

Massive carbon storage in the upper mantle via diapirism of subducted continental sediments

Jialiang Li^a, Wei-Qiang Ji^a, Xiao-Chi Liu^a, Jingao Liu^b, Matthew J. Kohn^c, Fu-Yuan Wu^a

^a State Key Laboratory of Lithospheric and Environmental Coevolution, Institute of Geology and Geophysics, Chinese Academy of Sciences, P.O. Box 9825, Beijing 100029, China

^b State Key Laboratory of Geological Processes and Mineral Resources, China University of Geosciences, Beijing 100083, China

^c Department of Geosciences, Boise State University, Boise, Idaho 83725, USA

Contents of this file

Table S1 Ages of the ultrapotassic-potassic lavas in the Payang and Zabuye areas, southern Tibet.

Table S2 Whole-rock major (wt.%)- and trace-element (ppm) data of the ultrapotassic-potassic lavas from the Payang, Sailipu, Zabuye, and Renbu areas and subduction complex, southern Tibet.

Table S3 Whole-rock Sr-Nd-Pb-Hf isotopic composition of the ultrapotassic-potassic lavas from the Payang, Sailipu, Zabuye, and Renbu areas and subduction complex, southern Tibet.

Table S4 Mg-Zn isotope data for the ultrapotassic-potassic lavas from the Payang, Sailipu, Zabuye, and Renbu areas and subduction complex, southern Tibet.

Table S5 Major-element (wt.%)- and trace-element (ppm) data of olivine from the Sailipu ultrapotassic lavas, southern Tibet.

Table S1. Ages of the ultrapotassic-potassic lavas in the Payang and Zabuye areas, southern Tibet

Analysis spot No.	Pb	Th	U	Th/U	Isotopic ratios						Apparent ages (Ma)					
					²⁰⁷ Pb/ ²⁰⁶ Pb	1σ	²⁰⁷ Pb/ ²³⁵ U	1σ	²⁰⁶ Pb/ ²³⁸ U	1σ	²⁰⁷ Pb/ ²⁰⁶ Pb	1σ	²⁰⁷ Pb/ ²³⁵ U	1σ	²⁰⁶ Pb/ ²³⁸ U	1σ
23PY-12 (Trachydacite, 16.8±0.2 Ma)																
23PY-12-01	1.21	170	396	0.43	0.0482	0.0058	0.0171	0.0017	0.0026	0.0001	109	263	17	2	17	0
23PY-12-02	1.12	167	374	0.45	0.0496	0.0058	0.0161	0.0014	0.0025	0.0001	176	252	16	1	16	0
23PY-12-03	1.21	217	376	0.58	0.0446	0.0061	0.0152	0.0017	0.0026	0.0001	error		15	2	17	0
23PY-12-05	1.27	200	400	0.50	0.0593	0.0070	0.0211	0.0022	0.0027	0.0001	576	257	21	2	17	0
23PY-12-06	1.12	135	345	0.39	0.0505	0.0062	0.0183	0.0019	0.0028	0.0001	217	263	18	2	18	1
23PY-12-07	1.38	220	409	0.54	0.0467	0.0061	0.0181	0.0021	0.0027	0.0001	35.3	285	18	2	18	0
23PY-12-08	0.90	105	308	0.34	0.0491	0.0068	0.0156	0.0016	0.0026	0.0001	150	300	16	2	17	0
23PY-12-09	1.15	187	375	0.50	0.0526	0.0065	0.0177	0.0018	0.0026	0.0001	322	86	18	2	16	0
23PY-12-10	0.96	174	306	0.57	0.0479	0.0054	0.0174	0.0019	0.0026	0.0001	98.2	248	17	2	17	1
23PY-12-11	1.42	357	423	0.84	0.0449	0.0046	0.0156	0.0013	0.0026	0.0001	error		16	1	17	0
23PY-12-12	1.30	228	409	0.56	0.0492	0.0066	0.0159	0.0017	0.0026	0.0001	167	289	16	2	17	0
23PY-12-13	2.02	431	633	0.68	0.0447	0.0042	0.0157	0.0011	0.0026	0.0001	error		16	1	17	0
23PY-12-14	1.88	432	570	0.76	0.0528	0.0051	0.0180	0.0017	0.0026	0.0001	320	220	18	2	17	0
23PY-12-15	1.74	403	534	0.76	0.0480	0.0052	0.0162	0.0013	0.0026	0.0001	98.2	246	16	1	17	0
23PY-12-17	1.36	200	457	0.44	0.0452	0.0047	0.0155	0.0012	0.0026	0.0001	error		16	1	17	0
23PY-12-18	1.07	141	348	0.41	0.0465	0.0063	0.0165	0.0018	0.0027	0.0001	33.4	291	17	2	17	0
23PY-12-19	1.38	285	452	0.63	0.0583	0.0070	0.0193	0.0017	0.0025	0.0001	543	267	19	2	16	0
23PY-12-20	1.21	205	384	0.53	0.0494	0.0052	0.0173	0.0014	0.0026	0.0001	169	226	17	1	17	0
23PY-12-21	1.06	185	341	0.54	0.0514	0.0067	0.0170	0.0018	0.0026	0.0001	257	274	17	2	17	0
23PY-15 (Trachydacite, 16.1±0.3 Ma)																
23PY-15-01	1.07	164	358	0.46	0.0526	0.0078	0.0170	0.0022	0.0025	0.0001	322	298	17	2	16	0
23PY-15-02	0.91	154	307	0.50	0.0508	0.0079	0.0166	0.0023	0.0025	0.0001	232	335	17	2	16	1
23PY-15-03	1.05	176	359	0.49	0.0528	0.0077	0.0169	0.0016	0.0024	0.0001	320	300	17	2	16	1

23PY-15-05	0.90	110	307	0.36	0.0550	0.0067	0.0175	0.0014	0.0025	0.0001	413	274	18	1	16	0
23PY-15-07	1.66	308	550	0.56	0.0482	0.0052	0.0162	0.0015	0.0024	0.0000	109	237	16	2	16	0
23PY-15-08	1.13	180	380	0.47	0.0628	0.0065	0.0208	0.0016	0.0025	0.0001	702	221	21	2	16	0
23PY-15-09	1.05	180	332	0.54	0.0541	0.0076	0.0179	0.0016	0.0026	0.0001	372	322	18	2	17	0
23PY-15-11	1.21	196	393	0.50	0.0498	0.0066	0.0160	0.0016	0.0025	0.0001	183	294	16	2	16	0
23PY-15-12	1.06	223	307	0.73	0.0350	0.0064	0.0134	0.0020	0.0028	0.0001	error		14	2	18	1
23PY-15-13	1.79	151	396	0.38	0.0451	0.0042	0.0238	0.0018	0.0040	0.0001	error		24	2	26	1
23PY-15-14	1.84	203	360	0.56	0.0875	0.0090	0.0425	0.0038	0.0040	0.0002	1372	198	42	4	26	1
23PY-15-15	1.46	245	445	0.55	0.0564	0.0076	0.0202	0.0021	0.0027	0.0001	478	302	20	2	17	0
23PY-15-16	2.06	196	327	0.60	0.0590	0.0054	0.0466	0.0039	0.0057	0.0003	569	193	46	4	37	2
23PY-15-17	1.31	209	441	0.47	0.0545	0.0077	0.0169	0.0019	0.0025	0.0001	394	322	17	2	16	0
23PY-15-18	0.97	117	339	0.35	0.0487	0.0075	0.0147	0.0015	0.0025	0.0001	200	261	15	1	16	0
23PY-15-19	1.15	149	389	0.38	0.0500	0.0063	0.0169	0.0020	0.0025	0.0001	195	270	17	2	16	0
23PY-15-20	0.87	114	285	0.40	0.0530	0.0077	0.0166	0.0021	0.0026	0.0001	328	300	17	2	17	0
23PY-15-21	1.06	156	355	0.44	0.0495	0.0068	0.0166	0.0020	0.0026	0.0001	172	293	17	2	16	0
23ZBY-07 (Trachydacite, 15.9±0.2 Ma)																
23ZBY-07-01	1.04	316	318	1.00	0.0551	0.0085	0.0165	0.0017	0.0023	0.0001	417	350	17	2	15	0
23ZBY-07-02	1.13	355	331	1.07	0.0535	0.0092	0.0169	0.0024	0.0024	0.0001	350	348	17	2	15	1
23ZBY-07-03	1.72	688	474	1.45	0.0513	0.0052	0.0170	0.0015	0.0025	0.0001	254	218	17	1	16	0
23ZBY-07-04	0.86	257	242	1.06	0.0553	0.0092	0.0173	0.0022	0.0025	0.0001	433	183	17	2	16	1
23ZBY-07-05	1.19	363	360	1.01	0.0757	0.0101	0.0223	0.0022	0.0024	0.0001	1087	269	22	2	15	0
23ZBY-07-06	1.05	296	302	0.98	0.0478	0.0078	0.0156	0.0023	0.0025	0.0001	87.1	348	16	2	16	0
23ZBY-07-07	2.29	384	375	1.02	0.2255	0.0222	0.1070	0.0113	0.0032	0.0001	3021	158	103	10	21	1
23ZBY-07-08	1.33	488	369	1.32	0.0531	0.0080	0.0171	0.0025	0.0024	0.0001	332	311	17	3	16	0
23ZBY-07-09	0.74	203	220	0.92	0.0475	0.0091	0.0153	0.0021	0.0025	0.0001	72.3	400	15	2	16	1
23ZBY-07-10	1.46	452	426	1.06	0.0515	0.0059	0.0167	0.0015	0.0025	0.0001	265	244	17	2	16	0
23ZBY-07-11	1.26	393	351	1.12	0.0524	0.0085	0.0167	0.0025	0.0025	0.0001	302	333	17	3	16	1

23ZBY-07-12	0.63	173	192	0.90	0.0571	0.0140	0.0158	0.0032	0.0025	0.0001	498	463	16	3	16	1
23ZBY-07-13	0.93	261	290	0.90	0.0497	0.0079	0.0156	0.0020	0.0025	0.0001	189	333	16	2	16	1
23ZBY-07-14	0.95	279	282	0.99	0.0517	0.0067	0.0169	0.0016	0.0024	0.0001	333	213	17	2	16	1
23ZBY-07-16	3.13	1016	946	1.07	0.0799	0.0106	0.0240	0.0035	0.0022	0.0000	1194	265	24	3	14	0
23ZBY-07-17	1.26	344	352	0.98	0.0526	0.0061	0.0171	0.0016	0.0025	0.0001	322	267	17	2	16	0
23ZBY-07-18	1.25	400	366	1.09	0.0521	0.0077	0.0174	0.0025	0.0025	0.0001	287	311	17	3	16	1
23ZBY-07-19	1.22	350	349	1.00	0.0558	0.0071	0.0172	0.0016	0.0025	0.0001	456	253	17	2	16	0
23ZBY-07-20	1.46	456	419	1.09	0.0448	0.0081	0.0146	0.0021	0.0025	0.0001	error		15	2	16	0
23ZBY-07-21	1.24	403	345	1.17	0.0534	0.0070	0.0171	0.0016	0.0025	0.0001	346	302	17	2	16	0
23ZBY-09 (Trachyandesite, 16.1±0.2 Ma)																
23ZBY-09-01	0.90	275	267	1.03	0.0532	0.0095	0.0168	0.0023	0.0025	0.0001	339	363	17	2	16	1
23ZBY-09-02	1.43	585	386	1.52	0.0490	0.0074	0.0162	0.0021	0.0025	0.0001	146	331	16	2	16	1
23ZBY-09-03	0.84	262	261	1.00	0.0552	0.0106	0.0153	0.0025	0.0024	0.0001	420	379	15	2	15	1
23ZBY-09-04	1.45	458	430	1.06	0.0568	0.0072	0.0174	0.0016	0.0025	0.0001	483	277	18	2	16	0
23ZBY-09-05	1.24	412	348	1.18	0.0501	0.0087	0.0167	0.0023	0.0025	0.0001	211	350	17	2	16	1
23ZBY-09-06	10.33	1075	3789	0.28	0.0458	0.0025	0.0153	0.0008	0.0024	0.0000	error		15	1	16	0
23ZBY-09-07	7.20	683	2569	0.27	0.0435	0.0024	0.0154	0.0009	0.0025	0.0000	error		16	1	16	0
23ZBY-09-08	2.24	679	644	1.05	0.0546	0.0061	0.0176	0.0016	0.0025	0.0001	394	254	18	2	16	0
23ZBY-09-09	0.90	250	255	0.98	0.0544	0.0095	0.0174	0.0021	0.0026	0.0001	387	350	17	2	17	1
23ZBY-09-10	1.06	455	306	1.49	0.0465	0.0090	0.0129	0.0017	0.0023	0.0001	20	411	13	2	15	1
23ZBY-09-11	1.43	564	339	1.66	0.0520	0.0080	0.0187	0.0024	0.0027	0.0001	287	324	19	2	17	1
23ZBY-09-12	1.30	424	381	1.11	0.0490	0.0085	0.0152	0.0019	0.0025	0.0001	146	363	15	2	16	0
23ZBY-09-13	0.82	253	240	1.06	0.0654	0.0132	0.0211	0.0032	0.0024	0.0001	787	434	21	3	16	1
23ZBY-09-15	0.74	237	211	1.12	0.0503	0.0091	0.0168	0.0020	0.0025	0.0001	209	374	17	2	16	1
23ZBY-09-16	0.97	264	278	0.95	0.0612	0.0133	0.0170	0.0021	0.0026	0.0001	656	477	17	2	17	1
23ZBY-09-17	1.39	455	396	1.15	0.0495	0.0067	0.0154	0.0016	0.0025	0.0001	172	289	15	2	16	0
23ZBY-09-18	1.59	552	440	1.25	0.0472	0.0059	0.0154	0.0015	0.0025	0.0001	61.2	283	15	2	16	0

23ZBY-09-19	1.82	681	489	1.39	0.0595	0.0082	0.0189	0.0024	0.0025	0.0001	583	304	19	2	16	0
23ZBY-09-20	0.59	172	169	1.02	0.0571	0.0120	0.0166	0.0024	0.0026	0.0001	494	409	17	2	16	1
23ZBY-09-21	1.05	302	310	0.97	0.0526	0.0087	0.0177	0.0031	0.0026	0.0001	322	328	18	3	17	1
23ZBY-10 (Trachydacite, 15.8±0.2 Ma)																
23ZBY-10-01	1.21	404	362	1.12	0.0511	0.0069	0.0162	0.0015	0.0024	0.0001	243	289	16	1	16	0
23ZBY-10-02	1.28	408	381	1.07	0.0480	0.0067	0.0148	0.0016	0.0025	0.0001	98.2	300	15	2	16	0
23ZBY-10-03	1.10	350	329	1.06	0.0557	0.0099	0.0163	0.0021	0.0024	0.0001	443	352	16	2	15	0
23ZBY-10-04	1.31	451	369	1.22	0.0491	0.0063	0.0163	0.0016	0.0025	0.0001	154	278	16	2	16	0
23ZBY-10-05	1.10	332	318	1.05	0.0522	0.0071	0.0161	0.0014	0.0025	0.0001	300	276	16	1	16	0
23ZBY-10-06	1.31	337	318	1.06	0.0717	0.0129	0.0250	0.0039	0.0027	0.0001	977	372	25	4	18	1
23ZBY-10-07	1.13	324	330	0.98	0.0585	0.0084	0.0171	0.0018	0.0026	0.0001	550	312	17	2	16	0
23ZBY-10-08	3.67	1720	901	1.91	0.0475	0.0046	0.0156	0.0012	0.0025	0.0000	76.0	224	16	1	16	0
23ZBY-10-09	0.94	281	288	0.98	0.0531	0.0078	0.0169	0.0020	0.0025	0.0001	332	304	17	2	16	1
23ZBY-10-10	3.80	1474	1052	1.40	0.0491	0.0034	0.0165	0.0010	0.0025	0.0000	154	156	17	1	16	0
23ZBY-10-11	0.86	246	268	0.92	0.0584	0.0092	0.0169	0.0020	0.0024	0.0001	546	345	17	2	15	1
23ZBY-10-12	1.13	373	332	1.12	0.0563	0.0078	0.0169	0.0020	0.0024	0.0001	465	311	17	2	16	0
23ZBY-10-13	0.87	253	267	0.95	0.0523	0.0084	0.0171	0.0024	0.0024	0.0001	302	330	17	2	16	1
23ZBY-10-14	1.21	464	329	1.41	0.0548	0.0077	0.0167	0.0019	0.0025	0.0001	467	323	17	2	16	0
23ZBY-10-15	1.07	336	312	1.07	0.0528	0.0077	0.0157	0.0015	0.0025	0.0001	320	300	16	2	16	1
23ZBY-10-16	1.33	480	362	1.32	0.0660	0.0094	0.0203	0.0025	0.0024	0.0001	806	302	20	3	16	0
23ZBY-10-17	4.17	1969	1063	1.85	0.0510	0.0039	0.0169	0.0011	0.0024	0.0000	243	178	17	1	16	0
23ZBY-10-18	1.02	305	312	0.98	0.0478	0.0073	0.0156	0.0022	0.0024	0.0001	100	317	16	2	16	0
23ZBY-10-19	1.07	331	323	1.03	0.0489	0.0072	0.0164	0.0022	0.0025	0.0001	143	315	17	2	16	0
23ZBY-10-20	1.20	413	358	1.15	0.0442	0.0060	0.0142	0.0017	0.0024	0.0001	error		14	2	16	0
23ZBY-10-21	1.02	273	322	0.85	0.0535	0.0096	0.0172	0.0025	0.0025	0.0001	350	372	17	3	16	1
23ZBY-20 (Trachydacite, 16.3±0.2 Ma)																
23ZBY-20-01	5.01	2616	1173	2.23	0.0455	0.0038	0.0159	0.0012	0.0025	0.0000	error		16	1	16	0

23ZBY-20-02	3.18	1370	823	1.66	0.0497	0.0044	0.0169	0.0012	0.0025	0.0001	183	206	17	1	16	0
23ZBY-20-03	6.67	3302	1596	2.07	0.0482	0.0028	0.0170	0.0009	0.0026	0.0000	109	133	17	1	16	0
23ZBY-20-04	6.26	3166	1506	2.10	0.0472	0.0031	0.0165	0.0010	0.0025	0.0000	61.2	148	17	1	16	0
23ZBY-20-05	1.98	774	579	1.34	0.0552	0.0064	0.0173	0.0016	0.0024	0.0001	433	259	17	2	16	0
23ZBY-20-06	4.64	2215	1162	1.91	0.0494	0.0042	0.0172	0.0014	0.0025	0.0000	165	185	17	1	16	0
23ZBY-20-07	4.68	2263	1147	1.97	0.0517	0.0038	0.0177	0.0012	0.0025	0.0000	272	167	18	1	16	0
23ZBY-20-08	2.61	1013	747	1.36	0.0468	0.0050	0.0160	0.0015	0.0025	0.0001	39.0	237	16	1	16	0
23ZBY-20-09	2.62	691	608	1.14	0.1223	0.0109	0.0500	0.0049	0.0028	0.0001	1990	155	50	5	18	0
23ZBY-20-10	1.64	683	458	1.49	0.0538	0.0063	0.0172	0.0015	0.0024	0.0001	361	267	17	1	16	0
23ZBY-20-11	2.67	974	732	1.33	0.0521	0.0049	0.0176	0.0014	0.0025	0.0001	300	217	18	1	16	0
23ZBY-20-12	6.76	3771	1548	2.44	0.0447	0.0033	0.0154	0.0011	0.0025	0.0000	error		16	1	16	0
23ZBY-20-13	1.75	663	481	1.38	0.0523	0.0058	0.0175	0.0016	0.0025	0.0001	302	283	18	2	16	0
23ZBY-20-14	3.07	740	568	1.30	0.1775	0.0121	0.0714	0.0043	0.0030	0.0001	2631	108	70	4	19	0
23ZBY-20-15	1.15	377	335	1.12	0.0459	0.0076	0.0152	0.0024	0.0025	0.0001	error		15	2	16	0
23ZBY-20-16	2.92	1227	696	1.76	0.0668	0.0073	0.0245	0.0025	0.0026	0.0001	833	229	25	2	17	0
23ZBY-20-17	1.66	410	517	0.79	0.0508	0.0073	0.0178	0.0020	0.0026	0.0001	232	300	18	2	17	0
23ZBY-20-18	2.21	875	621	1.41	0.0453	0.0051	0.0149	0.0015	0.0025	0.0001	error		15	1	16	0
23ZBY-20-19	1.08	341	334	1.02	0.0488	0.0080	0.0151	0.0020	0.0025	0.0001	139	344	15	2	16	0
23ZBY-20-20	1.69	715	454	1.57	0.0444	0.0058	0.0148	0.0016	0.0025	0.0001	error		15	2	16	0

Table S2 Whole-rock major (wt.%)- and trace-element (ppm) data of the ultrapotassic-potassic lavas from the Payang, Sailipu, Zabuye, and Renbu areas and subduction complex, southern Tibet.

Samples	23PY-12	23PY-13	23PY-15	23PY-16	23RD-12	23RD-13	23RD-13-1	23ZBY-07	23ZBY-08	23ZBY-09	23ZBY-10
	Trachydac ite	Trachydacit e	Trachydacite	Trachydacite	Basaltic trachyandes ite	Basaltic trachyandesit e	Basaltic trachyandesite	Trachydacite	Trachyandesite	Trachyandesi te	Trachydacite
SiO ₂	62.35	62.25	60.69	59.41	58.12	59.04	59.05	62.43	60.72	60.58	61.35
TiO ₂	0.79	0.80	0.88	0.88	1.40	1.26	1.24	0.92	1.05	1.04	0.94
Al ₂ O ₃	15.97	15.83	15.15	15.61	13.74	14.44	14.35	14.70	14.08	14.11	15.91
Fe ₂ O ₃ T	4.52	4.60	5.85	5.42	5.88	5.77	5.80	4.58	5.24	5.14	5.01
MnO	0.05	0.06	0.19	0.07	0.09	0.07	0.07	0.07	0.10	0.07	0.07
MgO	2.50	2.50	2.63	3.49	5.51	4.20	4.25	2.66	3.31	3.39	2.23
CaO	4.61	4.61	4.79	5.29	4.88	4.59	4.71	4.28	4.58	4.68	3.34
Na ₂ O	3.32	3.29	3.34	2.69	2.59	2.93	2.93	3.17	3.07	3.08	3.39
K ₂ O	3.36	3.48	4.18	3.78	5.75	5.77	5.72	5.61	6.06	5.99	5.84
P ₂ O ₅	0.34	0.33	0.60	0.58	0.77	0.57	0.57	0.54	0.72	0.72	0.49
LOI	1.73	1.67	1.04	2.30	0.84	0.81	0.79	0.57	0.44	0.53	0.53
SUM	99.54	99.42	99.34	99.52	99.56	99.43	99.47	99.52	99.37	99.34	99.09
Mg#	56	56	51	60	69	63	63	57	60	61	51
FeOT	4.06	4.14	5.26	4.88	5.29	5.19	5.22	4.12	4.72	4.62	4.51
Li	10.7	10.5	14.9	13.7	16.5	17.5	16.5	17.9	18.6	16.2	14.1
Be	2.73	2.76	3.79	3.95	13.6	7.21	7.31	8.53	10.3	9.21	6.17
Sc	8.25	8.50	15.5	15.6	14.1	12.6	12.9	9.81	10.9	11.2	10.3
V	143	110	126	121	112	103	103	92.2	110	108	86.6
Cr	49.0	48.2	142	115	235	191	193	67.9	91.7	86.8	62.4
Co	11.4	11.7	16.8	13.3	21.5	16.8	18.5	11.9	14.1	13.9	12.4
Ni	19.3	18.6	30.9	25.3	133	93.4	97.5	34.6	57.4	56.2	46.8
Cu	12.0	16.4	32.4	19.1	24.8	36.9	40.9	22.7	42.6	26.8	17.0
Zn	76.8	75.4	101	86.5	85.2	88.7	93.6	81.0	71.3	65.6	68.3
Ga	21.6	22.1	21.2	21.1	24.2	22.3	22.3	20.2	21.1	20.8	21.7
Rb	125	122	212	189	496	375	377	407	449	444	351

Sr	1103	1110	949	946	862	728	727	1010	1182	1205	1400
Y	18.5	15.0	27.6	21.2	25.7	18.2	18.5	19.3	21.6	21.8	17.7
Zr	162	162	198	192	539	377	376	284	335	336	293
Nb	8.09	8.11	11.9	11.0	27.6	21.7	21.5	24.3	30.7	30.4	23.5
Sn	2.00	1.84	2.79	2.90	2.22	2.62	2.71	4.33	5.19	5.75	4.03
Cs	6.94	6.85	14.1	13.8	13.8	13.8	14.2	45.8	31.8	25.7	20.9
Ba	966	971	1607	1505	2374	1685	1470	1665	2239	2196	2214
La	40.3	37.7	40.1	37.4	122	79.7	80.1	51.9	63.3	63.9	54.7
Ce	82.0	77.7	88.0	81.0	301	177	181	112	138	139	115
Pr	10.4	9.75	11.9	11.1	43.6	25.3	25.2	14.8	18.7	19.0	15.1
Nd	41.5	37.8	50.7	46.6	179	102	103	56.7	73.3	73.0	57.6
Sm	7.82	6.70	11.0	10.2	32.6	17.2	17.4	12.5	15.6	15.5	11.7
Eu	1.90	1.66	2.32	2.19	4.88	2.89	2.82	2.33	2.94	2.92	2.53
Gd	5.45	4.50	7.48	6.59	15.3	8.23	8.34	7.13	8.88	9.16	6.94
Tb	0.72	0.60	0.97	0.95	1.68	0.98	0.92	0.85	1.07	1.08	0.88
Dy	3.62	3.03	4.93	4.45	6.37	4.22	4.18	4.04	5.10	5.01	4.11
Ho	0.66	0.54	0.90	0.78	0.94	0.67	0.66	0.71	0.80	0.76	0.68
Er	1.68	1.43	2.48	2.16	2.27	1.72	1.65	1.74	1.89	2.08	1.73
Tm	0.22	0.18	0.34	0.28	0.28	0.22	0.22	0.24	0.25	0.26	0.22
Yb	1.41	1.17	2.15	1.80	1.81	1.39	1.42	1.62	1.60	1.62	1.48
Lu	0.21	0.17	0.33	0.26	0.26	0.21	0.20	0.22	0.24	0.25	0.22
Hf	4.4	4.4	5.8	5.5	14.5	10.4	10.2	7.9	9.6	9.2	8.1
Ta	0.59	0.59	0.80	0.76	1.41	1.16	1.13	1.48	1.76	1.73	1.32
Tl	0.59	0.66	1.55	1.01	3.77	2.87	2.78	1.83	1.98	2.97	3.06
Pb	26	26	36	39	64	44	43	55	93	81	61
Th	8.7	8.3	40.3	35.1	177.0	102.1	102.2	64.8	76.6	77.0	55.3
U	2.8	2.4	7.5	6.2	22.4	13.2	13.2	14.7	18.4	18.0	9.6

Samples	23ZBY-11	23ZBY-19	12FW118a	16JT95a	22RXS-01	22RXS-03	22RXS-03-1
	Trachydac ite	Trachyande site	Minette	Minette	Subduction mélange	Subduction mélange	Subduction mélange
SiO2	60.74	58.76	48.06	52.33	67.88	36.26	36.23

TiO2	1.05	1.11	1.35	1.26	0.35	0.22	0.22
Al2O3	14.37	14.37	10.72	13.40	9.05	5.06	5.08
Fe2O3T	5.17	5.63	7.47	7.26	4.96	6.03	6.03
MnO	0.08	0.08	0.11	0.11	0.08	0.61	0.61
MgO	2.91	3.12	11.59	7.07	1.70	1.80	1.79
CaO	4.55	4.44	7.84	5.89	6.45	26.14	26.21
Na2O	3.27	3.42	1.13	2.63	0.65	0.23	0.23
K2O	5.93	6.84	4.97	6.66	1.22	0.32	0.32
P2O5	0.73	0.84	1.57	1.23	0.04	0.04	0.04
LOI	0.46	0.52		0.91	7.59	22.92	22.92
SUM	99.26	99.12		98.75	99.97	99.62	99.68
K2O/Na2 O	1.8	2.0	4.4	2.5	1.9	1.4	1.4
K2O+Na2 O	9.20	10.25	6.09	9.29	1.88	0.55	0.55
Mg#	57	56	75.45	65.86	44.4	41.0	40.9
A/CNK	0.72	0.68	0.50	0.60	0.64	0.10	0.11
A/NK	1.22	1.10	1.48	1.16	3.77	7.05	6.97
FeOT	4.65	5.06			4.46	5.42	5.43
Li	15.7	24.3			27.5	27.2	26.2
Be	9.65	8.64			1.41	0.82	0.76
Sc	11.6	10.8			10.6	9.88	9.54
V	102	99.8			46.8	25.5	25.7
Cr	82.9	83.2			40.2	23.4	23.0
Co	14.0	15.0			10.1	17.1	17.3
Ni	59.4	66.9			47.4	45.1	45.0
Cu	27.9	51.0			27.6	16.9	16.9
Zn	80.6	78.3			70.5	70.0	70.2
Ga	21.9	23.2	17.0	21.3	12.3	7.85	7.67
Rb	444	493	280	460	60.8	16.4	16.1
Sr	1265	1626	673	1495	136	183	181
Y	24.4	25.8	28.5	26.5	22.1	34.6	34.5

Zr	361	508	525	606	60.1	45.8	45.2
Nb	31.4	47.8	19.6	31.7	8.41	5.35	5.38
Sn	3.04	6.52			1.69	0.87	0.90
Cs	24.3	28.3	27.3	0.5	3.03	0.80	0.80
Ba	2207	3164	2360	3970	230	79.6	79.8
La	65.5	102	127.3	151	33.0	32.2	31.8
Ce	142	198	271.7	347	56.7	55.9	55.4
Pr	19.4	26.7	38.29	42.6	7.12	7.11	7.03
Nd	75.2	103	149.6	182	26.3	26.9	26.5
Sm	15.8	19.2	25.14	31.1	4.96	5.84	5.72
Eu	3.08	3.84	4.99	5.21	0.95	1.18	1.17
Gd	9.47	12.2	13.74	15.45	4.23	5.66	5.71
Tb	1.20	1.44	1.538	1.46	0.66	0.92	0.91
Dy	5.29	6.10	6.19	6.32	3.97	5.63	5.66
Ho	0.89	0.93	0.981	0.94	0.75	1.08	1.11
Er	2.25	2.23	2.2	2.09	2.13	3.15	3.16
Tm	0.27	0.29	0.25	0.28	0.30	0.44	0.44
Yb	1.76	1.75	1.55	1.63	1.93	2.80	2.71
Lu	0.27	0.26	0.22	0.24	0.29	0.41	0.40
Hf	9.8	13.0	14.0	15.5	1.9	1.3	1.3
Ta	1.74	2.80	1.05	1.70	0.60	0.36	0.36
Tl	1.59	1.13			0.33	0.11	0.090
Pb	65	117	86	76	14	9	9
Th	81.1	123.3	67.0	172.5	8.5	4.9	4.9
U	18.9	31.6	9.1	22.0	0.8	0.8	0.8

References

a. Ji, W.Q., Wu, F-Y., Liu, X.C., Liu, Z.C., Zhang, C., Liu, T., Wang, J-G., Paterson, S.R., 2020. Pervasive Miocene melting of thickened crust from the Lhasa terrane to Himalaya, southern Tibet and its constraint on generation of Himalayan leucogranite. *Geochimica et Cosmochimica Acta* 278, 137–156.

Table S3 Whole-rock Sr-Nd-Pb-Hf isotopic composition of the ultrapotassic-potassic lavas from the Payang, Sailipu, Zabuye, and Renbu areas and subduction complex, southern Tibet.

Sample	Lithology	Rb($\mu\text{g/g}$)	Sr($\mu\text{g/g}$)	$^{87}\text{Rb}/^{86}\text{Sr}$	$^{87}\text{Sr}/^{86}\text{Sr}$	2σ	$(^{87}\text{Sr}/^{86}\text{Sr})_i$	Sm ($\mu\text{g/g}$)	Nd ($\mu\text{g/g}$)	$^{147}\text{Sm}/^{144}\text{Nd}$	$^{143}\text{Nd}/^{144}\text{Nd}$	2σ	$(^{143}\text{Nd}/^{144}\text{Nd})_i$	$\epsilon_{\text{Nd}}(t)$
23PY-12	Trachydacite	125	1103	0.328	0.7086	6	0.7112	7.8	41.5	0.114	0.51231	7	0.5121	-9.2
23PY-12-repeat	Trachydacite	125	1103	0.328	0.7086	9	0.7112	7.8	41.5	0.114	0.51230	7	0.5121	-9.2
23PY-15	Trachydacite	212	949	0.646	0.7110	11	0.7108	11.0	50.7	0.131	0.51211	6	0.5121	-10.1
23RD-12	Basaltic trachyandesite	496	862	1.666	0.7195	14	0.7191	32.6	178.7	0.110	0.51191	6	0.5119	-14.1
23RD-13	Basaltic trachyandesite	375	728	1.492	0.7131	7	0.7127	17.2	102.2	0.102	0.51202	5	0.5120	-11.9
23RD-13-01	Basaltic trachyandesite	375	728	1.492	0.7131	8	0.7127	17.2	102.2	0.102	0.51201	5	0.5120	-12.1
23ZBY-07	Trachydacite	407	1010	1.166	0.7113	8	0.7111	12.5	56.7	0.133	0.51216	4	0.5121	-9.1
23ZBY-08	Trachyandesite	449	1182	1.099	0.7115	7	0.7112	15.6	73.3	0.129	0.51217	7	0.5122	-9.0
23ZBY-09	Trachyandesite	444	1205	1.065	0.7114	13	0.7112	15.5	73.0	0.128	0.51217	6	0.5122	-9.1
23ZBY-10	Trachydacite	351	1400	0.725	0.7110	7	0.7108	11.7	57.6	0.123	0.51219	6	0.5122	-8.6
23ZBY-19	Trachyandesite	493	1626	0.876	0.7107	11	0.7105	19.2	102.5	0.113	0.51223	5	0.5122	-7.8
22RXS-01	Subduction mélange	61	136	1.298	0.7123	16	0.7086	5.0	26.3	0.114	0.51205	12	0.5119	-9.4
22RXS-03	Subduction mélange	16	183	0.260	0.7096	15	0.7089	5.8	26.9	0.131	0.51204	10	0.51187	-10.0
12FW118a	Minette			1.202	0.7135	14	0.7133			0.1015	0.51207	7		-10.9
16JT95	Minette	460	1495	0.891	0.7206	14	0.72046	31.1	182	0.103	0.51197	7	0.51196	-12.9
16JT95-repeat	Minette	460	1495	0.891	0.7206	10	0.72045	31.1	182	0.103	0.51196	9	0.51195	-13.0
Sample	Lithology	$^{206}\text{Pb}/^{204}\text{Pb}$	2σ	$^{207}\text{Pb}/^{204}\text{Pb}$	2σ	$^{208}\text{Pb}/^{204}\text{Pb}$	2σ	Lu ($\mu\text{g/g}$)	Hf ($\mu\text{g/g}$)	$^{176}\text{Lu}/^{177}\text{Hf}$	$^{176}\text{Hf}/^{177}\text{Hf}$	2σ	$(^{176}\text{Hf}/^{177}\text{Hf})_i$	$\epsilon_{\text{Hf}}(t)$

23PY-12	Trachydacite	18.7803	0.0005	15.7188	0.0005	39.3162	0.0014	0.21	4.36	0.007	0.28255	8	0.28254	-7.7
23PY-12-repeat	Trachydacite	18.7777	0.0007	15.7172	0.0006	39.3106	0.0015	0.21	4.36	0.007	0.28253	5	0.28253	-8.1
23PY-15	Trachydacite	18.7641	0.0008	15.7364	0.0007	39.4538	0.0018	0.33	5.84	0.008	0.28252	7	0.28252	-8.6
23RD-12	Basaltic trachyandesite	18.6940	0.0005	15.7587	0.0005	39.8093	0.0015	0.26	14.50	0.002	0.28229	5	0.28229	-16.8
23RD-13	Basaltic trachyandesite	18.7282	0.0006	15.7491	0.0006	39.6236	0.0015	0.21	10.39	0.003	0.28243	5	0.28243	-11.8
23RD-13-01	Basaltic trachyandesite	18.7273	0.0004	15.7488	0.0004	39.6223	0.0011	0.21	10.39	0.003	0.28243	5	0.28243	-11.7
23ZBY-07	Trachydacite	18.8249	0.0004	15.7566	0.0004	39.5385	0.0014	0.22	7.87	0.004	0.28254	7	0.28254	-7.8
23ZBY-08	Trachyandesite	18.7998	0.0005	15.7583	0.0004	39.5256	0.0013	0.24	9.57	0.003	0.28253	6	0.28252	-8.4
23ZBY-09	Trachyandesite	18.7954	0.0004	15.7580	0.0004	39.5262	0.0012	0.25	9.17	0.004	0.28253	5	0.28253	-8.3
23ZBY-10	Trachydacite	18.8219	0.0006	15.7558	0.0006	39.5398	0.0015	0.22	8.14	0.004	0.28254	6	0.28254	-7.8
23ZBY-19	Trachyandesite	18.7963	0.0006	15.7546	0.0006	39.5543	0.0015	0.26	12.96	0.003	0.28257	5	0.28257	-7.0
22RXS-01	Subduction mélange							0.41	1.33	0.043	0.28268	9	0.28252	-4.6
22RXS-03	Subduction mélange							0.40	1.32	0.042	0.28266	9	0.282501	-5.2
12FW118a	Minette									0.002	0.28252	4		-8.8
16JT95	Minette							0.24	15.5	0.0022	0.282418	4	0.28242	-12.2
16JT95-repeat	Minette							0.24	15.5	0.0022	0.282428	6	0.28243	-11.9

References

- a. Ji, W.Q., Wu, F-Y., Liu, X.C., Liu, Z.C., Zhang, C., Liu, T., Wang, J-G., Paterson, S.R., 2020. Pervasive Miocene melting of thickened crust from the Lhasa terrane to Himalay Cosmochimica Acta 278, 137–156.

Table S4 Mg-Zn isotope data for the potassic–ultrapotassic lavas from the Payang, Sailipu, Zabuye, and Renbu areas and subduction complex, southern Tibet.

Sample ID	Type	$\delta^{26}\text{Mg}$	2SD	n	$\delta^{66}\text{Zn}$	2SD	$\delta^{68}\text{Zn}$	2SD	n
12FW118	Minette	-0.20	0.02	4	0.23	0.05	0.48	0.15	3
16JT95	Minette	-0.22	0.03	4	0.26	0.05	0.50	0.12	3
23PY-12	Trachydacite	-0.13	0.02	4	0.26	0.02	0.51	0.03	3
23PY-15	Trachydacite	-0.12	0.01	4	0.24	0.02	0.49	0.01	3
23RD-12	Basaltic trachyandesite	-0.21	0.02	4	0.33	0.01	0.65	0.00	3
23RD-13	Basaltic trachyandesite	-0.18	0.02	4	0.32	0.02	0.63	0.04	3
23ZBY-08	Trachyandesite	-0.16	0.03	4	0.29	0.03	0.57	0.05	3
23ZBY-09	Trachyandesite	-0.08	0.01	4	0.25	0.02	0.50	0.04	3
23ZBY-10	Trachydacite	-0.14	0.01	4	0.26	0.02	0.51	0.03	3
23ZBY-19	Trachyandesite	-0.20	0.02	4	0.25	0.02	0.51	0.04	3
22RXS-03	Subduction mélange	-0.44	0.02	4	0.26	0.06	0.49	0.03	3
BHVO-2	Basalt	-0.20	0.02	4	0.31	0.06	0.59	0.07	3
BCR-2	Basalt	-0.13	0.03	4	0.27	0.03	0.51	0.08	3
3702					0.27	0.05	0.50	0.03	9
Blank 1	31.2 ng								
Blank 2	27.6 ng								

Table S5 Major-element (wt.%)- and trace-element (ppm) data of olivine from the Sailipu ultrapotassic lavas, southern Tibet.

No.	23RD-12-1	23RD-12-2	23RD-12-3	23RD-12-4	23RD-12-5	23RD-12-6	23RD-12-7	23RD-12-8	23RD-12-9	23RD-12-10	23RD-12-11	23RD-12-12	23RD-12-13	23RD-12-14	23RD-12-15
SiO ₂	39.68	38.55	38.03	38.72	38.73	38.66	39.83	39.04	39.44	38.54	39.12	39.24	39.74	39.20	38.93
TiO ₂	0.07	0.03	0.00	0.05	0.00	0.02	0.02	0.00	0.05	0.04	0.02	0.01	0.00	0.04	0.02
Al ₂ O ₃	0.03	0.01	0.02	0.04	0.00	0.00	0.00	0.00	0.04	0.00	0.03	0.01	0.00	0.03	0.01
Cr ₂ O ₃	0.00	0.01	0.03	0.00	0.00	0.03	0.01	0.00	0.00	0.00	0.04	0.04	0.02	0.00	0.02
FeO*	19.73	20.09	23.75	20.48	24.20	21.58	17.69	21.48	18.39	24.39	22.96	20.95	18.34	19.59	22.08
MnO	0.34	0.37	0.40	0.32	0.41	0.36	0.27	0.39	0.31	0.43	0.39	0.36	0.30	0.34	0.33
MgO	40.29	41.22	38.15	40.93	37.25	39.68	42.50	39.52	42.27	36.45	38.11	39.60	42.01	41.20	39.17
CaO	0.16	0.17	0.17	0.16	0.14	0.17	0.15	0.15	0.20	0.14	0.15	0.11	0.20	0.15	0.13
NiO	0.14	0.16	0.11	0.19	0.13	0.16	0.14	0.16	0.14	0.16	0.12	0.17	0.12	0.17	0.17
K ₂ O	0.02	0.00	0.01	0.00	0.00	0.03	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.00	0.01
Na ₂ O	0.01	0.00	0.00	0.07	0.00	0.00	0.08	0.03	0.00	0.00	0.05	0.08	0.00	0.03	0.00
Total	100.46	100.60	100.65	100.95	100.86	100.69	100.69	100.79	100.84	100.16	100.98	100.59	100.76	100.74	100.86
Fo	83	83	79	82	78	81	85	81	84	78	79	82	84	83	81
Li	15.5	15.4	19.7	19.3	20.4	20.8	19.8	26.1	22.4	15.5					
P	1817.0	1858.5	2638.5	2894.4	595.0	650.1	1700.5	4427.5	2302.8	643.5					
Sc	6.0	6.7	7.1	6.7	7.5	7.2	6.6	7.9	7.3	6.0					
Ti	97.5	99.7	104.7	558.9	98.7	97.6	94.8	124.7	122.6	94.1					
V	8.2	8.5	12.7	17.1	12.3	12.6	13.6	27.5	14.3	8.7					
Cr	73.9	80.6	104.0	119.5	76.7	97.2	57.2	86.6	106.6	129.0					
Co	185.6	185.5	183.6	182.4	186.0	182.5	187.3	177.0	179.4	188.0					
Zn	372.8	402.2	446.7	351.4	458.0	446.6	565.7	633.8	521.4	389.5					
Y	2.2	2.4	2.9	4.2	0.6	0.5	2.1	3.8	2.7	0.4					

No.	23RD-13-1	23RD-13-2	23RD-13-3	23RD-13-4	23RD-13-5	23RD-13-6	23RD-13-7	23RD-13-8	23RD-13-9	23RD-13-10
SiO ₂	40.03	37.97	38.87	39.70	38.70	38.59	38.95	39.11	39.66	39.13
TiO ₂	0.00	0.03	0.07	0.03	0.00	0.04	0.03	0.01	0.00	0.00

Al ₂ O ₃	0.00	0.01	0.00	0.08	0.03	0.01	0.02	0.02	0.01	0.05
Cr ₂ O ₃	0.00	0.00	0.02	0.01	0.02	0.01	0.03	0.04	0.00	0.03
FeO*	16.22	24.54	20.89	19.44	18.92	21.03	18.77	19.13	18.68	19.17
MnO	0.24	0.33	0.36	0.30	0.30	0.34	0.31	0.27	0.21	0.32
MgO	43.73	37.70	39.91	39.96	42.33	40.34	41.80	41.83	41.74	39.69
CaO	0.16	0.20	0.15	0.19	0.16	0.18	0.12	0.16	0.10	0.16
NiO	0.27	0.18	0.16	0.13	0.20	0.13	0.22	0.20	0.13	0.12
K ₂ O	0.00	0.03	0.02	0.02	0.00	0.01	0.00	0.01	0.01	0.00
Na ₂ O	0.00	0.07	0.00	0.09	0.06	0.00	0.04	0.05	0.00	0.04
Total	100.65	101.06	100.44	99.94	100.73	100.69	100.29	100.84	100.53	98.70
Fo	86	78	82	83	84	82	84	84	84	83
Li	15.7	14.8	13.0	15.3	14.8	15.6	10.4	2.8	4.9	10.7
P	518.8	404.6	527.3	510.0	605.6	625.7	751.2	62.0	56.3	314.7
Sc	7.2	6.3	7.4	8.9	6.5	6.6	6.4	3.3	3.1	4.7
Ti	87.9	92.0	96.4	94.4	94.0	102.0	91.9	120.1	126.1	60.5
V	25.0	12.2	12.5	17.9	11.7	10.8	8.0	6.5	6.7	11.5
Cr	116.4	116.9	95.3	82.1	148.0	166.8	64.6	22.7	23.1	127.5
Co	190.7	193.7	187.3	191.9	196.4	191.9	210.6	226.0	231.9	180.7
Zn	493.4	414.4	464.7	487.4	376.0	395.5	357.7	188.1	189.4	329.4
Y	1.3	0.3	0.4	0.7	0.4	0.4	0.6	0.4	0.4	0.3
