/^{86}Sr$	0.113979	0.138746	0.065972	0.031141
$^{87}Sr/^{86}Sr$	0.707303	0.708629	0.706341	0.706886
2 Sigma	0.000007	0.000008	0.000006	0.000007
$(^{87}Sr/^{86}Sr)i$	0.706303	0.707412	0.705762	0.706613
Sm (ppm)	7.48	6.81	6.00	5.85
Nd (ppm)	32.42	31.29	28.30	28.53
$^{147}Sm/^{144}Nd$	0.139563	0.131527	0.128162	0.124087
$^{143}Nd/^{144}Nd$	0.512378	0.512376	0.512220	0.512406
2 Sigma	0.000005	0.000008	0.000005	0.000006
$(^{143}Nd/^{144}Nd)i$	0.511816	0.511846	0.511703	0.511906
εNd(t)	-0.58	0.01	-2.77	1.18
$^{208}Pb/^{204}Pb$	38.5881	37.9535	38.2144	37.8966
$^{207}Pb/^{204}Pb$	15.5111	15.4904	15.4878	15.4785
$^{206}Pb/^{204}Pb$	17.8718	17.5374	17.5531	17.3722
Pb (ppm)	2.74	4.97	2.66	6.22
Th (ppm)	2.26	2.22	1.67	2.04
U (ppm)	0.57	0.92	0.41	0.49
$(^{208}Pb/^{204}Pb)i$	38.2548	37.7752	37.9627	37.7663
$(^{207}Pb/^{204}Pb)i$	15.4986	15.4795	15.4786	15.4739
$(^{206}Pb/^{204}Pb)i$	17.6137	17.3124	17.3644	17.2765
$^{176}Hf/^{177}Hf$	0.282664	0.282664	0.282578	0.282663
2 Sigma	0.000006	0.000008	0.000007	0.000009
$(^{176}Hf/^{177}Hf)i$	0.282537	0.282547	0.282458	0.282546
Lu	0.43	0.38	0.31	0.33
Hf	5.41	5.19	4.15	4.54
εHf(t)	5.24	5.59	2.46	5.59
2 Sigma	0.23	0.28	0.27	0.31
T_{DM2}(Ma)	1223	1200	1398	1200

TABLE S4. LASER-ABLATION-INDUCTIVELY COUPLED PLASMA-MASS SPECTROMETRY (LA-ICP-MS) U-PB DATA FOR DETRITAL ZIRCONS IN THE SUGETBRAK FORMATION SANDSTONES.

Spot	Isotopic ratios						Th/U	Isotopic Ages						Concor-dance	Interpreted ages	
	$^{207}Pb/^{206}Pb$	$^{207}Pb/^{206}Pb$	$^{207}Pb/^{235}U$	$^{207}Pb/^{235}U$	$^{206}Pb/^{238}U$	$^{206}Pb/^{238}U$		$^{207}Pb/^{206}Pb$	$^{207}Pb/^{206}Pb$	$^{207}Pb/^{235}U$	$^{207}Pb/^{235}U$	$^{206}Pb/^{238}U$	$^{206}Pb/^{238}U$			
	Ratio	1sigma	Ratio	1sigma	Ratio	1sigma		Ma	1sigma	Ma	1sigma	Ma	1sigma		Ma	1sigma
Sample 96AKS19																
1	0.110690	0.001293	4.819794	0.059566	0.315114	0.002729	0.81	1811	21	1788	10	1766	13	98%	1811	21
2	0.064942	0.001255	1.151029	0.023093	0.128170	0.001193	1.29	772	38	778	11	777	7	99%	777	7
3	0.122727	0.003612	5.891597	0.167781	0.351151	0.005428	1.13	1996	45	1960	25	1940	26	98%	1996	45
4	0.115320	0.001504	5.317436	0.076960	0.333635	0.003164	1.43	1885	28	1872	12	1856	15	99%	1885	28
5	0.060268	0.001162	0.835333	0.018292	0.100053	0.001219	0.45	613	35	617	10	615	7	99%	615	7
6	0.063395	0.001610	1.109473	0.026309	0.127986	0.001671	1.10	720	48	758	13	776	10	97%	776	10
7	0.126606	0.002408	6.788506	0.202045	0.382983	0.004708	0.84	2052	32	2084	26	2090	22	99%	2052	32
8	0.111122	0.001522	4.979996	0.072355	0.325241	0.003506	1.45	1818	24	1816	12	1815	17	99%	1818	24
9	0.109955	0.001790	5.087458	0.085919	0.335776	0.003797	1.05	1798	28	1834	14	1866	18	98%	1798	28
10	0.111315	0.001451	5.122858	0.072211	0.333325	0.003438	0.95	1821	29	1840	12	1854	17	99%	1821	29
11	0.134325	0.001522	7.536510	0.094920	0.406121	0.004315	0.54	2155	20	2177	11	2197	20	99%	2155	20
12	0.065344	0.001667	1.122011	0.026354	0.125586	0.001849	1.47	787	50	764	13	763	11	99%	763	11
13	0.060250	0.001359	0.827526	0.018587	0.099645	0.001084	0.91	613	47	612	10	612	6	99%	612	6
14	0.117310	0.001239	5.718709	0.067885	0.352019	0.003311	0.55	1917	18	1934	10	1944	16	99%	1917	18
15	0.111811	0.001415	5.012656	0.065407	0.324529	0.003153	1.09	1829	24	1821	11	1812	15	99%	1829	24
16	0.118529	0.001128	5.765796	0.061276	0.351241	0.002887	0.26	1944	17	1941	9	1941	14	99%	1944	17
17	0.064293	0.001536	1.168623	0.026525	0.132350	0.001780	0.77	750	38	786	12	801	10	98%	801	10
18	0.108731	0.001638	4.999464	0.084392	0.332212	0.003566	1.47	1789	26	1819	14	1849	17	98%	1789	26
19	0.069139	0.000979	1.418408	0.022629	0.148190	0.001549	0.62	902	44	897	10	891	9	99%	891	9
20	0.065369	0.001140	1.156620	0.018767	0.128881	0.001381	0.62	787	34	780	9	781	8	99%	781	8
21	0.064651	0.001094	1.128446	0.020767	0.126608	0.001386	1.07	765	35	767	10	768	8	99%	768	8

22	0.064556	0.001649	1.099994	0.027783	0.124050	0.001640	0.52	761	56	753	13	754	9	99%	754	9
23	0.066094	0.000924	1.227851	0.018259	0.134636	0.001362	1.01	809	32	813	8	814	8	99%	814	8
24	0.111321	0.001676	4.805863	0.077365	0.313270	0.003545	1.68	1821	27	1786	14	1757	17	98%	1821	27
25	0.111457	0.001255	4.954672	0.063011	0.321958	0.003174	0.77	1833	20	1812	11	1799	16	99%	1833	20
26	0.110729	0.001419	4.944200	0.075952	0.322759	0.003781	0.72	1813	20	1810	13	1803	18	99%	1813	20
27	0.067293	0.001157	1.275621	0.021897	0.137415	0.001569	1.01	856	31	835	10	830	9	99%	830	9
28	0.062070	0.001754	0.885257	0.023616	0.104133	0.001275	0.68	676	96	644	13	639	7	99%	639	7
29	0.065985	0.001560	1.196769	0.027516	0.132059	0.001567	0.85	806	52	799	13	800	9	99%	800	9
30	0.110887	0.001498	4.987855	0.080559	0.325873	0.004109	1.44	1814	24	1817	14	1818	20	99%	1814	24
31	0.128265	0.001286	6.801013	0.083580	0.383285	0.003893	0.78	2076	17	2086	11	2092	18	99%	2076	17
32	0.124085	0.001480	6.078483	0.080631	0.354180	0.003368	0.38	2017	20	1987	12	1955	16	98%	2017	20
33	0.111379	0.001277	4.843539	0.060695	0.314316	0.002680	0.76	1822	20	1792	11	1762	13	98%	1822	20
34	0.065874	0.001354	1.188415	0.025313	0.131420	0.001704	0.65	1200	44	795	12	796	10	99%	796	10
35	0.065972	0.001074	1.208804	0.021091	0.132846	0.001458	0.80	806	33	805	10	804	8	99%	804	8
36	0.112658	0.001299	5.020521	0.058945	0.322766	0.002863	0.79	1843	21	1823	10	1803	14	98%	1843	21
37	0.065702	0.001002	1.154564	0.018665	0.127138	0.001191	0.86	798	31	779	9	772	7	98%	772	7
38	0.069267	0.001834	1.368147	0.034063	0.144391	0.001637	0.94	906	44	875	15	869	9	99%	869	9
39	0.062001	0.001877	0.850858	0.025537	0.100315	0.001384	0.82	676	56	625	14	616	8	98%	616	8
40	0.112275	0.001250	5.210754	0.064775	0.336325	0.003351	0.95	1837	19	1854	11	1869	16	99%	1837	19
41	0.114095	0.001251	5.244325	0.063815	0.333044	0.003113	0.51	1866	16	1860	10	1853	15	99%	1866	16
42	0.112362	0.001955	5.289766	0.096721	0.342667	0.004263	0.86	1839	31	1867	16	1899	20	98%	1839	31
43	0.060443	0.001127	0.835397	0.015758	0.100490	0.001046	0.73	620	36	617	9	617	6	99%	617	6
44	0.069953	0.001355	1.388687	0.028419	0.143644	0.001517	0.81	928	31	884	12	865	9	97%	865	9
45	0.067853	0.000862	1.321338	0.017186	0.141040	0.001234	0.31	865	26	855	8	851	7	99%	851	7
46	0.115526	0.001805	5.316085	0.088709	0.333203	0.003273	1.08	1888	27	1871	14	1854	16	99%	1888	27
47	0.067194	0.001039	1.247379	0.019366	0.134463	0.001373	0.93	843	28	822	9	813	8	98%	813	8
48	0.118101	0.001346	5.877864	0.074328	0.359509	0.003304	0.91	1927	20	1958	11	1980	16	98%	1927	20
49	0.110619	0.001287	4.993879	0.062485	0.326897	0.003432	0.83	1810	21	1818	11	1823	17	99%	1810	21

50	0.066668	0.001705	1.243760	0.035750	0.135153	0.002001	1.48	828	42	821	16	817	11	99%	817	11
51	0.064847	0.001056	1.254532	0.023260	0.140138	0.002014	0.66	769	229	825	10	845	11	97%	845	11
52	0.066567	0.001270	1.244465	0.026009	0.136413	0.002182	1.23	833	41	821	12	824	12	99%	824	12
53	0.111739	0.001401	5.118479	0.070896	0.331045	0.003346	0.49	1828	22	1839	12	1843	16	99%	1828	22
54	0.065068	0.001125	1.203655	0.021674	0.133782	0.001312	0.80	776	35	802	10	809	7	99%	809	7
55	0.064672	0.001035	1.284249	0.022703	0.143538	0.001502	0.97	765	35	839	10	865	8	96%	865	8
56	0.067803	0.000812	1.343944	0.018072	0.143413	0.001451	0.62	863	24	865	8	864	8	99%	864	8
57	0.066972	0.000966	1.294465	0.020200	0.139699	0.001362	0.86	837	24	843	9	843	8	99%	843	8
58	0.159895	0.001771	10.278600	0.116438	0.464765	0.003979	0.58	2455	19	2460	11	2461	18	99%	2455	19
59	0.165733	0.001984	11.178579	0.212100	0.486128	0.007519	0.28	2517	18	2538	18	2554	33	99%	2517	18
60	0.065952	0.001080	1.225214	0.021172	0.134526	0.001367	0.73	806	31	812	10	814	8	99%	814	8
61	0.063620	0.001020	1.166949	0.019255	0.133120	0.001332	0.70	728	33	785	9	806	8	97%	806	8
62	0.060189	0.001079	0.825692	0.013377	0.099906	0.000934	0.89	609	31	611	7	614	5	99%	614	5
63	0.114968	0.001901	5.290609	0.095172	0.332594	0.003065	0.99	1879	27	1867	15	1851	15	99%	1879	27
64	0.161306	0.001773	11.070948	0.133981	0.496638	0.004908	0.42	2469	17	2529	11	2599	21	97%	2469	17
65	0.066528	0.001106	1.248338	0.021918	0.135951	0.001391	0.87	833	35	823	10	822	8	99%	822	8
66	0.066788	0.001083	1.252114	0.021504	0.135755	0.001366	0.87	831	33	824	10	821	8	99%	821	8
67	0.063914	0.001097	1.155738	0.021786	0.130729	0.001354	1.13	739	36	780	10	792	8	98%	792	8
68	0.066916	0.000919	1.197673	0.019022	0.129323	0.001386	1.07	835	27	800	9	784	8	98%	784	8
69	0.117850	0.001669	5.567358	0.085314	0.342475	0.004131	0.90	1924	26	1911	13	1899	20	99%	1924	26
70	0.062325	0.001126	0.931206	0.017024	0.108067	0.001215	0.65	687	40	668	9	662	7	98%	662	7
71	0.067580	0.001346	1.273196	0.028157	0.136655	0.002175	0.55	857	39	834	13	826	12	99%	826	12
72	0.060888	0.001382	0.839558	0.020611	0.099986	0.001740	0.89	635	35	619	11	614	10	99%	614	10
73	0.061853	0.000828	0.858847	0.011922	0.100496	0.001005	0.93	733	29	629	7	617	6	98%	617	6
74	0.063400	0.002087	0.901355	0.029568	0.103270	0.001535	0.78	720	48	652	16	634	9	97%	634	9
75	0.066224	0.001038	1.228638	0.019155	0.134499	0.001413	0.32	813	30	814	9	813	8	99%	813	8
76	0.120384	0.001339	5.855455	0.071430	0.351506	0.003282	0.45	1962	20	1955	11	1942	16	99%	1962	20
77	0.069246	0.003036	0.953476	0.040705	0.100204	0.002008	1.60	906	176	680	21	616	12	90%	616	12

78	0.065916	0.001244	1.180010	0.024342	0.129585	0.001617	0.98	803	39	791	11	786	9	99%	786	9
79	0.064278	0.001089	1.113898	0.019983	0.125790	0.001532	0.40	750	31	760	10	764	9	99%	764	9
80	0.119506	0.001620	5.406047	0.077501	0.327445	0.003529	0.68	1950	76	1886	12	1826	17	96%	1950	76
81	0.111115	0.001179	5.038341	0.061855	0.327853	0.003339	0.67	1818	23	1826	10	1828	16	99%	1818	23
82	0.111224	0.001481	4.998494	0.070533	0.325854	0.003753	1.34	1820	22	1819	12	1818	18	99%	1820	22
83	0.117141	0.001330	5.621817	0.066847	0.346884	0.002911	1.11	1913	20	1919	10	1920	14	99%	1913	20
84	0.111659	0.001175	4.973238	0.052039	0.322506	0.002845	1.03	1828	20	1815	9	1802	14	99%	1828	20
85	0.059403	0.001091	0.824567	0.015538	0.100483	0.001156	0.77	583	35	611	9	617	7	98%	617	7
86	0.066432	0.000765	1.252038	0.016419	0.136022	0.001204	0.58	820	24	824	7	822	7	99%	822	7
87	0.063021	0.004294	0.911402	0.054397	0.106977	0.002594	0.62	709	65	658	29	655	15	99%	655	15
88	0.120765	0.001613	5.957114	0.084210	0.356591	0.003872	0.48	1969	28	1970	12	1966	18	99%	1969	28
89	0.139256	0.002142	8.249514	0.146279	0.429199	0.006968	0.75	2218	54	2259	16	2302	31	98%	2218	54
90	0.065335	0.001655	1.152629	0.033074	0.128319	0.002797	2.08	785	35	778	16	778	16	99%	778	16
91	0.111897	0.001516	5.160463	0.080743	0.335108	0.004698	0.71	1831	24	1846	13	1863	23	99%	1831	24
92	0.064402	0.001038	1.199468	0.022747	0.134914	0.001916	0.91	754	36	800	11	816	11	98%	816	11
93	0.064092	0.001068	1.171405	0.020121	0.132409	0.001327	0.85	746	35	787	9	802	8	98%	802	8
94	0.110963	0.001742	5.121661	0.085643	0.334321	0.003556	1.06	1817	23	1840	14	1859	17	98%	1817	23
95	0.064968	0.001036	1.156116	0.019021	0.128767	0.001273	0.86	772	36	780	9	781	7	99%	781	7
96	0.119139	0.001633	5.835777	0.079446	0.355186	0.003310	0.61	1944	24	1952	12	1959	16	99%	1944	24
97	0.112612	0.002038	5.191844	0.093331	0.335708	0.004067	1.09	1843	32	1851	15	1866	20	99%	1843	32
98	0.067017	0.000709	1.298510	0.016377	0.139968	0.001253	0.23	839	20	845	7	844	7	99%	844	7
99	0.067192	0.000883	1.295388	0.017556	0.139700	0.001254	0.47	843	26	844	8	843	7	99%	843	7
100	0.062145	0.000984	0.859991	0.013036	0.100402	0.000875	0.90	680	33	630	7	617	5	97%	617	5
Sample 103AKS19																
1	0.169568	0.001839	11.905319	0.154468	0.507764	0.005799	0.55	2553	19	2597	12	2647	25	98%	2553	19
2	0.118192	0.001508	5.244899	0.076757	0.320655	0.003496	0.90	1929	24	1860	13	1793	17	96%	1929	24
3	0.111272	0.001513	5.085703	0.073413	0.331355	0.003724	0.58	1820	30	1834	12	1845	18	99%	1820	30
4	0.109987	0.001111	4.800432	0.053744	0.315806	0.003203	0.59	1799	19	1785	9	1769	16	99%	1799	19

5	0.117634	0.001145	5.646947	0.064711	0.346631	0.003461	0.41	1921	18	1923	10	1918	17	99%	1921	18
6	0.064700	0.001173	0.996794	0.018858	0.111522	0.001275	1.10	765	38	702	10	682	7	97%	682	7
7	0.121855	0.001334	6.032366	0.076228	0.357999	0.004113	0.61	1984	19	1981	11	1973	20	99%	1984	19
8	0.061458	0.001877	0.837976	0.026024	0.098750	0.001415	0.61	654	111	618	14	607	8	98%	607	8
9	0.120649	0.001240	5.798785	0.079430	0.347346	0.004547	0.71	1966	20	1946	12	1922	22	98%	1966	20
10	0.112006	0.001081	4.837386	0.052258	0.311800	0.002882	1.00	1832	17	1791	9	1750	14	97%	1832	17
11	0.108512	0.002075	4.602444	0.091710	0.307412	0.004545	1.93	1776	28	1750	17	1728	22	98%	1776	28
12	0.065877	0.001256	1.138325	0.022708	0.125190	0.001520	1.28	1200	37	772	11	760	9	98%	760	9
13	0.130119	0.001444	6.774416	0.080564	0.377047	0.003911	0.28	2100	20	2082	11	2062	18	99%	2100	20
14	0.118480	0.001195	5.765459	0.073103	0.352204	0.004156	0.37	1944	17	1941	11	1945	20	99%	1944	17
15	0.122913	0.001225	6.368480	0.073232	0.375312	0.004082	0.40	1999	17	2028	10	2054	19	98%	1999	17
16	0.117910	0.001130	5.804065	0.067558	0.355831	0.003740	0.34	1925	17	1947	10	1962	18	99%	1925	17
17	0.111149	0.001618	5.059210	0.074886	0.331518	0.004144	0.85	1818	32	1829	13	1846	20	99%	1818	32
18	0.108636	0.001356	4.809018	0.063317	0.320165	0.003187	0.79	1777	23	1786	11	1791	16	99%	1777	23
19	0.111269	0.001627	5.126395	0.076796	0.334545	0.003995	0.86	1820	26	1840	13	1860	19	98%	1820	26
20	0.109521	0.001598	5.085271	0.075705	0.337457	0.004165	0.99	1792	25	1834	13	1874	20	97%	1792	25
21	0.060105	0.000953	0.829767	0.014977	0.099855	0.001164	1.16	607	33	613	8	614	7	99%	614	7
22	0.121225	0.001552	5.518019	0.071541	0.329618	0.003437	0.81	1976	19	1903	11	1837	17	96%	1976	19
23	0.114386	0.001257	4.383265	0.054214	0.277405	0.002883	1.30	1870	19	1709	10	1578	15	92%	1870	19
24	0.111416	0.001221	5.038384	0.063941	0.327716	0.003639	0.71	1833	20	1826	11	1827	18	99%	1833	20
25	0.124384	0.001427	6.703730	0.098357	0.390036	0.004695	0.57	2020	20	2073	13	2123	22	97%	2020	20
26	0.065941	0.001461	0.895875	0.020427	0.099591	0.001670	1.08	806	46	650	11	612	10	94%	612	10
27	0.117741	0.001680	4.724221	0.076453	0.291159	0.004155	0.87	1922	14	1772	14	1647	21	92%	1922	14
28	0.118149	0.001144	5.504797	0.064152	0.337439	0.003579	0.45	1929	12	1901	10	1874	17	98%	1929	12
29	0.135531	0.001733	5.995684	0.077018	0.321072	0.004320	0.80	2172	21	1975	11	1795	21	90%	2172	21
30	0.123010	0.001392	6.086631	0.080975	0.358861	0.004166	0.28	2067	19	1988	12	1977	20	99%	2067	19
31	0.128993	0.001323	5.270225	0.061767	0.295364	0.002720	1.18	2084	17	1864	10	1668	14	88%		
32	0.111899	0.001343	5.114695	0.075484	0.330750	0.003737	0.88	1831	22	1839	13	1842	18	99%	1831	22

33	0.110841	0.001275	4.993724	0.064760	0.326583	0.003497	0.94	1813	21	1818	11	1822	17	99%	1813	21
34	0.059398	0.002663	0.819818	0.037384	0.099969	0.001771	1.11	583	90	608	21	614	10	98%	614	10
35	0.112753	0.001394	5.112082	0.073394	0.328086	0.003567	0.52	1844	22	1838	12	1829	17	99%	1844	22
36	0.226802	0.035712	2.510679	0.236222	0.101504	0.003657	2.28	3029	252	1275	68	623	21	31%		
37	0.119836	0.001443	5.789639	0.083742	0.349032	0.003790	0.58	1954	22	1945	13	1930	18	99%	1954	22
38	0.138606	0.001422	7.959522	0.091413	0.415430	0.004061	0.40	2210	18	2226	10	2240	19	99%	2210	18
39	0.111829	0.001403	5.179012	0.076074	0.335110	0.003787	0.61	1829	24	1849	13	1863	18	99%	1829	24
40	0.111273	0.001192	5.054399	0.066961	0.328197	0.003660	0.67	1820	14	1828	11	1830	18	99%	1820	14
41	0.124143	0.001328	6.425474	0.085789	0.373579	0.004111	0.56	2016	19	2036	12	2046	19	99%	2016	19
42	0.160300	0.001687	10.368522	0.140967	0.467294	0.005890	0.69	2459	17	2468	13	2472	26	99%	2459	17
43	0.119883	0.001503	5.977817	0.088965	0.360081	0.004618	0.95	1955	21	1973	13	1983	22	99%	1955	21
44	0.122893	0.001396	5.925230	0.084458	0.347336	0.003836	1.01	1998	21	1965	12	1922	18	97%	1998	21
45	0.109543	0.001603	4.918979	0.072011	0.325874	0.004222	0.73	1792	22	1806	12	1818	21	99%	1792	22
46	0.132069	0.001946	7.512931	0.111455	0.412583	0.004766	0.46	2126	23	2175	13	2227	22	97%	2126	23
47	0.117147	0.001293	5.799178	0.070854	0.357792	0.003735	0.36	1913	20	1946	11	1972	18	98%	1913	20
48	0.077416	0.001699	1.108095	0.026890	0.102890	0.001108	1.46	1131	73	757	13	631	6	81%		
49	0.107866	0.001343	4.939374	0.070565	0.330800	0.003416	0.62	1765	24	1809	12	1842	17	98%	1765	24
50	0.115777	0.001184	5.764767	0.068044	0.360852	0.003930	0.57	1892	23	1941	10	1986	19	97%	1892	23
51	0.110336	0.001075	4.976066	0.058195	0.326466	0.003225	0.76	1806	23	1815	10	1821	16	99%	1806	23
52	0.110679	0.001431	4.830608	0.065096	0.316982	0.003224	0.76	1811	24	1790	11	1775	16	99%	1811	24
53	0.170373	0.001842	11.195242	0.200082	0.472558	0.005887	0.48	2561	18	2540	17	2495	26	98%	2561	18
54	0.132915	0.002226	6.583064	0.146699	0.356512	0.004526	1.66	2137	29	2057	20	1966	22	95%	2137	29
55	0.111413	0.001264	5.057845	0.067820	0.329462	0.003626	0.82	1833	20	1829	11	1836	18	99%	1833	20
56	0.118985	0.002066	6.033019	0.111965	0.369222	0.005086	2.28	1943	29	1981	16	2026	24	97%	1943	29
57	0.122372	0.001384	6.157529	0.083003	0.364449	0.003744	1.02	1991	19	1998	12	2003	18	99%	1991	19
58	0.122688	0.001715	6.224879	0.109499	0.367598	0.005246	0.43	1996	22	2008	15	2018	25	99%	1996	22
59	0.111131	0.001498	5.112157	0.074561	0.333690	0.003551	0.84	1818	24	1838	12	1856	17	99%	1818	24
60	0.112220	0.002001	5.181349	0.092112	0.335960	0.004114	0.92	1836	31	1850	15	1867	20	99%	1836	31

61	0.116301	0.001224	5.874965	0.074317	0.365427	0.004030	0.41	1902	23	1958	11	2008	19	97%	1902	23
62	0.127867	0.002354	5.468478	0.107174	0.310102	0.003965	1.54	2069	33	1896	17	1741	20	91%	2069	33
63	0.124128	0.001401	6.497811	0.092887	0.379909	0.005484	0.58	2016	20	2046	13	2076	26	98%	2016	20
64	0.062153	0.001458	0.853448	0.022112	0.099878	0.002178	0.70	680	44	627	12	614	13	97%	614	13
65	0.113262	0.001280	5.679170	0.074007	0.361937	0.004184	0.58	1861	19	1928	11	1991	20	96%	1861	19
66	0.113701	0.001205	5.691318	0.070829	0.361502	0.004030	0.58	1861	20	1930	11	1989	19	96%	1861	20
67	0.108721	0.001810	5.003583	0.092584	0.333342	0.004238	1.06	1789	31	1820	16	1855	21	98%	1789	31
68	0.116640	0.001315	5.875936	0.065444	0.364946	0.003643	0.72	1905	19	1958	10	2006	17	97%	1905	19
69	0.109675	0.001644	5.050644	0.080868	0.334277	0.003962	0.81	1794	26	1828	14	1859	19	98%	1794	26
70	0.066202	0.001059	1.153002	0.021693	0.125698	0.001377	0.93	813	32	779	10	763	8	98%	763	8
71	0.119833	0.001373	5.991102	0.079594	0.361908	0.003867	0.51	1954	20	1975	12	1991	18	99%	1954	20
72	0.117673	0.001268	5.720443	0.070751	0.352296	0.003746	0.63	1921	19	1934	11	1946	18	99%	1921	19
73	0.129784	0.001358	6.844105	0.083304	0.381852	0.003833	0.48	2095	18	2091	11	2085	18	99%	2095	18
74	0.111586	0.001172	5.023786	0.059849	0.326178	0.003258	1.09	1826	19	1823	10	1820	16	99%	1826	19
75	0.124400	0.001261	6.260640	0.074369	0.363887	0.003354	0.91	2020	18	2013	10	2001	16	99%	2020	18
76	0.066280	0.001998	1.162752	0.034017	0.128632	0.001786	1.90	817	63	783	16	780	10	99%	780	10
77	0.064038	0.001375	1.051171	0.022053	0.119025	0.001398	1.19	743	33	729	11	725	8	99%	725	8
78	0.117946	0.001224	5.728803	0.070752	0.351066	0.003617	1.04	1926	19	1936	11	1940	17	99%	1926	19
79	0.116022	0.002077	5.012974	0.100688	0.312120	0.004256	0.77	1896	40	1822	17	1751	21	96%	1896	40
80	0.122645	0.001098	6.296394	0.073648	0.370643	0.004008	0.69	1995	11	2018	10	2032	19	99%	1995	11
81	0.109517	0.001736	4.958136	0.084774	0.329245	0.004572	0.76	1792	29	1812	14	1835	22	98%	1792	29
82	0.117394	0.001422	5.805448	0.089265	0.358714	0.005383	0.58	1917	22	1947	13	1976	26	98%	1917	22
83	0.119646	0.001413	5.818726	0.082468	0.352080	0.004618	0.59	1951	21	1949	12	1945	22	99%	1951	21
84	0.187965	0.001788	13.171932	0.157511	0.506383	0.005649	0.92	2724	15	2692	11	2641	24	98%	2724	15
85	0.112180	0.001279	5.169689	0.072259	0.333185	0.003825	1.23	1835	21	1848	12	1854	19	99%	1835	21
86	0.127592	0.001334	6.798732	0.107017	0.384626	0.005296	0.27	2065	17	2086	14	2098	25	99%	2065	17
87	0.064769	0.001883	1.136241	0.031217	0.128796	0.001907	1.36	769	61	771	15	781	11	98%	781	11
88	0.116933	0.001604	5.820435	0.088748	0.360713	0.004409	0.40	1910	30	1949	13	1986	21	98%	1910	30

89	0.110701	0.001782	5.015582	0.081959	0.330345	0.004020	0.84	1811	29	1822	14	1840	20	99%	1811	29
90	0.112288	0.001455	5.011682	0.071575	0.323167	0.003026	0.94	1837	24	1821	12	1805	15	99%	1837	24
91	0.157777	0.001658	9.908672	0.155271	0.452523	0.005421	0.50	2432	18	2426	15	2406	24	99%	2432	18
92	0.111802	0.001465	5.090559	0.076314	0.330617	0.003710	0.80	1829	24	1835	13	1841	18	99%	1829	24
93	0.138457	0.002226	7.170134	0.155721	0.373010	0.004804	0.74	2209	28	2133	19	2044	23	95%	2209	28
94	0.157249	0.002120	9.862349	0.142599	0.455560	0.004913	0.57	2428	22	2422	13	2420	22	99%	2428	22
95	0.124967	0.001386	6.276514	0.083040	0.363840	0.003693	0.32	2028	19	2015	12	2000	17	99%	2028	19
96	0.136801	0.001503	7.534267	0.093170	0.399552	0.004069	0.40	2187	19	2177	11	2167	19	99%	2187	19
97	0.129619	0.001988	6.740144	0.106674	0.377424	0.004056	0.63	2094	24	2078	14	2064	19	99%	2094	24
98	0.114732	0.002058	5.319436	0.088632	0.337213	0.003611	0.82	1876	32	1872	14	1873	17	99%	1876	32
99	0.129479	0.002728	6.162551	0.123584	0.346330	0.005060	0.77	2091	26	1999	18	1917	24	95%	2091	26
100	0.119802	0.001367	5.970620	0.077199	0.360628	0.004080	0.39	1954	20	1972	11	1985	19	99%	1954	20

TABLE S5. COMPILATION OF ZIRCON U-PB DATING DATA FOR THE MAGMATIC ROCKS FROM THE CENTRAL TIANSHAN TERRANE.

	Locations	Lithology	Methods	Age (Ma)	Error	Coordinates	Reference
1	Huoshaoqiao	granitic intrusions	LA-ICP-MS zircon U–Pb	903.5	2.2	43°12′50″N, 85°00′32″E	Gao et al., 2015
2	Wulasutanwutuaiken	gneissic granodiorite	LA-ICP-MS zircon U–Pb	933.6	1.2	43°02′39″N,86°47′36″E	
3	Wuwamen bimodal intrusive complex	meta-gabbro	SIMS zircon U–Pb	733	5	42°36′55″N,86°16′10″E	
4	Wuwamen bimodal intrusive complex	granite	SIMS zircon U–Pb	730	5	42°36′55″N,86°16′10″E	
5	Xialebaketekekesayi valley, Wenquan	Granitic gneiss	SHRIMP zircon U–Pb	919	6	44°56'5.4″N,80°50'33.8″E	Hu et al., 2010
6	Xingxingxia	Granitic gneiss	SHRIMP zircon U–Pb	942	7		
7	Kulaerbiejingzhen valley, Wenquan	Granitic gneiss	SHRIMP zircon U–Pb	904	13		
8	Bingdaban, Baluntai	granitic gneisses	SHRIMP zircon U–Pb	926	8	43°6.7224'N,86°50.548'E	Chen et al., 2009
9	Laerdundaban, Yili	granitic gneisses	SHRIMP zircon U–Pb	948	8	43°10.115'N,84°21.541'E	
10	Bingdaban, Baluntai	granitic gneiss	SHRIMP zircon U–Pb	969	11		Yang et al., 2008
11	Alatage	granitic gneisses	LA-ICP-MS zircon U–Pb	923	5	41°48.8'N,E94°59.0'E	Huang et al., 2015a
12	Xingxingxia	granitic gneisses	LA-ICP-MS zircon U–Pb	914	12	41°35.8'N,E91°48.8'E	
13	Xingxingxia	granitic gneisses	LA-ICP-MS zircon U–Pb	930	4	41°48.7'N,E95°3.1'E	

14	Shaquanzi	biotite monzonitic gneiss	LA-ICP-MS zircon U–Pb	942.4	5.1	41°51'N,94°54'E	Wang et al., 2014c
15	Alatage	biotite gneiss	LA-ICP-MS zircon U–Pb	945	6	41°35.505'N,91°48.799'E	Huang et al., 2014
16	Alatage	augen gneiss	LA-ICP-MS zircon U–Pb	942	6	41°40.246'N,91°52.941'E	
17	Kawabulake	granitic gneisses	LA-ICP-MS zircon U–Pb	942.1	7.2		Peng et al., 2012
18	Kawabulake	granitic gneisses	LA-ICP-MS zircon U–Pb	941.9	4.9		
19	Akshairak Range	felsic tuff	LA-ICP-MS zircon U–Pb	842	16		Glorie et al., 2011
20	Sary-Dzhaz Range	granitoid	LA-ICP-MS zircon U–Pb	831	6		
21	Akshairak Range	migmagtite	LA-ICP-MS zircon U–Pb	806	20		
22	Atbashi Range	gneiss	LA-ICP-MS zircon U–Pb	788	26		
23	Karasu Lake	granite	SHRIMP zircon U–Pb	728	11	41°33.547′N,73°15.765′E	Konopelko et al., 2013
24	Karasu Lake	granite	SHRIMP zircon U–Pb	778	11	41°33.530′N,73°15.692′E	
25	Shigaokuang, Wuwamen	Leucogranite dyke	SIMS zircon U–Pb	785	15	42°38′7.8″N,86°12′20.8″E	Wang et al., 2014d
26	Hongliujing, Xingxingxia	A-type granite	LA-ICP-MS Zircon U-Pb	737.2	3.8	41°53'18.4"N,94°54'46.8"E	Lei et al., 2013
27	Hongliujing, Xingxingxia	A-type granite	LA-ICP-MS Zircon U-Pb	741.7	7.1	41°53'18.4"N,94°54'46.8"E	
28	Alatage	gneissic granodiorite	LA-ICP-MS zircon U–Pb	1437	4	41°43.2′N,92°38.1′E	He et al., 2015
29	Alatage	gneissic granodiorite	LA-ICP-MS zircon U–Pb	1438	5	41°42.6′N,92°38.4′E	
30	Alatage	gneissic monzogranite	LA-ICP-MS zircon U–Pb	1436	4	41°41.9′N,92°38.6′E	
31	Alatage	gneissic monzogranite	LA-ICP-MS zircon U–Pb	1436	5	41°42.4′N,92°36.4′E	
32	Alatage	gneissic tonalite	LA-ICP-MS zircon U–Pb	1436	5	41°42.6′N,92°38.4′E	

33	Alatage	gneissic tonalite	LA-ICP-MS zircon U–Pb	1436	5	41°42.3′N,92°38.5′E	
34	Alatage	gneissic tonalite	LA-ICP-MS zircon U–Pb	1436	5	41°41.6′N,92°37.5′E	
35	Weiya	granitic gneiss	LA-ICP-MS zircon U–Pb	926	3	41°44.8′N,94°6.6′E	
36	Weiya	granitic gneiss	LA-ICP-MS zircon U–Pb	1433	27	41°44.8′N,94°6.6′E	
37	Xingxingxia	granitic gneiss	LA-ICP-MS zircon U–Pb	1409	33	41°54.5′N,94°59.3′E	
38	Laerdundaban	granitic gneiss	zircon standard isotope dilution methods	882	33		Chen et al., 2000a
39	Muzhaerte	granitoid orthogneiss	zircon mixed isotope dilution methods	707	13		Chen et al., 2000b
40	Baluntai	banded granitic gneiss	LA-ICP-MS zircon U–Pb	630	5	43°6'58″N,86°51'16″E	Chen et al., 2012
41	Xingxingxia	granodiorite	LA-ICP-MS zircon U–Pb	809	41	41°52′36.6″N,95°18′18.9″E	Lei et al., 2011
42	Alatagh	augen-gneisses	LA-ICP-MS zircon U–Pb	918	5.1		Huang et al., 2017
43	Alatagh	mylonitic gneisses	LA-ICP-MS zircon U–Pb	896	3.9		
44	Xingxingxia	monzonitic granite	LA-ICP-MS zircon U–Pb	949.7	6.1		Ren, 2019
45	Xingxingxia	granodiorite	LA-ICP-MS zircon U–Pb	927.6	7.5		
46	Beishan	granodiorite	LA-ICP-MS zircon U–Pb	1404	4	N40°47′33″,E97°19′17″	Yuan Y. et al., 2019
47		Bt-Pl gneiss		1418	10	N40°47′32″,E97°19′15″	
48		granodiorite		1403	22	N40°47′15″,E97°19′19″	
49		granitic gneiss		1450	22	N40°47′05″,E97°19′29″	
50		granitic gneiss		1401	5	N40°47′31″,E97°19′20″	

DATA SOURCE

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FIGURE S1. CATHODOLUMINESCENCE (CL) IMAGES OF REPRESENTATIVE ZIRCONS WITH ANALYZED SPOTS AND PREFERRED AGES (IN MA).

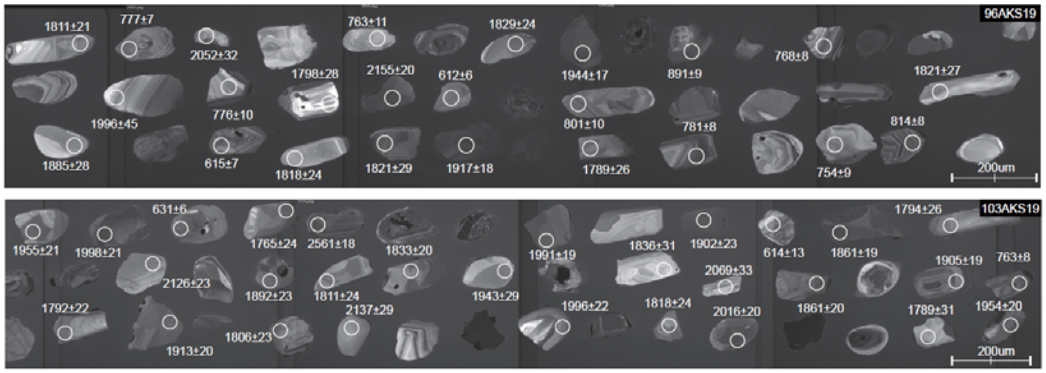

FIGURE S2. DETRITAL ZIRCON TH/U RATIO VERSUS AGE PLOT FOR TWO SANDSTONE SAMPLES IN THIS STUDY.