

39 Ma U-Pb ZIRCON AGE FOR THE SHAKI-RASH GABBRO IN THE BULFAT IGNEOUS COMPLEX, KURDISTAN REGION, IRAQI ZAGROS SUTURE ZONE: RIFTING OF AN INTRA-NEOTETHYS CENOZOIC ARC

Sarmad Asi Ali

Department of Applied Geology, Kirkuk University, Iraq, and GeoQuEST Research Centre, University of Wollongong, Australia.

SUPPLEMENTARY FILES

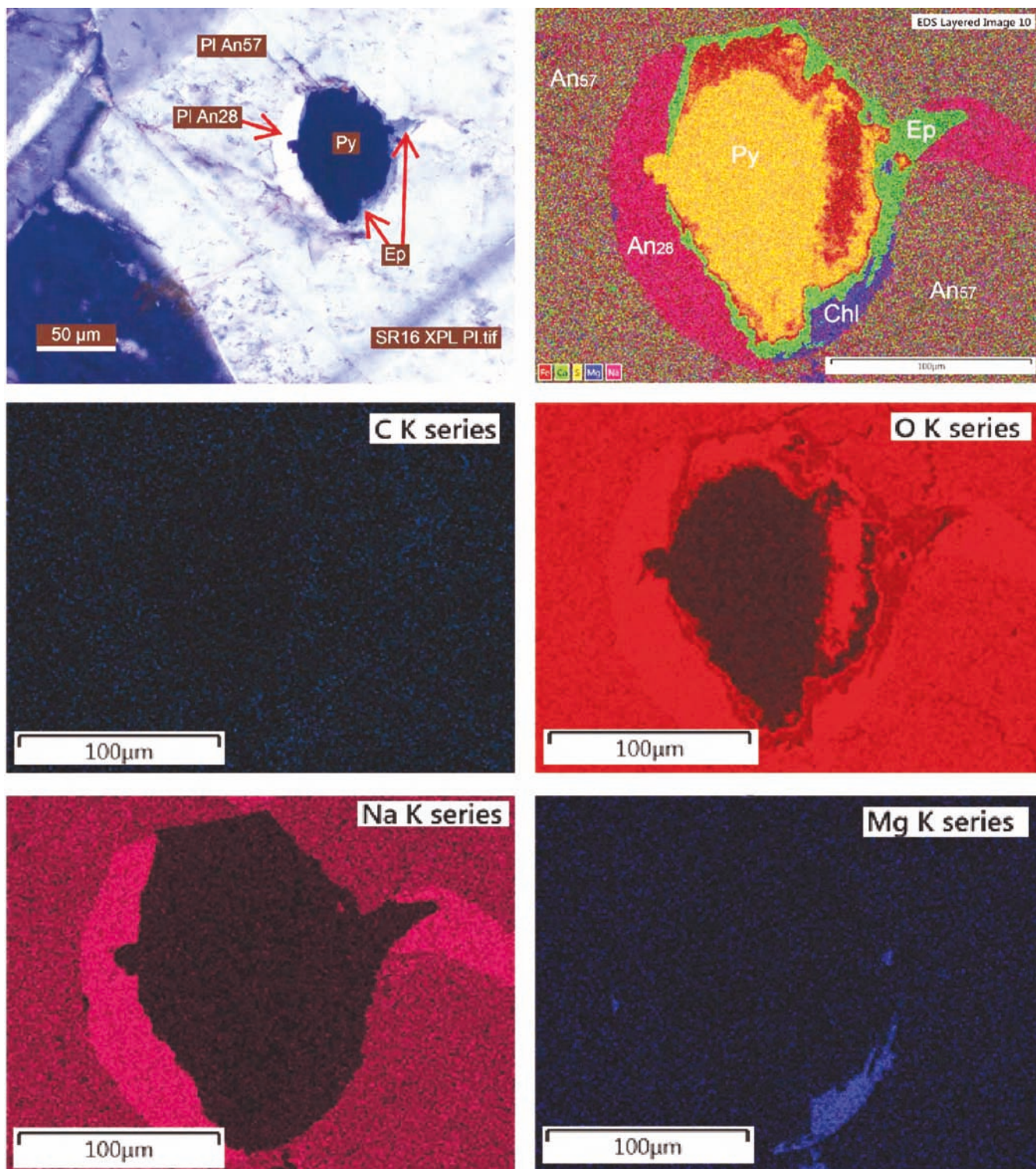


Fig. S1. X-ray maps showing Ca and Na zonation in plagioclase with some alteration to the epidote in the rim in sample SR16 (e.g., An57 to An28).

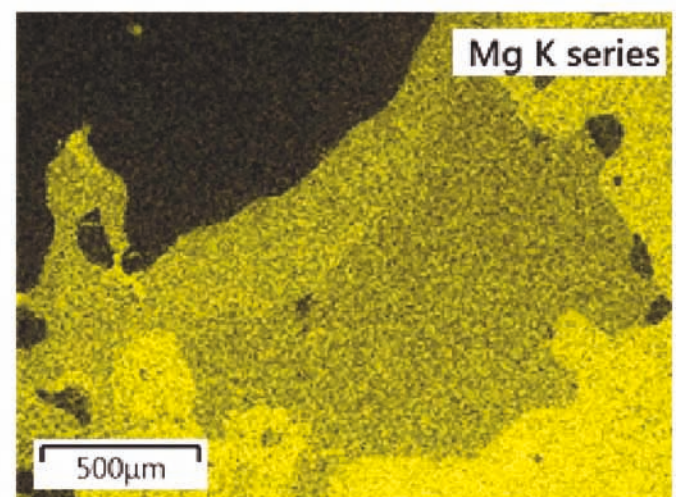
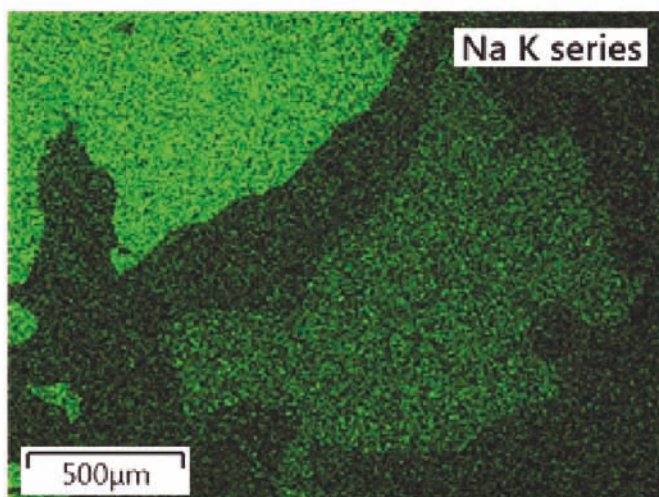
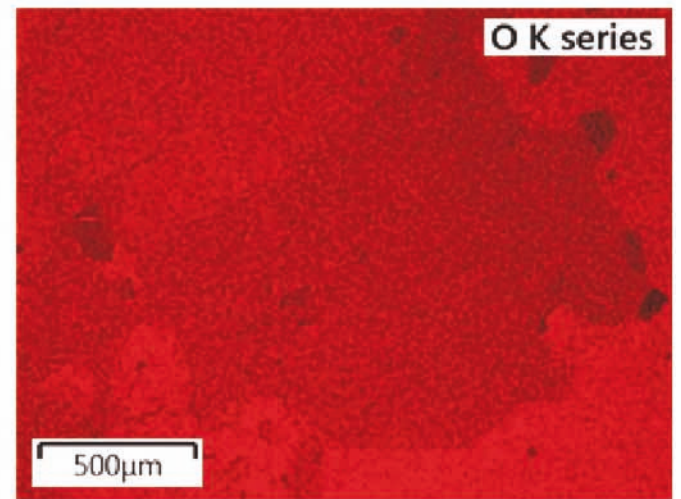
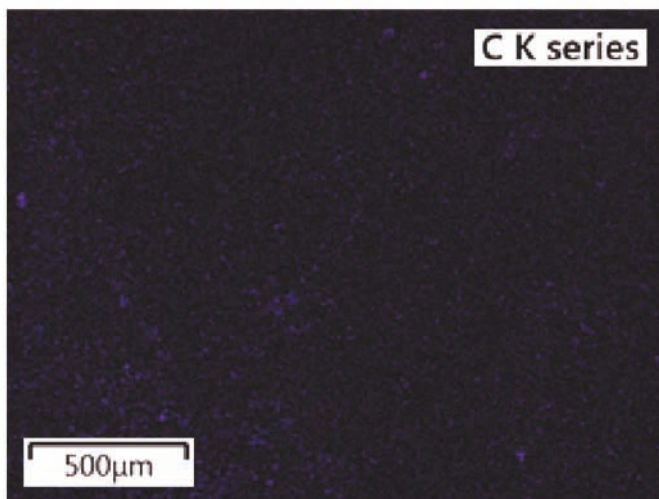
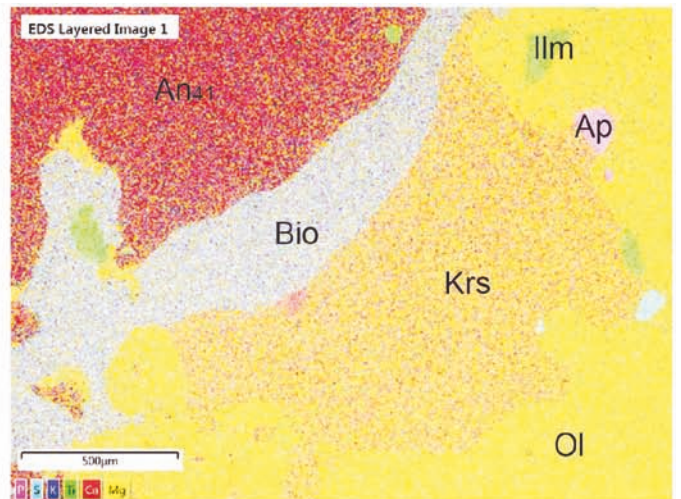
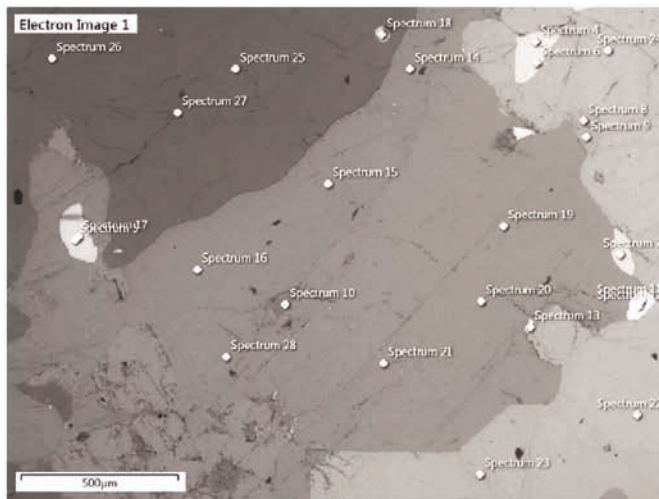


Fig. S2. X-ray maps showing the contact between the kaersutite, biotite, plagioclase and olivine.

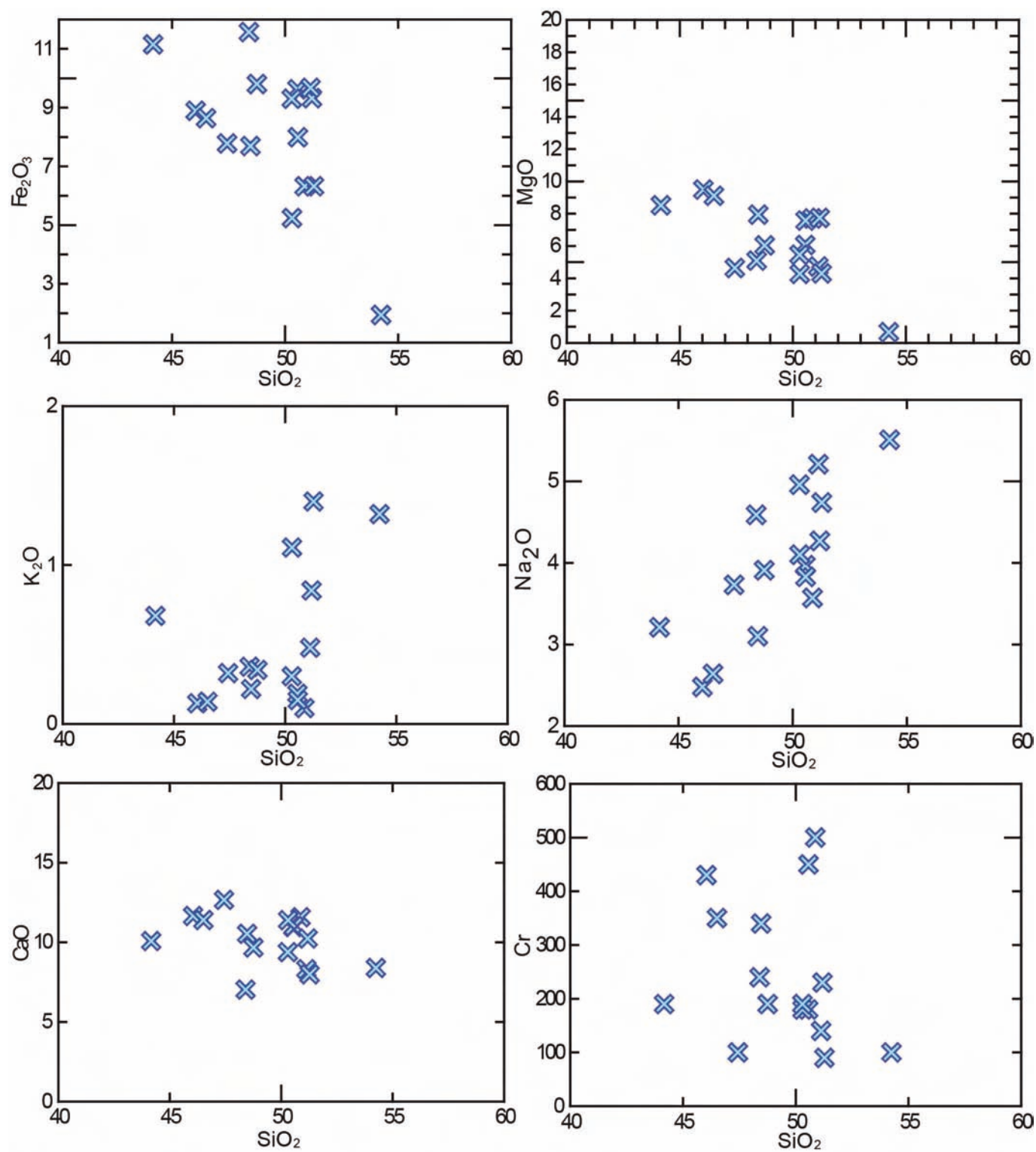


Fig. S3. Harker variation diagrams, which show the variation of some oxides and Cr compared with SiO_2

Table S1. Representative feldspar analyses from Shaki-Rash olivine gabbros.

sample	SR16-71	SR16-72	SR16-73	SR16-74	SR16-75	SR16-93	SR16-94	SR16-95	SR16-96	SR16-97	SR16-98	SR16-99	SR16-100	SR16-101	SR16-102	SR16-103	SR16-104	SR16-110	SR16-111
Si O ₂	57.026	60.683	60.491	60.320	56.384	54.630	54.609	53.839	54.416	53.582	50.694	45.796	47.400	49.903	55.657	51.550	54.587	49.304	55.101
Ti O ₂	0.035	0.000	0.000	0.000	0.030	0.000	0.000	0.043	0.000	0.451	0.417	0.517	0.501	0.501	0.000	0.384	0.384	0.300	0.000
Al ₂ O ₃	21.799	23.594	22.064	22.460	20.892	27.617	27.542	26.994	27.258	22.592	26.182	30.092	28.392	26.748	28.108	25.766	27.636	25.067	27.957
Fe O	1.116	1.323	3.094	2.887	3.117	1.357	1.265	1.691	1.633	1.479	1.530	1.608	1.466	1.710	0.514	1.016	0.965	0.862	0.656
Mg O	0.382	0.448	0.431	0.415	0.315	0.431	0.398	0.365	0.348	1.161	1.211	1.493	1.228	1.410	0.348	0.896	0.664	0.647	0.465
Ca O	7.038	7.958	6.072	6.417	6.141	14.858	14.697	14.352	14.927	3.218	2.952	2.294	2.532	2.910	9.541	8.828	9.275	7.667	9.317
Na ₂ O	8.355	8.718	9.325	9.123	8.624	5.875	5.862	5.875	5.875	7.101	4.945	2.223	3.342	4.406	5.808	5.430	5.808	5.375	5.725
K ₂ O	0.182	0.182	0.154	0.168	0.000	0.378	0.308	0.322	0.322	1.686	4.070	6.586	5.707	4.527	0.265	0.313	0.337	0.229	0.289
Number of Ions calculated on 8 oxygen basis																			
Si	2.635	2.617	2.641	2.632	2.625	2.340	2.349	2.344	2.341	2.604	2.463	2.281	2.352	2.428	2.495	2.460	2.462	2.473	2.488
Ti	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.016	0.015	0.019	0.019	0.018	0.000	0.014	0.013	0.011	0.000
Al	1.187	1.199	1.135	1.155	1.146	1.394	1.396	1.385	1.382	1.294	1.499	1.766	1.660	1.534	1.485	1.449	1.469	1.482	1.488
Fe ⁺²	0.043	0.048	0.113	0.105	0.121	0.049	0.046	0.062	0.059	0.060	0.062	0.067	0.061	0.070	0.019	0.041	0.036	0.036	0.025
Mg	0.026	0.029	0.028	0.027	0.022	0.028	0.026	0.024	0.022	0.084	0.088	0.111	0.091	0.102	0.023	0.064	0.045	0.048	0.031
Ca	0.348	0.368	0.284	0.300	0.306	0.682	0.677	0.670	0.688	0.168	0.154	0.122	0.135	0.152	0.458	0.451	0.448	0.412	0.451
Na	0.748	0.729	0.789	0.772	0.778	0.488	0.489	0.496	0.490	0.669	0.466	0.215	0.321	0.416	0.505	0.502	0.508	0.523	0.501
K	0.011	0.010	0.009	0.009	0.000	0.021	0.017	0.018	0.018	0.105	0.252	0.418	0.361	0.281	0.015	0.019	0.019	0.015	0.017
An	31	33	26	28	28	57	57	57	58	18	18	16	16	18	47	46	46	43	47
Ab	68	66	73	71	72	41	41	42	41	71	53	28	39	49	52	52	52	55	52
Or	1	1	1	1	0	2	1	2	1	11	29	55	44	33	2	2	2	2	2

sample	SR16-112	SR9-25	SR9-26	SR9-27	SR9-56	SR9-57	SR9-58	SR9-59	SR19-40	SR19-41	SR19-42	SR19-43	SR19-44	SRga5-45	SRga5-46	SRga5-47	SRga5-48	SRga5-49
Si O ₂	54.673	50.438	49.004	50.331	51.357	52.470	48.277	49.646	52.534	51.272	50.994	51.486	51.956	55.122	55.101	55.272	55.379	54.138
Ti O ₂	0.000	0.484	0.000	0.501	0.350	0.851	0.451	0.000	0.334	0.718	0.935	0.718	0.434	0.000	0.000	0.000	0.000	0.000
Al ₂ O ₃	28.448	23.990	23.442	23.801	24.349	25.067	23.046	23.783	24.765	24.406	23.877	23.499	23.405	26.654	26.408	26.597	26.578	25.596
Fe O	0.617	2.302	1.980	1.659	1.826	1.890	1.968	1.312	1.119	1.222	2.251	2.482	2.366	1.466	1.698	1.260	1.710	2.868
Mg O	0.431	1.244	1.211	1.178	0.713	0.763	0.813	0.664	0.680	0.614	1.211	1.609	1.676	1.692	1.825	1.676	2.024	3.036
Ca O	9.555	7.401	7.107	7.401	7.862	7.764	7.065	7.471	8.058	7.750	8.002	8.058	7.750	8.898	8.814	9.569	9.191	8.548
Na ₂ O	5.617	5.550	5.496	5.630	5.859	5.657	5.590	5.415	5.606	5.862	5.686	5.538	5.632	5.862	5.889	5.686	5.646	5.619
K ₂ O	0.289	0.373	0.361	0.506	0.265	0.289	0.433	0.373	0.277	0.313	0.301	0.265	0.253	0.193	0.193	0.181	0.000	0.205
Number of Ions calculated on 8 oxygen basis																		
Si	2.466	2.472	2.479	2.482	2.492	2.498	2.473	2.514	2.531	2.499	2.463	2.478	2.501	2.473	2.472	2.475	2.473	2.427
Ti	0.000	0.018	0.000	0.019	0.013	0.030	0.017	0.000	0.012	0.026	0.034	0.026	0.016	0.000	0.000	0.000	0.000	0.000
Al	1.512	1.386	1.398	1.383	1.393	1.406	1.392	1.419	1.406	1.402	1.359	1.333	1.328	1.410	1.396	1.403	1.399	1.352
Fe ⁺²	0.023	0.094	0.084	0.068	0.074	0.075	0.084	0.056	0.045	0.050	0.091	0.100	0.095	0.055	0.064	0.047	0.064	0.108
Mg	0.029	0.091	0.091	0.087	0.052	0.054	0.062	0.050	0.049	0.045	0.087	0.115	0.120	0.113	0.122	0.112	0.135	0.203
Ca	0.462	0.389	0.385	0.391	0.409	0.396	0.388	0.405	0.416	0.405	0.414	0.415	0.400	0.428	0.424	0.459	0.440	0.411
Na	0.491	0.527	0.539	0.538	0.551	0.522	0.555	0.532	0.524	0.554	0.533	0.517	0.526	0.510	0.512	0.494	0.489	0.488
K	0.017	0.023	0.023	0.032	0.016	0.018	0.028	0.024	0.017	0.019	0.019	0.016	0.016	0.011	0.011	0.010	0.000	0.012
An	48	41	41	41	42	42	40	42	43	41	43	44	42	45	45	48	47	45
Ab	51	56	57	56	56	56	57	55	55	57	55	54	56	54	54	51	53	54
Or	2	2	2	3	2	2	3	3	2	2	2	2	2	1	1	1	0	1

Table S2. Representative olivine analyses from Shaki-Rash olivine gabbros.

sample	SRga5-60	SRga5-61	SRga5-62	SRga5-63	SRga5-64	SR19-9	SR19-10	SR19-11	SR19-12	SR19-13	SR9-22	SR9-23	SR9-24
Si O ₂	37.326	35.743	40.042	40.021	40.277	35.999	36.491	33.039	36.235	36.919	34.395	35.358	33.133
Ti O ₂	0.000	0.000	0.000	0.000	0.000	0.367	0.284	0.238	0.267	0.350	0.000	0.000	1.068
Al ₂ O ₃	3.608	2.229	2.796	3.155	3.117	2.456	2.116	2.704	2.116	2.078	1.020	1.587	2.153
Fe O	20.242	20.357	21.180	21.708	22.209	27.019	27.469	25.084	27.019	27.019	35.789	33.295	33.282
Mn O	0.000	0.000	0.000	0.000	0.452	0.465	0.568	0.734	0.516	0.568	0.736	0.891	0.646
Mg O	27.838	29.215	32.102	31.869	31.637	22.247	22.131	34.200	21.832	22.214	22.629	22.231	20.655
Ca O	1.805	1.119	1.273	1.273	1.413	1.525	1.651	2.432	2.071	2.224	0.727	0.979	1.133
Number of Ions calculated on 4 oxygen basis													
Si	1.098	1.071	1.089	1.084	1.083	1.114	1.124	0.888	1.124	1.128	1.025	1.061	1.026
Ti	0.000	0.000	0.000	0.000	0.000	0.009	0.007	0.005	0.006	0.008	0.000	0.000	0.025
Al	0.125	0.079	0.090	0.101	0.099	0.090	0.077	0.086	0.077	0.075	0.036	0.056	0.079
Fe ⁺³	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.128	0.000	0.000	0.000	0.000	0.000
Fe ⁺²	0.498	0.510	0.482	0.492	0.499	0.699	0.707	0.436	0.701	0.690	0.892	0.835	0.862
Mn	0.000	0.000	0.000	0.000	0.010	0.012	0.015	0.017	0.014	0.015	0.019	0.023	0.017
Mg	1.221	1.305	1.302	1.287	1.268	1.026	1.016	1.371	1.009	1.012	1.005	0.994	0.954
Ca	0.057	0.036	0.037	0.037	0.041	0.051	0.054	0.070	0.069	0.073	0.023	0.031	0.038
Te	0	0	0	0	1	1	1	1	1	1	1	1	1
Fo	69	71	71	71	70	57	57	68	56	57	52	53	51
Fa	28	28	26	27	27	39	39	28	39	39	46	44	46

Table S3. Representative pyroxene analyses from Shaki-Rash olivine gabbros.

sample	SRga5-50	SRga5-51	SRga5-52	SRga5-53	SRga5-54	SRga5-55	SRga5-56	SRga5-58	SRga5-59	SRga5-65	SRga5-66	SRga5-67	SRga5-68	SRga5-69
Si O ₂	46.801	46.416	49.347	48.299	49.133	40.577	40.384	48.726	49.154	52.427	52.020	51.742	52.085	52.127
Ti O ₂	0.534	0.601	0.000	0.584	0.751	2.637	2.587	0.501	0.534	0.000	0.000	0.000	0.000	0.000
Al ₂ O ₃	5.119	5.006	5.421	5.346	6.914	12.449	12.977	7.839	8.009	4.704	4.420	4.515	4.345	3.797
Fe O	7.214	7.343	7.279	7.112	6.173	8.282	8.488	5.851	5.350	13.889	13.786	14.005	13.490	14.172
Mn O	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.400	0.349	0.387	0.336
Mg O	14.234	14.666	15.147	14.218	12.791	12.426	12.111	11.912	12.011	24.603	25.134	24.404	25.051	25.781
Ca O	15.585	15.291	15.361	16.158	17.082	9.681	9.401	16.536	16.382	2.001	2.280	1.861	1.707	1.595
Na ₂ O	1.132	1.078	1.172	1.132	1.428	3.032	3.059	1.644	1.711	0.000	0.000	2.183	0.714	0.000
Number of Ions calculated on 6 oxygen basis														
Si	1.884	1.871	1.914	1.900	1.905	1.641	1.635	1.913	1.923	1.934	1.909	1.853	1.905	1.915
Ti	0.016	0.018	0.000	0.017	0.022	0.080	0.079	0.015	0.016	0.000	0.000	0.000	0.000	0.000
Al	0.243	0.238	0.248	0.248	0.316	0.593	0.619	0.363	0.369	0.205	0.191	0.191	0.187	0.164
Fe ⁺³	0.046	0.068	0.013	0.004	0.000	0.203	0.193	0.000	0.000	0.000	0.000	0.254	0.054	0.006
Fe ⁺²	0.197	0.179	0.224	0.230	0.200	0.077	0.095	0.192	0.175	0.429	0.423	0.165	0.359	0.430
Mn	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.011	0.012	0.010
Mg	0.854	0.881	0.876	0.834	0.739	0.749	0.731	0.697	0.701	1.353	1.375	1.303	1.366	1.412
Ca	0.672	0.660	0.638	0.681	0.710	0.419	0.408	0.695	0.687	0.079	0.090	0.071	0.067	0.063
Na	0.088	0.084	0.088	0.086	0.107	0.238	0.240	0.125	0.130	0.000	0.000	0.152	0.051	0.000
Wo	38	37	36	39	43	29	29	44	44	4	5	4	4	3
En	48	49	50	48	45	52	51	44	45	73	73	73	74	74
Fs	14	14	13	13	12	19	20	12	11	23	22	23	22	23

Table S4. Representative amphibole analyses from Shaki-Rash olivine gabbros.

sample	SR19-29	SR19-30	SR19-31	SR16-105	SR16-106	SR16-107	SR16-108	SR16-109	SR9-19	SR9-20	SR9-21	SR9-28
Si O ₂	39.79	39.10	38.89	39.06	39.81	39.64	40.38	41.07	39.06	38.44	39.40	39.31
Ti O ₂	4.54	4.96	4.97	3.55	3.47	3.50	3.61	3.29	3.45	3.24	3.12	2.99
Al ₂ O ₃	13.36	13.00	13.53	11.81	12.35	11.96	12.47	13.19	11.05	10.92	11.05	11.54
Fe O	10.10	10.22	10.03	9.62	10.02	9.99	9.94	9.26	14.80	14.16	14.20	13.08
Mg O	9.79	10.24	9.79	11.36	11.03	11.51	11.31	10.90	11.81	11.96	11.90	11.53
Ca O	8.72	8.58	8.93	9.22	9.40	9.40	9.54	9.37	8.63	8.73	8.88	8.23
Na ₂ O	5.20	2.74	2.82	2.69	2.87	2.72	2.80	2.91	2.51	2.41	2.26	2.29
K ₂ O	0.92	0.82	0.76	0.72	0.75	0.77	0.79	0.71	0.98	0.94	0.99	1.31
Number of Ions calculated on 23 oxygen basis												
Si	6.18	6.20	6.17	6.30	6.32	6.29	6.32	6.40	6.00	5.99	6.07	6.14
Al ⁺⁴	1.82	1.80	1.83	1.70	1.68	1.71	1.68	1.60	2.00	2.01	1.93	1.86
T	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
Al ⁺⁶	0.63	0.63	0.70	0.54	0.63	0.53	0.63	0.82	0.00	0.00	0.08	0.26
Ti	0.53	0.59	0.59	0.43	0.41	0.42	0.42	0.39	0.40	0.38	0.36	0.35
Fe ⁺³	0.00	0.06	0.00	0.12	0.00	0.15	0.00	0.00	1.43	1.42	1.33	1.20
Fe ⁺²	1.31	1.29	1.33	1.17	1.33	1.18	1.30	1.21	0.47	0.42	0.50	0.51
Mg	2.27	2.42	2.32	2.73	2.61	2.73	2.64	2.53	2.70	2.78	2.73	2.68
Csite	4.74	5.00	4.94	5.00	4.99	5.00	4.99	4.94	5.00	5.00	5.00	5.00
Ca	1.45	1.46	1.52	1.59	1.60	1.60	1.60	1.56	1.42	1.46	1.47	1.38
Na	0.55	0.54	0.48	0.41	0.40	0.40	0.40	0.44	0.58	0.54	0.53	0.62
Bsite	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Na	1.02	0.30	0.38	0.43	0.48	0.44	0.45	0.44	0.17	0.19	0.14	0.07
K	0.18	0.17	0.15	0.15	0.15	0.16	0.16	0.14	0.19	0.19	0.19	0.26
Asite	1.20	0.46	0.54	0.58	0.63	0.59	0.61	0.58	0.36	0.37	0.34	0.33
Mg/(Mg+Fe)	0.63	0.65	0.64	0.70	0.66	0.7	0.67	0.68	0.85	0.87	0.84	0.84

Table S5. Representative biotite analyses from Shaki-Rash olivine gabbros.

sample	SR9-14	SR9-15	SR9-16
Si O ₂	35.850	35.914	35.807
Ti O ₂	4.106	4.456	4.590
Al ₂ O ₃	14.885	14.923	14.394
Fe O	12.448	12.217	12.191
Mn O	0.000	0.000	0.000
Mg O	12.293	12.443	12.608
Ca O	1.917	1.623	1.469
Na ₂ O	1.280	1.145	1.078
K ₂ O	6.032	6.730	6.742
Number of Ions calculated on 11oxygen basis			
Si	2.815	2.805	2.816
Ti	0.243	0.262	0.272
Al	1.378	1.374	1.334
Fe ⁺³	0.000	0.000	0.000
Fe ⁺²	0.818	0.798	0.802
Mn	0.000	0.000	0.000
Mg	1.439	1.449	1.478
Ca	0.161	0.136	0.124
Na	0.195	0.173	0.164
K	0.604	0.671	0.676

Table S6. (a) Representative ilmenite analyses from Shaki-Rash olivine gabbro rocks

sample	SR9-4	SR9-5	SR9-6	SR9-7	SR9-17	SR9-18	SR9-40	SR9-44	SR9-45	SR9-46	SR19-34	SR19-35	SR19-36	SR19-37	SR19-38
Ti O ₂	31.227	32.112	29.992	30.309	32.329	26.554	25.636	35.733	28.723	31.494	37.619	37.486	37.135	34.148	32.963
Al ₂ O ₃	2.569	6.347	2.531	2.663	6.479	8.463	9.558	5.403	5.214	4.723	4.609	4.250	3.702	3.041	5.648
Fe O	36.034	30.478	37.114	36.047	30.440	25.463	26.144	34.671	32.497	34.118	33.089	33.372	33.758	31.211	32.407
Mn O	0.658	0.000	0.000	0.000	0.000	0.000	0.633	0.503	0.503	0.426	0.607	0.710	0.000	0.633	0.865
Mg O	7.117	4.197	7.631	7.466	4.081	3.965	2.721	2.870	6.055	5.276	3.335	3.418	3.998	4.114	4.479
Ca O	1.049	1.189	1.189	1.763	1.147	2.196	2.518	1.497	1.497	1.315	1.973	1.847	1.609	1.511	1.987
Si O ₂	12.492	14.374	13.155	13.283	14.289	17.925	19.914	11.658	15.551	13.604	11.529	11.080	11.315	10.246	14.460
Number of Ions calculated on 6 oxygen basis															
Ti	1.500	1.566	1.451	1.463	1.571	1.419	1.367	1.635	1.430	1.514	1.698	1.700	1.705	1.691	1.546
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Al	0.193	0.485	0.192	0.202	0.493	0.709	0.799	0.387	0.407	0.356	0.326	0.302	0.266	0.236	0.415
Nb	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fe	1.925	1.652	1.996	1.935	1.645	1.513	1.550	1.764	1.798	1.823	1.660	1.683	1.723	1.718	1.690
Mn	0.036	0.000	0.000	0.000	0.000	0.000	0.038	0.026	0.028	0.023	0.031	0.036	0.000	0.035	0.046
Mg	0.678	0.406	0.732	0.715	0.393	0.420	0.288	0.260	0.597	0.503	0.298	0.307	0.364	0.404	0.416
Ca	0.072	0.083	0.082	0.121	0.079	0.167	0.191	0.098	0.106	0.090	0.127	0.119	0.105	0.107	0.133
Si	0.798	0.932	0.846	0.853	0.923	1.273	1.412	0.709	1.029	0.869	0.692	0.668	0.691	0.675	0.902

Table S6. (b) Representative magnetite analyses from Shaki-Rash olivine gabbro rocks.

sample	SR9-42	SR9-43	ga5- 70
Tit-magn			
Si O ₂	15.486	14.203	15.294
Ti O ₂	5.157	5.675	0.000
Al ₂ O ₃	9.785	8.897	3.835
Cr ₂ O ₃	2.949	2.876	0.000
Fe O	51.697	49.961	63.001
Mn O	0.000	0.426	0.000
Mg O	1.742	1.692	9.888
Number of Ions calculated on 4 oxygen basis			
Si	0.588	0.561	4.147
Ti	0.147	0.169	0.000
Al	0.438	0.414	1.225
Cr	0.088	0.090	0.000
Fe ⁺³	0.004	0.035	6.480
Fe ⁺²	1.636	1.616	7.805
Mn	0.000	0.014	0.000
Mg	0.099	0.100	3.997

Table S7. Representative epidote analyses from Shaki-Rash olivine gabbro rocks.

sample	SR 16 -76	SR 16 -77	SR 16 -78	SR 16 -79	SR 16 -80
SiO ₂	40.021	37.839	40.085	39.058	39.743
TiO ₂	0.000	0.000	0.000	0.000	0.000
Al ₂ O ₃	26.862	25.539	25.558	25.218	26.975
FeO	5.221	8.671	6.889	8.223	6.417
MgO	0.431	0.597	0.431	0.000	0.332
CaO	26.772	25.576	26.381	26.105	26.795
Na ₂ O	1.779	1.509	1.967	1.954	1.873
Number of Ions calculated on 12.5 oxygen basis					
Si	3.029	2.929	3.040	2.998	2.988
Ti	0.000	0.000	0.000	0.000	0.000
Al	2.396	2.330	2.285	2.281	2.390
Fe ⁺³	0.331	0.561	0.437	0.528	0.404
Mg	0.049	0.069	0.049	0.000	0.037
Ca	2.171	2.122	2.144	2.147	2.159
Na	0.261	0.227	0.289	0.291	0.273

Table S8. UOW XRF major element standards.

	Na ₂ O	MgO	Al ₂ O ₃	SiO ₂	P ₂ O ₅	SO ₃	K ₂ O	CaO	TiO ₂	MnO	Fe ₂ O ₃	Total
MAY10	2.35	6.95	13.72	49.78	0.28	0.05	0.53	11.50	2.80	0.16	12.16	100.28
accepted - normalised	2.34	6.93	13.68	49.64	0.28	0.05	0.53	11.47	2.79	0.16	12.13	100.00
ANU15	2.59	6.98	13.67	49.72	0.29	0.06	0.54	11.63	2.84	0.17	12.33	100.80
ANU15	2.52	7.10	14.09	51.15	0.30	0.06	0.53	11.67	2.83	0.16	12.49	102.90
ANU15	2.53	6.87	13.60	49.29	0.29	0.06	0.53	11.48	2.81	0.16	12.21	99.81
ANU15	2.44	7.03	13.85	50.43	0.30	0.06	0.54	11.57	2.82	0.16	12.28	101.47
ANU15	2.42	7.00	13.75	50.02	0.29	0.06	0.53	11.59	2.83	0.16	12.54	101.20
ANU15	2.56	6.94	13.64	49.48	0.28	0.06	0.53	11.58	2.83	0.16	12.28	100.34
ANU15	2.40	6.92	13.71	49.56	0.29	0.06	0.54	11.59	2.82	0.16	12.47	100.46
ANU15	2.38	6.94	13.61	49.43	0.29	0.06	0.53	11.58	2.83	0.16	12.33	100.15
ANU15	2.40	6.92	13.71	49.56	0.29	0.06	0.54	11.59	2.82	0.16	12.47	100.46
ANU15	2.42	6.99	13.74	50.03	0.29	0.06	0.55	11.62	2.84	0.16	12.41	101.11
ANU15	2.50	6.94	13.66	49.38	0.29	0.06	0.53	11.57	2.82	0.16	12.29	100.21
ANU15	2.41	7.07	13.87	50.46	0.29	0.06	0.55	11.74	2.86	0.17	12.55	102.02
ANU15	2.31	6.93	13.67	49.49	0.29	0.06	0.52	11.52	2.80	0.16	12.26	100.02
ANU15	2.42	7.00	13.73	49.72	0.29	0.06	0.53	11.52	2.82	0.16	12.23	100.48
ANU15	2.55	7.01	13.78	49.79	0.29	0.06	0.53	11.53	2.81	0.16	12.30	100.80
ANU15	2.59	7.12	13.90	50.33	0.29	0.06	0.54	11.63	2.84	0.16	12.46	101.93
ANU15	2.44	7.10	13.95	50.54	0.29	0.06	0.54	11.72	2.86	0.16	12.29	101.96
ANU15	2.44	7.02	13.84	50.11	0.29	0.06	0.53	11.61	2.83	0.16	12.39	101.28
ANU15	2.49	7.04	13.84	50.06	0.29	0.06	0.53	11.69	2.84	0.17	12.53	101.54
ANU15	2.65	7.14	13.96	50.43	0.29	0.06	0.54	11.67	2.85	0.16	12.44	102.21
ANU15	2.52	7.00	13.73	49.77	0.29	0.06	0.54	11.62	2.84	0.17	12.42	100.96
ANU15	2.39	7.07	13.81	49.96	0.29	0.06	0.55	11.55	2.82	0.16	12.40	101.06
ANU15	2.66	7.08	13.77	49.90	0.29	0.06	0.53	11.55	2.82	0.16	12.33	101.15
ANU15	2.60	7.05	13.77	49.72	0.29	0.06	0.54	11.65	2.84	0.16	12.47	101.16
ANU15	2.52	7.12	13.84	50.13	0.29	0.06	0.54	11.60	2.83	0.16	12.36	101.45
ANU15	2.49	7.02	13.65	49.50	0.29	0.06	0.53	11.59	2.83	0.16	12.35	100.47
ANU15	2.58	7.06	13.69	49.65	0.29	0.06	0.54	11.59	2.83	0.17	12.38	100.84
ANU15	2.51	7.10	13.88	50.13	0.29	0.06	0.54	11.64	2.84	0.16	12.39	101.54
ANU15	2.62	7.03	13.62	49.32	0.29	0.06	0.54	11.50	2.82	0.16	12.36	100.31
ANU-15	2.49	7.02	13.72	49.64	0.29	0.06	0.53	11.56	2.83	0.16	12.38	100.68
ANU15	2.60	7.07	13.76	49.70	0.29	0.06	0.54	11.55	2.83	0.16	12.33	100.88
ANU-15	2.43	7.05	13.68	49.56	0.29	0.06	0.54	11.55	2.81	0.16	12.39	100.52
ANU-15_R01	2.50	7.05	13.71	49.59	0.29	0.06	0.53	11.55	2.82	0.16	12.37	100.63
ANU15	2.45	7.02	13.63	49.48	0.29	0.06	0.53	11.56	2.82	0.16	12.25	100.25
ANU15	2.61	7.10	13.70	49.59	0.29	0.07	0.53	11.61	2.83	0.16	12.42	100.91
ANU15	2.67	7.08	13.70	49.49	0.29	0.07	0.53	11.63	2.84	0.16	12.44	100.91
ANU15	2.78	6.97	13.48	48.68	0.28	0.06	0.54	11.48	2.80	0.16	12.15	99.39
ANU-15R	2.74	6.95	13.48	48.71	0.29	0.07	0.55	11.54	2.81	0.16	12.10	99.39
ANU15	2.93	7.04	13.65	49.30	0.29	0.07	0.53	11.22	2.73	0.16	11.84	99.75
ANU-15	3.02	7.03	13.61	49.10	0.29	0.08	0.52	11.23	2.74	0.16	11.99	99.76

Table S8 (continued).

accepted - normalised	Na ₂ O	MgO	Al ₂ O ₃	SiO ₂	P ₂ O ₅	SO ₃	K ₂ O	CaO	TiO ₂	MnO	Fe ₂ O ₃	Total
W-2	2.24	6.39	15.34	52.45	0.13	0.04	0.63	11.00	1.09	0.16	10.80	100.00
W-2	2.23	6.37	15.30	52.31	0.13	0.04	0.63	10.97	1.09	0.16	10.77	99.86
W-2	2.27	6.48	15.25	52.11	0.13	0.03	0.62	10.97	1.07	0.16	10.76	99.84
W-2	2.33	6.48	15.31	52.33	0.13	0.03	0.60	10.77	1.05	0.16	10.66	99.85
W-2	2.26	6.48	15.31	52.29	0.13	0.03	0.62	10.89	1.06	0.16	10.61	99.85
W-2	2.34	6.53	15.27	52.10	0.13	0.03	0.61	10.92	1.07	0.16	10.68	99.84
W-2	2.27	6.52	15.27	52.10	0.13	0.03	0.61	10.94	1.07	0.16	10.73	99.85
W-2	2.30	6.49	15.28	52.26	0.13	0.04	0.61	10.83	1.06	0.16	10.69	97.63
W-2	2.21	6.50	15.28	52.06	0.13	0.03	0.62	10.89	1.07	0.16	10.90	97.63
W-2	2.21	6.50	15.25	52.11	0.13	0.03	0.62	10.98	1.08	0.16	10.77	99.81
W-2	2.27	6.49	15.21	51.90	0.13	0.03	0.62	10.99	1.08	0.16	10.96	99.84
W-2	2.29	6.50	15.22	51.96	0.13	0.04	0.62	11.06	1.08	0.16	10.79	99.81
W-2	2.27	6.49	15.21	51.90	0.13	0.03	0.62	10.99	1.08	0.16	10.96	99.83
W-2	2.27	6.49	15.21	51.90	0.13	0.03	0.62	10.99	1.08	0.16	10.96	99.83
W-2	2.30	6.51	15.26	52.06	0.13	0.04	0.62	10.92	1.06	0.16	10.77	99.84
W-2	2.31	6.52	15.24	51.92	0.13	0.04	0.62	11.02	1.08	0.16	10.81	99.84
W-2	2.30	6.49	15.25	52.04	0.13	0.04	0.61	10.91	1.06	0.16	10.86	99.84
W-2	2.33	6.48	15.26	52.06	0.13	0.04	0.62	10.92	1.08	0.16	10.78	99.84
W-2	2.20	6.51	15.30	52.12	0.13	0.04	0.61	10.96	1.07	0.16	10.75	99.85
W-2	2.24	6.56	15.24	52.00	0.13	0.04	0.62	10.99	1.08	0.16	10.80	99.85
W-2	2.15	6.51	15.28	52.21	0.13	0.04	0.62	10.93	1.07	0.16	10.77	99.85
W-2	2.37	6.49	15.25	52.00	0.13	0.04	0.62	10.98	1.07	0.16	10.73	99.84
W-2	2.25	6.54	15.29	52.06	0.13	0.04	0.62	10.92	1.07	0.16	10.78	99.85
W-2	2.31	6.54	15.24	51.96	0.13	0.04	0.62	10.95	1.08	0.16	10.84	99.86
W-2	2.23	6.51	15.27	52.18	0.13	0.04	0.61	10.90	1.06	0.16	10.76	99.85
W-2	2.28	6.54	15.27	51.84	0.13	0.04	0.62	11.01	1.08	0.16	10.87	99.84
W-2	2.28	6.50	15.27	52.07	0.13	0.04	0.62	10.89	1.07	0.16	10.81	99.84
W-2	2.62	6.58	15.23	51.85	0.13	0.05	0.62	10.85	1.06	0.16	10.70	99.84
W2	2.44	6.53	15.16	51.78	0.13	0.05	0.62	11.01	1.08	0.16	10.88	99.84
W-2	2.47	6.56	15.17	51.87	0.13	0.05	0.62	10.94	1.08	0.16	10.77	99.86
W-2	2.52	6.50	15.15	51.74	0.13	0.05	0.62	11.03	1.08	0.16	10.90	99.84
W-2	2.43	6.53	15.16	51.83	0.13	0.05	0.62	11.03	1.08	0.16	10.82	99.85
W-2	2.40	6.49	15.17	51.95	0.13	0.05	0.62	10.98	1.07	0.16	10.80	99.83
W-2	2.46	6.48	15.18	51.86	0.13	0.05	0.62	10.99	1.08	0.16	10.83	99.85
W-2	2.47	6.49	15.14	51.79	0.13	0.05	0.62	11.01	1.07	0.16	10.91	99.85
W-2	2.44	6.51	15.18	51.84	0.13	0.05	0.63	10.99	1.08	0.16	10.83	99.84
W-2	2.45	6.53	15.15	51.74	0.14	0.05	0.62	11.00	1.08	0.16	10.91	99.84
W-2	2.39	6.50	15.13	51.83	0.14	0.05	0.62	11.04	1.08	0.16	10.91	99.85
W-2	2.33	6.52	15.16	51.83	0.14	0.05	0.63	11.06	1.08	0.16	10.90	99.86
W-2	2.40	6.50	15.10	51.71	0.13	0.05	0.64	11.13	1.09	0.16	10.93	99.84
W-2	2.39	6.51	15.10	51.80	0.14	0.05	0.62	11.03	1.08	0.16	10.96	99.85
W-2	2.52	6.53	15.11	51.65	0.13	0.06	0.63	11.09	1.08	0.16	10.88	99.84
W-2	2.60	6.51	15.11	51.63	0.14	0.06	0.64	11.07	1.09	0.16	10.84	99.84
W-2	2.79	6.49	15.24	51.87	0.13	0.06	0.63	10.78	1.06	0.16	10.64	99.85
W-2	2.86	6.51	15.22	51.89	0.14	0.06	0.63	10.74	1.04	0.16	10.60	99.84
W-2-1	2.71	6.46	15.23	51.93	0.14	0.06	0.65	10.83	1.06	0.16	10.63	99.85
W-2-2	2.80	6.49	15.19	51.82	0.14	0.06	0.64	10.85	1.06	0.16	10.63	99.83
W-2-3	2.83	6.48	15.22	51.86	0.14	0.06	0.63	10.84	1.06	0.16	10.57	99.84
W-2-4	2.71	6.51	15.20	51.83	0.14	0.06	0.63	10.79	1.05	0.16	10.63	99.85
W-2-5	2.70	6.49	15.20	51.84	0.14	0.06	0.64	10.87	1.06	0.16	10.69	99.84
W-2-6	2.77	6.52	15.20	51.84	0.14	0.06	0.64	10.86	1.05	0.16	10.61	99.85
W-2-7	2.82	6.48	15.16	51.75	0.13	0.06	0.64	10.93	1.07	0.16	10.63	99.83
W-2-8	2.82	6.49	15.18	51.67	0.14	0.07	0.65	10.98	1.06	0.16	10.64	99.85
W-2-9	2.72	6.51	15.19	51.85	0.14	0.07	0.63	10.86	1.06	0.16	10.67	99.85
W-2-10	2.83	6.51	15.21	51.78	0.14	0.07	0.64	10.87	1.06	0.16	10.60	99.84
W-2-11	2.90	6.47	15.14	51.65	0.14	0.07	0.64	10.95	1.06	0.16	10.68	99.84
W-2-12	2.79	6.50	15.19	51.72	0.14	0.07	0.64	10.92	1.06	0.16	10.67	99.85
W-2	2.71	6.51	15.23	51.86	0.13	0.05	0.64	10.92	1.07	0.16	10.56	99.84

Table S9. UOW XRF trace elements standards.

	V	Cr	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Rb	Sr	Y	Zr	Nb	Mo	Cd	Sn	Sb	Cs	Ba	La	Ce	Hf	Ta	W	Hg	Pb	Bi	Th	U	
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	
G-2	36	5	<3.0	3	11	86	23	1	1	0	0	170	478	11	309	11	<1.0	<2.0	7	<3.0	1	1880	90	160	8	1	<1	<0.3	30	<1.0	25	2.1	
G-2	47	5	<3.0	3	11	91	23	1	<0.5	0	0	170	482	9	316	11	<1.0	<2.0	7	<3.0	<4.0	1876	95	166	5	4	<1.0	<0.3	32	<1.0	26	4	
G-2	51	3	<3.0	3	10	90	23	1	<0.5	0	0	170	478	9	322	12	<1.0	6	2	<3.0	<4.0	1911	69	138	5	2	<1.0	<0.3	32	<1.0	25.4	3.9	
G-2	48	4	<3.0	3	10	90	23	1	0	0	0	170	480	10	319	12	<1.0	<2.0	6	<3.0	<4.0	1880	118	182	5	1	<1.0	<0.3	31	<1.0	25.4	3.1	
G-2	49	5	<3.0	3	10	90	23	1	<0.5	0	0	169	479	9	318	12	<1.0	<2.0	5	<3.0	<4.0	1884	86	161	5	2	<1.0	<0.3	32	<1.0	25.6	2.7	
G-2	44	5	<3.0	3	10	90	23	1	<0.5	0	<0.1	169	476	9	315	12	<1.0	<2.0	6	<3.0	<4.0	1921	114	189	5	4	<1.0	0	32	<1.0	25.8	2.6	
G-2	45	6	<3.0	3	12	91	23	1	0	0	0	170	479	9	316	12	<1.0	<2.0	4	<3.0	<4.0	1888	71	145	5	1	<1.0	<0.3	31	<1.0	25.8	3.6	
G-2	51	4	<3.0	3	10	90	23	1	<0.1	0	0	169	479	9	323	12	<1.0	1	2	1	<4.0	1883	67	132	5	2	<1.0	<0.3	32	<0.1	26	3.1	
G-2	47.1	7.6	<3.0	3.1	9.9	90.3	22.9	0.9	<0.2	0.4	0.2	168.9	479.1	9.4	325.3	11.7	<1.0	0.8	6	<3.0	<4.0	1898	83.4	164.2	5.3	2.3	<1.0	<0.3	31.7	<1.0	26.1	3.7	
G-2	53.6	3.9	<3.0	3	10.1	91.1	23.1	1	0.6	0.3	0.2	170.9	485.7	9.2	325.9	11.7	<1.0	<2.0	5	<3.0	<4.0	1892	82.6	139.6	5.1	2.7	<1.0	<0.3	31.4	<1.0	26.4	2.9	
G-2	52	4	<3.0	3.7	13.3	90.2	24.4	1.1	<0.5	0.5	0.2	169.7	480.6	9.2	324.7	11.9	<1.0	<2.0	2.4	0.8	<4.0	1910	112.3	235	3.8	0.9	<1.0	<0.3	31.9	<1.0	26.5	3.2	
G-2	51	4	<3.0	3	11	90	23	1	<0.5	0	0	169	479	9	319	12	<1.0	<2.0	6	<0.1	<1.7	1846	69	121	5	2	<1.0	1	32	<1.0	25.5	3.4	
G-2	47	6	<3.0	3	10	91	23	1	<0.5	0	0	170	481	9	326	12	<1.0	1	4	<3.0	<4.0	1921	106	191	6	2	<1.0	<0.3	32	<1.0	25.7	3.4	
G-2	49	5	<3.0	3	10	90	23	1	0	0	0	169	479	9	325	12	<1.0	1	5	<3.0	<4.0	1896	104	201	5	1	<1.0	1	32	<1.0	25.9	2.6	
G-2	50	5	<3.0	3	10	90	23	1	<0.5	0	0	170	478	9	321	12	<1.0	<2.0	7	<3.0	<4.0	1872	76	120	5	3	<1.0	<0.3	32	<1.0	25.8	2.9	
G-2	51	6	<3.0	3	10	90	23	1	<0.5	0	0	169	478	9	322	12	<1.0	<2.0	7	1	<4.0	1874	77	147	4	3	<1.0	<0.3	32	<1.0	25.8	3.8	
G-2	54	5	<3.0	3	12	90	24	1	<0.2	0	0	169	481	9	319	12	<1.0	1	5	2	<1.0	1911	94	166	5	1	<1.0	1	32	<1.0	26	3.4	
G-2	52	4	<3.0	3	10	90	23	1	1	0	0	170	479	9	322	12	<1.0	<2.0	4	1	<4.0	1882	94	190	5	1	<1.0	<0.3	31	<1.0	26.1	2.2	
G-2	46	4	<3.0	3	10	90	23	1	0	0	0	169	479	10	319	12	<1.0	<2.0	4	1	<4.0	1872	102	201	5	4	<1.0	<0.3	31	<1.0	25.5	3.6	
G-2	50	4	<3.0	3	12	90	24	1	0	0	<0.1	169	479	9	321	12	<1.0	<2.0	6	<3.0	<4.0	1884	108	201	4	1	<1.0	0	31	<0.3	25.4	2.4	
G-2	52	3	<3.0	4	10	91	23	1	<0.2	0	0	169	481	9	321	12	<1.0	<2.0	4	<3.0	<4.0	1888	104	175	5	2	<1.0	<0.3	32	<1.0	26.1	3	
G-2	46	6	<3.0	4	12	90	24	1	<0.5	0	<0.5	169	480	9	321	12	<1.0	<2.0	2	1	<4.0	1904	88	173	5	1	<1.0	1	32	<1.0	25.9	3.5	
G-2	51	6	<3.0	5	11	90	23	1	<0.5	0	<0.1	168	478	10	321	12	<1.0	<2.0	6	1	<4.0	1873	82	131	5	1	<1.0	0	32	<1.0	25.8	3.1	
G-2	49	4	<3.0	3	10	89	23	1	0	0	0	169	479	9	319	12	<1.0	<2.0	3	1	<4.0	1958	102	198	5	2	<1.0	0	32	<1.0	26.1	2.3	
G-2	48	4	<3.0	3	13	90	24	1	<0.5	0	0	170	479	9	322	12	<1.0	<2.0	6	<3.0	<0.1	1874	91	149	4	1	<1.0	<0.3	32	<1.0	25.8	3.9	
G-2	46	6	<3.0	2	10	89	23	2	<0.5	0	0	169	479	9	321	12	<1.0	<2.0	5	<3.0	<4.0	1893	104	199	5	5	<1.0	<0.3	32	<1.0	26.1	3	
G-2	47	5	<3.0	3	10	91	24	1	0	0	0	169	480	9	321	12	<1.0	<0.1	4	1	<4.0	1888	96	184	5	1	<1.0	<0.3	32	<1.0	26.4	3	
G-2	47	5	<3.0	3	10	91	23	1	0	0	0	170	480	10	322	12	<1.0	<0.1	2	<3.0	<4.0	1877	90	173	5	4	<1.0	<0.3	32	<1.0	26.0	2.6	
G-2	50	4	<3.0	2	10	91	23	1	<0.2	0	0	171	483	9	323	12	<1.0	<0.1	3	<3.0	<2.0	1924	117	216	6	4	<1.0	<0.3	32	<1.0	26	3.5	
G-2	48	4	<3.8	3	13	90	24	1	0	0	0	170	480	9	323	12	<1.0	<2.0	5	<3.0	<0.4	1910	85	189	4	1	<1.0	<0.3	32	<1.0	26.1	3.8	
G-2	45	6	<3.0	3	10	90	23	1	0	0	0	169	479	9	321	12	<1.0	<2.0	5	<3.0	<4.0	1902	104	181	6	5	<1.0	<0.3	31	<1.0	25.6	3.5	
G-2	45	6	<3.0	2	10	90	22	1	0	0	0	170	478	9	321	12	<1.0	<2.0	4	2	<4.0	1913	105	215	6	3	<1.0	<0.3	32	<1.0	26.1	3.1	
G-2	71	20	<3.0	3	13	91	24	1	<0.5	0	0	170	479	9	319	12	<1.0	1	4	15	48	1755	47	34	5	1	<1.0	<0.3	32	<1.0	25.5	2.9	
G-2	47	6	<3.0	3	10	90	23	1	<0.5	0	0	170	478	9	324	12	<1.0	0	5	1	<4.0	1880	72	121	5	3	<1.0	<0.3	32	<1.0	26	3	
G-2	52	16	<3.0	3	10	90	23	1	<0.5	0	0	170	480	9	318	12	<1.0	1	6	16	49	1752	50	34	5	1	<1.0	<0.3	32	<1.0	26.5	2.6	
G-2	52	5	<3.0	2	10	90	23	1	1	0	0	170	481	9	328	12	<1.0	<2.0	5	<3.0	<4.0	1965				4	<1.0	<0.3	31	<0.2	26.7	2.8	
G-2	68	19	<3.0	3	11	90	24	1	0	0	0	170	480	9	317	12	<1.0	1	7	15	44	1736	84			4	<1.0	<0.3	32	<0.2	25.7	2.7	
G-2	48	3	12	3	10	87	23	1	<0.5	0	<0.5	168	482	9	329	12	<1.0	1	15	2	<4.0	2054			5	1	<1.0	3	32	<0.3	28.4	3.1	
G-2	45	3	13	2	9	89	22	1	1	0	<0.5	169	482	10	323	12	<1.0	<0.2	3	<3.0	<4.0	1961	63			5	3	<1.0	3	32	<0.3	27.7	2.7
G-2	45	4	13	2	11	88	23	1	<0.2	0	<0.5	168	479	9	326	12	<1.0	1	17	2	<4.0	1932	55	183	4	1	<1.0	2	32	<0.3	27.3	1.8	
G-2	45	4	13	2	10	88	23	2	<0.5	0	<0.5	170	483	9	324	12	<1.0	1	15	3	<4.0	1923	71	185	5	1	<1.0	2	32	<0.3	27.8	2.2	
Detection l	1	1	1	1	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	1	0.5	1	1	1	1	1	3	3	4	1	1	0.2	0.5	0.5	1	1	1	1	1	

Table S9 (continued).

	V	Cr	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Rb	Sr	Y	Zr	Nb	Mo	Cd	Sn	Sb	Cs	Ba	La	Ce	Hf	Ta	W	Hg	Pb	Bi	Th	U
BIR-1	313	382	51	164	126	71	14	2	<0.5	<0.5	0	1	108	16	13	1	<1.0	<3.0	<3.0	<3.0	<4.0	7	<2	2	<2	9	2	<1.0	2	<1.0	<1.0	<1.0
BIR-1	326	414	51	164	132	68	15	<0.5	<0.5	<0.5	<0.5	1	109	17	13	1	<1.0	1	<3.0	<3.0	<4.0	<1.7	<2.0	<2.0	1	9	1	0	2	<1.0	<1.0	<1.0
BIR-1	316	402.9	52	165	130	68	14	2	<0.5	<0.5	<0.5	1	110	17	14	1	<1.0	0	<3.0	<3.0	<4.0	<1.7	3	<6.0	2	9	1	<1.0	2	<1.0	<1.0	<1.0
BIR-1	329	414	55	162	130	68	14	2	<0.5	<0.5	<0.5	1	110	17	13	0	<1.0	<2.0	<3.0	<3.0	<4.0	<1.7	<2.0	6	2	9	1	<1.0	2	<1.0	<1.0	<1.0
BIR-1	324	403	54	161	127	68	14	<0.2	<0.5	<0.5	<0.5	1	110	17	13	1	<1.0	1	<3.0	<3.0	<4.0	30	15	<0.2	2	9	1	<1.0	2	<1.0	<1.0	<1.0
BIR-1	327	419	61	164	129	69	15	<0.2	<0.5	<0.5	<0.5	1	110	17	13	1	<1.0	<2.0	<3.0	<3.0	<4.0	<1.6	<2.0	<2.0	2	9	1	<1.0	2	<1.0	<1.0	<1.0
BIR-1	321	396	57	163	129	67	14	1	<0.5	<0.5	<0.5	1	108	16	13	1	<1.0	<2.0	<3.0	<3.0	<4.0	<1.7	<2.0	<2.0	1	9	1	0	2	<1.0	<1.0	<1.0
BIR-1	374	423	62	166	131	69	14	<0.5	<0.5	<0.5	<0.5	1	110	17	14	1	<1.0	<2.0	<3.0	<3.0	<4.0	<1.7	<2.0	<2.0	1	9	2	<1.0	2	<1.0	<1.0	<1.0
BIR-1	329	403	60	166	131	69	14	2	<0.5	<0.5	<0.5	1	111	17	14	1	<1.0	<2.0	<3.0	<3.0	<4.0	<1.7	<2.0	<2.0	1	9	2	<1.0	2	<1.0	<1.0	<1.0
BIR-1	331	417	57	166	130	69	15	2	<0.5	<0.5	<0.1	1	110	17	13	0	<1.0	<2.0	<3.0	<3.0	<4.0	24	<2.0	<0.1	2	9	2	<1.0	2	<1.0	<1.0	<1.0
BIR-1	322	400	51	162	128	68	14	2	<0.5	<0.5	<0.1	1	110	17	13	1	<1.0	<2.0	<3.0	<3.0	<4.0	<1.7	<2.0	<2.0	1	9	2	<1.0	2	<1.0	<1.0	<1.0
BIR-1	329	413	60	165	133	69	14	2	<0.5	<0.5	<0.5	1	111	17	13	1	<1.0	<2.0	<3.0	<3.0	<4.0	<1.7	<2.0	<2.0	1	10	1	<1.0	2	<1.0	<1.0	<1.0
BIR-1	317	409	47	163	128	68	15	<0.5	<0.5	<0.5	<0.5	1	110	17	13	1	<1.0	1	<3.0	3	<4.0	<1.7	<2.0	<2.0	3	9	1	<0.6	2	<1.0	<1.0	<1.0
BIR-1	325	414	61	164	131	69	14	1	<0.5	<0.5	<0.5	1	110	17	13	1	<1.0	<2.0	<3.0	<3.0	<4.0	<1.7	<2.0	<2.0	3	9	2	<1.0	2	<1.0	<1.0	<1.0
BIR-1	327	409	61	162	130	69	14	1	<0.5	<0.5	<0.5	1	109	16	13	1	<1.0	<2.0	<3.0	<3.0	<4.0	<1.7	<2.0	<2.0	1	9	2	<1.0	2	<1.0	<1.0	<1.0
BIR-1	342	418	56	165	132	69	15	<0.5	<0.5	<0.5	<0.5	1	110	17	13	0	<1.0	<2.0	<3.0	<3.0	<4.0	23	21	29	3	9	1	<1.0	2	<1.0	<1.0	<1.0
BIR-1	329	408	53	163	130	68	15	<0.5	<0.5	<0.5	<0.5	1	110	17	13	1	<1.0	1	<3.0	<3.0	<4.0	<1.7	<2.0	1	3	9	1	<0.5	2	<1.0	<1.0	<1.0
BIR-1	340	412	55	166	132	68	14	<0.3	<0.5	<0.5	<0.5	1	110	17	13	1	<1.0	0	<3.0	<3.0	<4.0	21	<2.0	3	0	9	1	<1.0	2	<1.0	<1.0	<1.0
BIR-1	323	405	62	164	130	68	15	2	<0.5	<0.5	<0.5	1	110	17	13	1	<1.0	1	<3.0	<3.0	<4.0	15	17	<0.1	2	9	2	<1.0	2	<1.0	<1.0	<1.0
BIR-1	333	409	57	165	132	69	15	2	<0.5	<0.5	<0.5	1	110	17	13	1	<1.0	1	<3.0	<3.0	<4.0	<1.7	<2.0	<2.0	3	9	1	<1.0	2	<1.0	<1.0	<1.0
BIR-1	334	410	49	168	127	68	14	<0.1	<0.5	<0.5	<0.5	1	109	16	13	1	<1.0	<2.0	<3.0	<3.0	<4.0	25	10	<0.1	2	9	2	<1.0	2	<1.0	<1.0	<1.0
BIR-1	317	403	54	163	129	68	14	2	<0.5	<0.5	<0.1	1	110	17	13	1	<1.0	<2.0	<3.0	<3.0	<4.0	26	<2.0	16	2	9	1	<1.0	2	<1.0	<1.0	<1.0
BIR-1	324	410	45	161	125	69	13	2	<0.5	<0.5	<0.5	1	109	17	13	0	<1.0	<2.0	<3.0	<3.0	<4.0	24	<2.0	<0.1	2	9	1	<1.0	2	<1.0	<1.0	<1.0
BIR-1	334	404	54	163	132	69	15	2	<0.5	<0.5	<0.5	1	110	16	13	0	<1.0	<0.1	<3.0	<3.0	<4.0	<1.7	2	14	1	9	3	<1.0	2	<1.0	<1.0	<1.0
BIR-1	328	410	55	163	130	68	15	2	<0.5	<0.5	<0.5	1	110	17	13	1	<1.0	<2.0	<3.0	<3.0	<4.0	<1.7	<2.0	<2.0	2	9	1	<1.0	2	<1.0	<1.0	<1.0
BIR-1	315	402.9	53	162	127	68	14	2	<0.5	<0.5	<0.5	1	110	17	13	1	<1.0	<2.0	<3.0	<3.0	<4.0	23	7	<0.1	2	9	1	<1.0	2	<1.0	<1.0	<1.0
BIR-1	325	404	47	161	127	68	14	<0.5	<0.5	<0.5	<0.5	1	110	17	13	1	<1.0	<2.0	<3.0	<3.0	<4.0	<1.7	5	<2.0	2	9	2	1	3	<1.0	<1.0	<1.0
BIR-1	328	412	58	162	130	69	14	1	<0.5	<0.5	<0.5	1	110	17	13	0	<1.0	<2.0	<3.0	<3.0	<4.0	25	<2.0	<0.1	2	9	3	<1.0	2	<1.0	<1.0	<1.0
BIR-1	322	408	58	162	129	69	13	2	<0.5	<0.5	<0.5	1	109	16	13	1	<1.0	<0.1	<3.0	<3.0	<4.0	<1.7	<2.0	<2.0	2	9	1	<1.0	2	<1.0	<1.0	<1.0
BIR-1	334	416	55	168	129	69	14	<0.5	<0.5	<0.5	<0.5	1	110	17	13	0	<1.0	<2.0	<3.0	<3.0	<4.0	<1.7	9	8	2	9	2	1	3	<1.0	<1.0	<1.0
BIR-1	327	413	60	168	130	69	14	<0.1	<0.5	<0.5	<0.5	1	110	17	13	1	<1.0	0	<3.0	12	39	37	<2.0	<0.2	2	9	2	<0.5	2	<1.0	<1.0	<1.0
BIR-1	332	407	53	167	130	68	14	1	<0.5	<0.5	<0.1	1	109	17	13	1	<1.0	<0.3	<3.0	3	<4.0	19	<2.0	7	2	9	1	<1.0	2	<1.0	<1.0	<1.0
BIR-1	333	407	53	163	130	69	14	2	<0.5	<0.5	<0.5	1	109	16	13	1	<1.0	1	<3.0	12	41	33	<2.0	0	3	9	1	<1.0	2	<1.0	<1.0	<1.0
BIR-1	335	417	59	164	130	68	13	2	<0.5	<0.5	0	1	111	17	14	1	<1.0	1	<3.0	<3.0	<4.0	26	<0.2	<0.2	2	9	2	<1.0	2	<1.0	<1.0	<1.0
BIR-1	343	415	54	163	132	68	15	2	<0.5	<0.5	<0.5	0	1	110	17	13	1	<1.0	1	<3.0	11	38	28	<0.2	2	9	2	<1.0	2	<1.0	<1.0	<1.0
BIR-1	335	401	46	161	131	68	13	2	<0.5	<0.1	<0.5	1	109	17	14	1	<1.0	1	<3.0	<3.0	<4.0	<2.0	<2.0	<2.0	1	<1.0	1	3	2	<0.4	<1.0	<1.0
BIR-1	360	416	39	160	129	67	12	2	<0.5	<0.1	<0.5	1	110	17	14	1	<1.0	<2.0	<3.0	<3.0	<4.0	<2.0	<2.0	<2.0	<0.8	<1.0	<1.0	3	2	<0.4	<1.0	<1.0

Table S9 (continued).

	V	Cr	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Rb	Sr	Y	Zr	Nb	Mo	Cd	Sn	Sb	Cs	Ba	La	Ce	Hf	Ta	W	Hg	Pb	Bi	Th	U
AC-E	<1	<1	<3	9	5	231	42	2	2	<0.5	1	151	2	190	876	112	<1.0	22	<3.0	<3.0	<4.0	66	65	154	29	13	2	<1.0	38	<1.0	18.9	4
AC-E	<1.0	<3.0	<3.0	9	5	231	42	2	1	<0.5	0	151	2	191	871	112	<1.0	1	19	<3.0	<4.0	60	65	174	30	13	3	<1.0	39	<1.0	18.6	4.4
AC-E	<1.0	<1.0	<3.7	9	6	231	42	2	2	<0.5	1	151	3	190	876	112	<1.0	<0.1	1	<3.0	<4.0	66	77	184	29	12	3	<1.0	38	<1.0	18.6	3.5
AC-E	<1.0	<1.0	<1.0	9	5	231	42	2	2	<0.5	1	150	2	190	870	111	<1.0	1	19	<3.0	<4.0	66	78	184	29	13	2	<1.0	38	<1.0	17.8	4.5
AC-E	<1.0	<1.0	8	10	6	233	42	2	1	<0.5	1	151	2	191	875	112	<1.0	<2.0	23	<3.0	<4.0	61	66	159	29	14	4	<1.0	39	<1.0	18.3	3.9
AC-E	<1.0	<1.0	<3.7	9	6	228	42	2	2	<0.5	1	150	2	189	873	112	<1.0	0	20	<3.0	<4.0	63	74	156	28	13	3	<1.0	38	<1.0	19.1	4.2
AC-E	<1.0	<1.0	4	9	6	232	42	2	1	<0.5	1	152	2	192	866	112	<1.0	0	19	<3.0	<4.0	62	61	184	30	12	4	<1.0	39	<1.0	17.9	4.1
AC-E	<1.0	<1.0	5.7	8.9	5.5	231.3	42.2	2.1	1.7	<0.5	0.4	150.7	2.3	190.5	884.8	113.2	<1.0	0.5	18.3	<3.0	<4.0	62.1	63.5	176.5	29.4	11.8	3	<1.0	38.5	<1.0	18.1	4.9
AC-E	<1.0	<1.0	<3.7	9.2	5.5	232.3	42.3	2.2	1.2	<0.5	0.6	151.9	2.4	193.3	889.7	113.8	<1.0	<2.0	17.9	<3.0	<4.0	37.9	56.5	168.9	30.1	14.1	4	<1.0	39.2	<1.0	18.5	4.4
AC-E	<1.0	<1.0	<3.7	9.6	5.2	230.4	41.7	1.9	0.8	<0.5	0.4	150.6	2.4	190.9	886.2	113.3	<1.0	<0.1	18.8	<3.0	<4.0	67.2	73.8	194.2	29.5	13	3.5	<0.4	39.2	<1.0	18.7	4.6
AC-E	<1.0	<1.0	<3.8	9	6	231	43	2	2	<0.5	1	152	2	193	884	115	<1.0	<2.0	18	<3.0	<4.0	65	79	167	29	13	4	<1.0	39	<1.0	19.1	4.3
AC-E	<1.0	<1.0	<3.0	9	6	232	42	2	1	<0.5	0	151	2	192	884	114	<1.0	1	19	<3.0	<4.0	59	89	197	29	14	3	<1.0	39	<1.0	18.2	4.4
AC-E	<1.0	<1.0	5	9	5	230	42	3	2	<0.5	0	151	2	191	875	112	<1.0	<2.0	18	<3.0	<4.0	54	61	157	29	13	3	<1.0	38	<1.0	18.4	4
AC-E	<1.0	<1.0	4	9	5	231	42	2	2	<0.5	1	150	2	190	875	113	<1.0	<2.0	20	<3.0	<4.0	57	58	154	30	13	2	<1.0	38	<1.0	18.9	5.1
AC-E	<1.0	<1.0	<3.8	9	5	231	42	2	2	<0.5	1	151	3	191	881	114	<1.0	0	18	<3.0	<4.0	61	60	159	29	14	2	<1.0	38	<1.0	18.3	4.2
AC-E	<1.0	<1.0	5	9	5	231	42	2	1	<0.5	1	151	3	191	876	112	<1.0	0	19	<3.0	<4.0	59	63	158	29	13	3	<1.0	39	<1.0	17.9	4.5
AC-E	<1.0	<1.0	<3.7	9	5	230	42	2	1	<0.5	0	151	2	192	872	112	<1.0	<2.0	20	<3.0	<4.0	52	50	196	29	15	3	<1.0	39	<1.0	18	4.2
AC-E	<1.0	<1.0	<3.0	10	5	231	42	2	2	<0.5	1	151	2	191	874	112	<1.0	<2.0	18	<3.0	<4.0	59	54	177	30	13	2	<1.0	39	<1.0	18.3	4.1
AC-E	<1.0	<1.0	6	27	5	231	42	2	2	<0.5	1	150	2	191	886	113	<1.0	<2.0	18	<3.0	<4.0	63	69	174	30	13	2	<1.0	38	<1.0	18.4	4.7
AC-E	<1.0	<1.0	5	9	6	231	42	2	2	<0.5	1	151	2	191	876	113	<1.0	<2.0	24	<3.0	<4.0	66	69	165	29	12	3	<1.0	38	<1.0	18.5	3.6
AC-E	<1.0	<1.0	<3.7	9	6	231	42	3	1	<0.5	1	151	2	190	871	113	<1.0	<2.0	18	<3.0	<4.0	52	69	188	30	13	3	<1.0	39	<1.0	18.5	4.2
AC-E	<1.0	<1.0	<3.0	9	5	230	41	2	2	<0.5	1	150	2	191	875	113	<1.0	<2.0	21	<3.0	<4.0	56	59	147	30	15	3	<1.0	38	<1.0	18.4	4.9
AC-E	<1.0	<1.0	5	9	4	230	42	2	1	<0.5	1	151	2	191	881	113	<1.0	1	20	<3.0	<4.0	67	67	166	29	15	3	<1.0	39	<1.0	18.9	4.5
AC-E	<1.0	<1.0	<3.7	9	5	230	42	2	2	<0.5	1	151	2	190	873	112	<1.0	1	25	<3.0	<4.0	61	56	158	30	14	6	<1.0	39	<1.0	18.6	5.1
AC-E	<1.0	<1.0	<3.0	9	5	229	42	2	2	<0.5	1	151	2	191	879	113	<1.0	<2.0	20	<3.0	<4.0	57	75	170	30	13	4	<1.0	38	<1.0	18.4	4.3
AC-E	<1.0	<1.0	5	9	6	231	42	2	2	<0.5	1	151	2	190	875	113	<1.0	<2.0	21	<3.0	<4.0	60	79	171	29	13	3	<1.0	38	<1.0	18.3	3.7
AC-E	<1.0	<1.0	<3.0	9	6	232	42	2	2	<0.5	0	151	2	191	878	113	<1.0	<2.0	19	<3.0	<4.0	63	68	147	30	13	3	<1.0	38	<1.0	18.5	4.1
AC-E	<1.0	<1.0	<3.0	9	5	230	42	2	2	<0.5	0	151	2	191	876	112	<1.0	1	20	<3.0	<4.0	63	68	171	30	12	3	<1.0	38	<1.0	18.8	4.1
AC-E	<1.0	<1.0	<3.7	9	5	231	42	2	2	<0.5	0	151	2	191	879	113	<1.0	<2.0	21	<3.0	<4.0	51	78	176	29	15	3	<1.0	38	<1.0	18.8	3.6
AC-E	<1.0	<1.0	<3.7	9	5	230	42	2	1	<0.5	1	151	2	191	881	113	<1.0	<2.0	21	<3.0	<4.0	64	66	172	30	13	4	<1.0	39	<1.0	18.9	3.8
AC-E	<1.0	<1.0	<3.7	9	6	231	42	2	1	<0.5	1	150	2	190	879	113	<1.0	<2.0	21	<3.0	<4.0	58	82	179	30	13	3	<1.0	39	<1.0	18.5	3.7
ACE	<1.0	<1.0	<3.7	9	5	228	41	2	2	<0.5	0	151	2	190	882	114	<1.0	<2.0	21	<3.0	<4.0	67	82	201	30	13	2	<1.0	38	<1.0	18.9	4
AC-E	<1.0	<1.0	<3.7	14	6	229	41	2	2	<0.5	1	150	3	189	878	113	<1.0	1	15	14	43	61	39	57	29	12	2	<1.0	38	<1.0	18.6	4.6
AC-E	<1.0	<1.0	5	9	5	231	42	2	2	<0.5	0	151	2	191	877	112	<1.0	<2.0	19	<3.0	<4.0	53	66	169	29	15	4	<1.0	38	<1.0	18.8	4.7
AC-E	4	7	<3.7	8	5	227	42	2	2	<0.5	0	150	2	190	871	112	<1.0	1	15	11	42	54	26	29	28	13	3	<1.0	38	<1.0	18.7	4.3
AC-E	<1.0	<1.0	<3.7	8.8	5.4	227	42.1	2.3	1.3	<0.5	0.6	149.8	2.4	190.1	892.5	115	<1.0	0.4	22.6	<3.0	<4.0	57.9					3.3	<1.0	38.3	<1.0	18.8	4.2
AC-E	32	7	<3.7	9	6	230	42	2	2	<0.5	1	151	2	191	868	112	<1.0	1	16	14	39	49			29	11	3	<1.0	38	<1.0	17.8	4.7
AC-E	<1.0	<1.0	36	8	5	222	42	2	2	0	<0.5	149	2	191	901	117	<1.0	1	30	4	11	58	59		29	6	7	1	39	<0.3	20.7	3.9
AC-E	<1.0	<1.0	41	8	6	222	42	2	2	0	<0.5	149	2	191	897	116	<1.0	1	31	2	12	66	67		30	6	6	1	38	<0.3	20.3	4.5
AC-E	<1.0	<1.0	38	8	6	223	42	2	2	0	<0.5	149	2	189	901	117	<1.0	1	29	2	18	65	55	151	29	5	6	1	38	<0.3	20.8	4.7
AC-E	<1.0	<1.0	42	9	6	226	43	2	2	0	<0.5	151	2	192	890	115	<1.0	1	31	3	22	75	68		29	6	7	1	39	<0.3	21	4.6

Table S10. Major and trace elements of the Shaki-Rash olivine gabbro rocks. (nd , not determined).

sample	SR-GA2	SR-GA3	SR-GA4	SR-GA5	SR-GA6	SR-6	SR-7	SR-8	SR-9	SR-16	SR-17	SR-19	SR-24	SR-26	SR-GI	D2
SiO ₂	46.05	48.47	50.55	50.87	50.57	54.25	47.44	50.31	48.40	44.17	46.51	48.76	51.19	51.13	51.28	50.30
TiO ₂	1.09	1.15	2.28	0.42	1.20	0.20	2.65	1.64	2.33	3.68	1.19	2.19	1.20	2.38	2.53	1.72
Al ₂ O ₃	19.91	20.30	16.50	17.62	18.04	24.54	16.42	17.76	19.51	15.76	19.72	17.15	14.55	16.66	19.07	16.34
Fe ₂ O ₃	8.89	7.69	9.62	6.32	7.99	1.94	7.78	5.24	11.57	11.15	8.64	9.80	9.32	9.67	6.32	9.30
MnO	0.15	0.13	0.20	0.11	0.13	0.04	0.18	0.10	0.19	0.17	0.14	0.17	0.19	0.17	0.11	0.15
MgO	9.49	7.94	6.06	7.70	7.57	0.66	4.64	4.28	5.09	8.52	9.11	6.04	7.74	4.73	4.30	5.46
CaO	11.65	10.53	10.96	11.57	11.02	8.39	12.66	11.39	7.03	10.08	11.40	9.67	10.24	8.31	7.99	9.38
Na ₂ O	2.48	3.10	3.97	3.57	3.83	5.51	3.73	4.10	4.59	3.21	2.64	3.91	4.27	5.21	4.74	4.96
K ₂ O	0.13	0.22	0.19	0.10	0.15	1.32	0.32	1.11	0.36	0.68	0.14	0.34	0.84	0.48	1.40	0.30
P ₂ O ₅	0.04	0.03	0.35	0.02	0.15	0.04	0.22	0.20	0.31	0.15	0.06	0.32	0.24	0.52	0.03	0.23
SO ₃	0.41	0.30	0.28	0.19	0.20	0.10	0.19	0.01	0.36	0.15	0.32	0.23	0.41	0.16	0.01	0.02
LOI	0.58	0.86	0.19	0.70	0.38	2.43	4.37	3.23	0.00	1.14	0.31	0.65	-0.01	0.14	1.96	1.07
Total	100.87	100.71	101.15	99.18	101.24	99.42	100.61	99.37	99.73	98.72	100.18	99.22	100.17	99.55	99.73	99.22
Mg#	68	67	56	71	65	40	54	62	47	60	68	55	62	49	57	54
XRF																
Co	41	39	26	39	33	9	26	24	33	43	39	33	39	31	25	33
Ni	107	91	31	92	104	15	31	39	59	72	100	38	78	44	20	38
Cu	63	51	40	57	55	56	31	15	64	43	56	35	48	36	24	42
Zn	60	53	56	34	53	48	66	27	89	75	53	72	72	75	36	65
Pb	1	1	1	1	1	9	3	3	3	2	1	3	7	3	2	<1.0
ICPMS																
Ga	15.4	16.8	15	13	14.9	23.4	15.3	15.9	18.4	17.4	15.4	16.5	15.9	18.2	15.9	17.2
V	143	139	339	161	204	13	202	120	259	506	151	230	238	262	285	247
Cr	430	340	180	500	450	100	100	180	240	190	350	190	230	140	90	190
Ba	45.4	55.5	89.9	40.8	66.9	154.5	98.9	85.4	157.5	121	39.3	82.8	115	154.5	123.5	62.7
Rb	3.5	2.6	1.2	0.7	0.8	35	8.8	31.9	1.9	10	2.4	3.8	24.4	2.3	37.4	0.7
Sr	421	395	294	320	293	741	421	455	371	308	418	334	321	302	548	305
Y	7.3	10.6	27.2	10.9	17	1.9	19	13.5	8.3	46.8	7.5	20.6	31.3	48.5	22	36.9
Zr	16	24	30	18	27	4	59	45	20	98	18	49	45	67	54	149
Nb	2.3	2.8	6.4	0.3	2.5	0.8	8	5.5	9	14.1	2.3	6.8	4.6	12.1	6.1	8
Cs	0.17	0.11	0.05	0.03	0.02	0.2	5.39	0.2	0.08	0.14	0.26	0.48	2.71	0.12	3.26	0.06
Hf	0.5	0.7	0.9	0.7	0.8	nd	1.4	1	0.5	2.9	0.4	1.2	1.4	2.1	1.5	3.7
Ta	0.2	0.2	0.5	nd	0.2	nd	0.7	0.4	0.7	0.9	0.2	0.5	0.4	0.8	0.4	0.5
Th	0.2	0.15	0.22	0.08	0.09	0.08	0.29	0.33	0.24	0.42	0.19	0.32	1.1	0.3	0.16	0.11
U	nd	nd	0.05	nd	nd	nd	0.09	0.08	0.06	0.1	nd	0.08	0.31	0.08	nd	nd
La	2.7	4	7.1	1.7	4.1	6.6	7.9	7	14.2	9.4	2.9	8.7	8.4	16.3	4.9	9.7
Ce	5.9	8.7	18.8	4.5	10.5	10.6	18.4	15.3	19	28.8	5.9	20.5	20.1	42.6	13.1	26.3
Pr	0.74	1.14	2.71	0.68	1.56	0.96	2.32	1.97	2.18	4.41	0.76	2.61	2.54	5.94	1.89	3.55
Nd	3.3	5.2	14.1	3.8	7.6	3.4	11	8.3	9.1	22.1	3.5	12.7	11.5	28.7	9.3	16.3
Sm	0.99	1.53	4.33	1.5	2.52	0.56	3.08	2.16	1.99	6.95	1.12	3.57	3.75	7.77	2.98	4.58
Eu	0.74	0.8	1.9	0.89	1.21	1.83	1.35	1.41	1.66	1.71	0.72	1.48	1.22	2.31	1.3	1.63
Gd	1.31	1.82	5.26	1.89	3.14	0.52	3.33	2.56	1.96	7.87	1.34	3.81	4.83	9.21	3.57	5.27
Tb	0.19	0.29	0.79	0.29	0.45	0.06	0.53	0.36	0.25	1.26	0.19	0.56	0.8	1.39	0.57	0.88
Dy	1.35	2.03	5.16	2.1	3.13	0.34	3.64	2.45	1.52	8.38	1.33	3.97	5.69	9.85	3.96	6.25
Ho	0.29	0.4	1.1	0.44	0.64	0.07	0.75	0.5	0.33	1.74	0.28	0.8	1.09	1.93	0.85	1.29
Er	0.83	1.18	2.89	1.17	1.84	0.16	1.98	1.49	0.88	4.86	0.81	2.3	3.33	5.46	2.22	3.78
Tm	0.11	0.17	0.36	0.14	0.25	0.02	0.29	0.19	0.27	0.68	0.12	0.31	0.44	0.72	0.31	0.52
Yb	0.69	1	2.37	1.05	1.44	0.13	1.79	1.2	0.68	4.03	0.71	1.82	2.87	4.42	1.93	3.47
Lu	0.11	0.16	0.32	0.15	0.22	0.03	0.29	0.18	0.11	0.59	0.11	0.26	0.42	0.64	0.29	0.49

nd , not determined