

## Supplementary Materials

Table S1 LA-ICP-MS U-Pb isotopic compositions of zircons from the Laohuya granite

	Th (ppm)	U (ppm)	Th/U	207Pb/206Pb	2sigma	207Pb/235U	2sigma	206Pb/238U	2sigma	rho
LHY01-1	10177.1	9973.948	1.020368	0.051465829	0.004695307	0.101484766	0.008156900	0.014081528	0.000578119	0.510790817
LHY01-2	2419.298	6683.914	0.361958	0.058923817	0.005884748	0.114127908	0.010661302	0.013796267	0.000535415	0.415442315
LHY01-3	6019.411	13200.03	0.456015	0.0534776	0.004269897	0.094826834	0.008645587	0.012631755	0.000866419	0.752317545
LHY01-4	2199.161	6884.775	0.319424	0.054777102	0.005737035	0.117158727	0.011470326	0.015306137	0.000601179	0.401178096
LHY01-5	11449.62	16366.59	0.699573	0.051117155	0.003987098	0.083830138	0.007245909	0.011703519	0.000746516	0.737954778
LHY01-6	9746.992	14472.46	0.673486	0.06075704	0.005065284	0.104498237	0.008466401	0.012333197	0.000691756	0.692289350
LHY01-7	6374.649	9213.452	0.691885	0.051252887	0.004045445	0.100664387	0.008664817	0.013929819	0.000788167	0.657339130
LHY01-8	12727.11	13344.55	0.953731	0.05038468	0.00417078	0.093340147	0.008368167	0.013112909	0.000682708	0.580730075
LHY01-9	4165.622	5311.988	0.784193	0.054780087	0.004951693	0.103249982	0.009499958	0.013444088	0.000761296	0.615446932
LHY01-10	5103.818	5379.535	0.948747	0.059205206	0.005581899	0.109294168	0.010518537	0.013136929	0.000751583	0.594462500
LHY01-11	3292.664	6538.739	0.503563	0.053257409	0.005757576	0.101928161	0.010405730	0.013880913	0.000929628	0.656013749
LHY01-12	12584.78	7877.784	1.597503	0.049510273	0.004634577	0.099798744	0.009445554	0.014289037	0.000838649	0.620118740
LHY01-13	3535.123	14233.79	0.248361	0.054547358	0.004352457	0.119239019	0.008655488	0.015409618	0.000447492	0.400055474
LHY01-14	2232.064	9564.205	0.233377	0.058646458	0.005399315	0.113021573	0.009724021	0.013516907	0.000457634	0.393510298
LHY01-15	10233.27	12381.64	0.826488	0.044992341	0.003652032	0.088201599	0.007943918	0.013655979	0.000768645	0.624949077
LHY01-16	2984.394	11034.03	0.270472	0.046075242	0.004335195	0.088602761	0.007544804	0.013537658	0.000587125	0.509314692

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Table S2 Trace-elements (ppm) compositions of zircons from the Laohuya granite

Sample	Ti	Temperature	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
LHY01-1	46.7701417	1010	13.28126	85.81986	13.69319	84.7801	184.9964	1.4914	688.7516	216.9656	2702.476	612.0131	2364.11	544.3359	4798.274	684.7736
LHY01-2	26.8015759	932	11.59184	76.28162	11.34456	61.8238	46.53874	0.119942	115.942	33.19908	506.5079	153.8912	692.3412	168.6206	1518.654	241.8589
LHY01-3	47.4157211	1012	12.47836	59.91667	8.106081	50.66562	99.59801	0.531215	453.2135	188.8133	2656.337	646.784	2678.827	646.7731	5998.318	888.6948
LHY01-4	21.8511924	906	2.958824	29.76196	1.934459	12.80111	24.7716	0.189436	123.2473	52.78813	833.9519	231.6403	1124.558	314.4409	3132.888	503.0119
LHY01-5	85.22651	1107	20.75713	113.0474	16.43666	104.8071	209.1762	1.313375	874.4149	348.7531	4784.74	1062.062	4118.029	972.4872	8619.98	1227.487
LHY01-6	50.5346245	1022	19.15128	96.97755	16.0491	92.86069	201.3692	1.655865	733.7525	245.7824	2975.558	654.668	2609.709	626.406	5848.025	847.7722
LHY01-7	42.7270813	997	8.730469	64.18253	6.121091	36.54538	75.86633	0.614168	331.6368	137.4893	1938.101	468.8404	1951.251	499.9312	4864.12	664.8765
LHY01-8	63.3110696	1057	9.697328	107.6939	8.746335	58.10166	137.1695	0.85625	651.7804	274.073	3676.365	814.7549	3058.436	688.9678	5938.482	853.2549
LHY01-9	40.2877161	989	9.682554	68.31363	6.664079	35.94028	67.74867	0.521294	254.055	99.89744	1495.244	375.1948	1703.458	486.3139	4961.416	690.0082
LHY01-10	34.6721279	967	8.962156	63.90691	5.985282	39.56965	82.30684	0.606407	313.0885	109.7112	1509.135	365.5191	1506.009	378.3444	3690.624	510.5054
LHY01-11	29.0136346	943	91.84265	158.6196	14.99003	60.92818	57.34637	0.479562	207.3644	80.80607	1184.311	282.6772	1154.975	289.2642	2821.185	374.5626
LHY01-12	37.8375303	980	52289.09	46729.5	4994.462	16468.81	3514.534	4.476767	2609.165	347.7763	2994.127	579.8742	2190.892	538.3464	5030.359	700.2253
LHY01-13	11.8733848	834	7.049873	58.47178	4.371906	29.61626	45.23698	0.166555	164.9661	57.30001	901.9408	264.4178	1171.235	282.4076	2515.955	396.7334
LHY01-14	12.9762404	844	168.4975	191.8407	18.43352	81.47117	29.883	0	92.91989	32.66231	571.9765	186.5267	877.3196	226.4563	2150.077	332.3737
LHY01-15	57.1876357	1041	1233.277	864.3145	65.47808	193.628	131.1179	0.656037	529.5535	210.2443	2784.271	622.6634	2317.951	515.0429	4492.986	632.1963
LHY01-16	19.076426	889	9.074329	50.67485	4.891888	29.98172	53.84405	0.5708	241.8961	98.13353	1419.48	367.8401	1563.38	386.0538	3582.753	531.3818

Table S3 Whole-rock major-elements (wt%) and trace-elements (ppm) compositions of the Laohuya granite

Sample	LHY01	LHY02	LHY03	LHY04	LHY05	LHY06	LHY07	LHY08	LHY09	LHY10	LHY11	LHY12
SiO <sub>2</sub>	76.33	76.20	75.81	76.06	75.95	75.95	75.92	75.13	75.91	75.94	75.81	75.90
TiO <sub>2</sub>	0.034	0.038	0.035	0.040	0.033	0.025	0.018	0.053	0.012	0.018	0.021	0.013
Al <sub>2</sub> O <sub>3</sub>	12.79	12.72	13.15	12.97	12.89	13.01	13.17	13.04	13.16	13.35	13.20	13.39
Fe <sub>2</sub> O <sub>3</sub>	0.12	0.13	0.12	0.06	0.07	0.06	0.05	0.12	0.05	0.14	0.07	0.17
FeO	1.03	1.02	1.07	1.07	1.36	1.07	1.05	1.15	1.10	1.10	1.09	0.99
MnO	0.09	0.06	0.11	0.06	0.08	0.04	0.09	0.08	0.05	0.05	0.05	0.05
MgO	0.08	0.07	0.12	0.08	0.09	0.12	0.12	0.12	0.13	0.13	0.13	0.15
CaO	0.71	0.75	0.66	0.66	0.70	0.69	0.59	0.69	0.71	0.68	0.68	0.63
Na <sub>2</sub> O	3.16	3.45	2.99	3.19	2.97	2.50	3.13	2.48	2.79	2.86	2.88	2.96
K <sub>2</sub> O	4.59	4.62	4.66	4.62	4.69	5.06	4.63	5.88	4.56	4.57	4.66	4.67
P <sub>2</sub> O <sub>5</sub>	0.012	0.007	0.009	0.012	0.013	0.009	0.007	0.013	0.009	0.009	0.011	0.008
total	98.93	99.06	98.74	98.82	98.84	98.53	98.78	98.75	98.47	98.85	98.60	98.93
TFe <sub>2</sub> O <sub>3</sub>	1.26	1.26	1.31	1.25	1.58	1.25	1.22	1.40	1.27	1.36	1.28	1.27
La	77.80	74.10	66.80	65.80	64.30	49.90	39.80	74.20	41.90	40.80	41.90	41.00
Ce	140.00	134.00	119.00	122.00	122.00	88.60	76.50	117.00	82.40	82.30	83.50	86.20
Pr	20.10	19.30	16.30	16.90	17.10	12.30	12.10	18.50	12.10	11.70	12.50	12.50
Nd	70.20	68.90	60.00	61.10	60.60	45.10	42.20	67.90	44.10	43.00	45.20	43.20
Sm	19.80	20.10	17.30	18.40	17.20	12.30	13.50	19.80	13.00	14.10	14.50	14.50
Eu	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.11	0.03	0.02	0.04	0.04
Gd	16.60	15.60	13.80	13.90	14.20	9.77	10.50	18.70	11.10	11.00	11.20	10.70
Tb	4.18	4.09	3.35	3.79	3.50	2.45	2.96	4.82	3.21	3.31	3.23	3.20
Dy	27.60	26.30	21.50	23.80	23.00	14.80	19.10	29.30	20.20	18.60	20.00	19.70
Ho	5.95	5.62	4.34	5.23	4.78	3.19	4.06	6.43	4.37	4.45	4.77	4.24
Er	16.90	17.20	13.00	15.40	15.20	9.12	11.40	17.10	13.00	14.00	13.20	13.80

Tm	3.53	3.56	2.66	3.12	3.05	1.85	2.68	3.37	2.84	2.79	3.14	2.71
Yb	26.00	26.00	20.10	22.20	21.70	14.40	20.10	22.50	21.80	20.70	23.70	20.90
Lu	3.67	3.57	2.83	3.28	3.25	2.00	2.66	3.27	3.00	3.16	3.15	3.19
Y	164.00	162.00	114.00	153.00	148.00	87.70	105.00	224.00	116.00	118.00	123.00	119.00
Rb	1335.00	1272.00	1252.00	1208.00	1202.00	1318.00	1231.00	1390.00	1300.00	1269.00	1362.00	1258.00
Ba	21.70	20.90	33.10	22.40	30.00	41.70	56.60	83.70	61.10	50.80	56.30	62.80
Th	56.10	54.10	51.70	55.00	54.30	31.10	26.90	51.90	26.10	28.90	26.30	29.00
U	57.10	48.80	39.80	46.10	46.20	19.00	32.50	39.50	32.40	32.80	37.60	33.90
Nb	90.00	92.30	87.50	84.00	82.60	67.80	63.00	77.90	67.50	58.80	61.40	54.30
Ta	22.10	24.00	26.00	23.90	22.70	27.50	36.10	15.40	37.40	31.60	33.40	28.70
Sr	19.40	19.50	23.40	15.80	16.00	18.70	15.10	18.90	29.40	27.00	23.90	24.00
Zr	175.00	142.00	130.00	120.00	122.00	70.20	93.40	97.90	102.00	96.50	112.00	105.00
Hf	8.78	8.30	7.92	6.64	7.30	4.49	8.04	5.21	8.43	7.65	7.38	8.04
ΣREE	432.39	418.40	361.03	374.97	369.93	265.83	257.61	403.00	273.05	269.93	280.03	275.88
Eu/Eu*	0.009	0.010	0.009	0.010	0.009	0.013	0.012	0.018	0.006	0.005	0.010	0.009
La/Yb <sub>N</sub>	2.15	2.04	2.38	2.13	2.13	2.49	1.42	2.37	1.38	1.41	1.27	1.41
Zr/Hf	19.93	17.11	16.41	18.07	16.71	15.63	11.62	18.79	12.10	12.61	15.18	13.06
Nb/Ta	4.07	3.85	3.37	3.51	3.64	2.47	1.75	5.06	1.80	1.86	1.84	1.89
Rb/Sr	68.81	65.23	53.50	76.46	75.13	70.48	81.52	73.54	44.22	47.00	56.99	52.42
Rb/Ba	61.52	60.86	37.82	53.93	40.07	31.61	21.75	16.61	21.28	24.98	24.19	20.03
t1	0.99	0.98	0.96	0.99	1.01	0.96	1.02	0.90	1.01	1.02	1.02	1.08
t3	1.20	1.23	1.21	1.23	1.21	1.19	1.27	1.20	1.28	1.24	1.22	1.30
TE <sub>1,3</sub>	1.09	1.10	1.08	1.10	1.10	1.07	1.14	1.04	1.14	1.13	1.12	1.18

Eu/Eu\* = Eu<sub>N</sub>/(Sm<sub>N</sub>×Gd<sub>N</sub>)<sup>1/2</sup>, Ce/Ce<sup>t</sup> = Ce<sub>N</sub>/(La<sub>N</sub><sup>2/3</sup>×Nd<sub>N</sub><sup>1/3</sup>), Pr/Pr<sup>t</sup> = Pr<sub>N</sub>/(La<sub>N</sub><sup>1/3</sup>×Nd<sub>N</sub><sup>2/3</sup>), t1 = (Ce/Ce<sup>t</sup>×Pr/Pr<sup>t</sup>)<sup>1/2</sup>, t3 = (Tb/Tb<sup>t</sup>×Dy/Dy<sup>t</sup>)<sup>1/2</sup>, degree of the tetrad effect: TE<sub>1,3</sub> = (t1×t3)<sup>1/2</sup>.

Table S4 LA-MC-ICP-MS Lu-Hf isotopic compositions of zircons from the Laohuya granite

Sample	Age (Ma)	$^{176}\text{Yb}/^{177}\text{Hf}$	$2\sigma$	$^{176}\text{Lu}/^{177}\text{Hf}$	$2\sigma$	$^{176}\text{Hf}/^{177}\text{Hf}$	$2\sigma$	$^{176}\text{Hf}/^{177}\text{Hf}_i$	$\epsilon_{\text{Hf}}(0)$	$\epsilon_{\text{Hf}}(t)$	$T_{\text{DM}}$ (Ma)	$T_{\text{DM2}}$ (Ma)	$f_{\text{Lu/Hf}}$
1	87.75	0.079111	0.00102	0.002667	0.0000287	0.28248	0.0000281	0.282476	-10.33	-8.56	1143	2367	-0.92
2	87.75	0.056674	0.000452	0.002051	0.0000197	0.282506	0.0000181	0.282503	-9.39	-7.59	1086	2280	-0.94
3	87.75	0.082947	0.000378	0.002942	0.0000113	0.282457	0.000023	0.282452	-11.15	-9.40	1186	2442	-0.91
4	87.75	0.069134	0.000695	0.002367	0.0000221	0.282502	0.0000339	0.282498	-9.54	-7.76	1101	2295	-0.93
5	87.75	0.059353	0.000656	0.002193	0.0000228	0.282445	0.0000218	0.282441	-11.57	-9.77	1179	2476	-0.93
6	87.75	0.138009	0.00413	0.004522	0.000132	0.282302	0.0000359	0.282294	-16.63	-14.97	1480	2939	-0.86
7	87.75	0.146951	0.00231	0.004877	0.0000728	0.282439	0.0000402	0.282431	-11.77	-10.13	1281	2506	-0.85
8	87.75	0.094637	0.000158	0.003361	0.00000383	0.282469	0.0000361	0.282463	-10.73	-9.00	1183	2406	-0.90
9	87.75	0.070805	0.000158	0.002509	0.00000523	0.282457	0.0000315	0.282453	-11.14	-9.36	1172	2439	-0.92
10	87.75	0.11004	0.00091	0.003814	0.0000268	0.282395	0.0000282	0.282388	-13.35	-11.65	1310	2643	-0.89