

Table A-1. Average composition of olivine from planetary basalt samples

Thin section Suite	ARCH-4		KEW-5		OF-1		OF-3	
	Archean		Keweenawan		Ocean Floor		Ocean Floor	
	N = 19		N = 28		N = 51		N = 49	
	avg.	s.d.	avg.	s.d.	avg.	s.d.	avg.	s.d.
SiO <sub>2</sub> (wt.%)	41.3	0.3	36.3	0.2	40.7	0.3	40.7	0.2
Al <sub>2</sub> O <sub>3</sub>	<0.02	0.00	<0.02	0.00	<0.02	0.00	<0.02	0.00
TiO <sub>2</sub>	<0.03	0.00	0.04	0.01	<0.03	0.00	<0.03	0.00
Cr <sub>2</sub> O <sub>3</sub>	0.22	0.02	<0.03	0.00	0.07	0.02	0.03	0.01
MgO	50.1	0.7	30.6	0.5	47.3	0.7	46.8	0.3
FeO	7.59	0.7	33.3	0.6	11.2	0.7	11.8	0.2
MnO	0.10	0.02	0.37	0.02	0.18	0.02	0.16	0.01
CaO	0.23	0.01	0.13	0.02	0.34	0.09	0.29	0.02
Total	99.6	0.3	100.8	0.4	99.9	0.5	99.8	0.4
<b>Formula proportions of cations based on 4 O atoms</b>								
Si	1.006		0.990		1.006		1.007	
Al	0.000		0.000		0.000		0.000	
Ti	0.000		0.001		0.000		0.000	
Cr	0.004		0.000		0.001		0.001	
Mg	1.820		1.246		1.742		1.729	
Fe	0.155		0.759		0.232		0.244	
Mn	0.002		0.009		0.004		0.003	
Ca	0.006		0.004		0.009		0.008	
Total	2.992		3.009		2.994		2.992	
ΣM1	1.987		2.019		1.988		1.985	
Fe/(Fe+Mg)	0.078		0.379		0.117		0.124	
<b>Trace elements in ppm</b>								
	N = 5		N = 5		N = 7		N = 6	
	avg.	s.d.	avg.	s.d.	avg.	s.d.	avg.	s.d.
Sc	5.7	0.4	11.1	0.9	9.9	0.5	8.7	0.3
Ti	72	10	235	34	161	13	79	3
V	8.9	1.1	14.1	1.7	12.9	0.4	8.7	0.4
Cr	1219	85	54	11	485	82	395	16
Mn	972	122	4580	369	1253	56	1429	20
Co	150	16	385	38	161	4	188	2
Ni	3717	85	2690	223	2113	200	2960	66
Y	0.1	0.0	1.9	2.7	0.1	0.0	0.2	0.0

Table A-1. Average composition of olivine from planetary basalt samples

Thin section Suite	IA-7 Island Arc N =44		IA-11 Island Arc N =43		CP-4 Columbia Plateau N =37		CP-8 Columbia Plateau N =42		
	avg.	s.d.	avg.	s.d.	avg.	s.d.	avg.	s.d.	
	SiO <sub>2</sub> (wt.%)	36.9	0.9	39.3	0.8	36.5	0.1	37.1	0.7
Al <sub>2</sub> O <sub>3</sub>	0.04	0.01	0.05	0.01	0.04	0.01	0.03	0.01	
TiO <sub>2</sub>	0.04	0.03	<0.03	0.02	0.04	0.01	0.05	0.03	
Cr <sub>2</sub> O <sub>3</sub>	<0.03	0.01	0.04	0.02	<0.03	0.00	<0.03	0.01	
MgO	33.0	3.9	43.5	3.5	32.6	0.1	35.1	2.9	
FeO	30.2	4.8	17.2	4.2	30.6	0.3	27.5	3.5	
MnO	0.40	0.08	0.23	0.07	0.37	0.02	0.32	0.04	
CaO	0.27	0.05	0.30	0.05	0.30	0.01	0.30	0.03	
Total	100.8	0.5	100.7	0.5	100.4	0.4	100.4	0.5	
Si	0.990		0.991		0.987		0.987		
Al	0.001		0.001		0.001		0.001		
Ti	0.001		0.000		0.001		0.001		
Cr	0.000		0.001		0.000		0.000		
Mg	1.319		1.635		1.313		1.393		
Fe	0.680		0.365		0.692		0.613		
Mn	0.009		0.005		0.008		0.007		
Ca	0.008		0.008		0.009		0.009		
Total	3.009		3.007		3.011		3.012		
ΣM1	2.017		2.015		2.023		2.024		
Fe/(Fe+Mg)	0.340		0.183		0.345		0.306		
		N = 6		N = 6		N = 7		N = 6	
		avg.	s.d.	avg.	s.d.	avg.	s.d.	avg.	s.d.
Sc		12.7	1.7	7.6	1.1	15.2	0.7	12.4	0.5
Ti		182	73	69	11	265	32	134	9
V		15.9	4.4	7.9	2.2	27.8	1.3	17.8	1.0
Cr		167	31	296	26	226	10	129	7
Mn		4213	505	1656	165	4621	36	3611	22
Co		377	25	196	12	377	3	374	4
Ni		806	103	2379	100	458	24	1107	21
Y		0.6	0.6	0.1	0.0	0.1	0.0	0.4	0.0

Table A-1. Average composition of olivine from planetary basalt samples

Thin section Suite	HAW-11 Hawaiian N =39		HAW-17 Hawaiian N =37		TP-1 Taos Plateau N =35		TP-17 Taos Plateau N =48		
	avg.	s.d.	avg.	s.d.	avg.	s.d.	avg.	s.d.	
SiO <sub>2</sub> (wt.%)	37.5	0.7	38.5	1.1	35.8	1.6	38.9	0.5	
Al <sub>2</sub> O <sub>3</sub>	0.06	0.01	0.04	0.01	0.03	0.01	<0.02	0.00	
TiO <sub>2</sub>	0.03	0.02	<0.03	0.02	0.04	0.03	<0.03	0.00	
Cr <sub>2</sub> O <sub>3</sub>	<0.03	0.03	<0.03	0.01	0.03	0.03	<0.03	0.00	
MgO	35.7	3.0	39.8	4.6	29.7	5.8	40.0	2.4	
FeO	26.8	3.8	21.6	5.8	32.6	7.0	19.7	2.7	
MnO	0.39	0.09	0.26	0.11	0.47	0.12	0.29	0.07	
CaO	0.33	0.03	0.29	0.02	0.26	0.04	0.14	0.03	
Total	100.7	0.7	100.5	0.7	99.1	0.4	99.1	0.4	
Si	0.990		0.993		0.994		1.008		
Al	0.002		0.001		0.001		0.000		
Ti	0.001		0.000		0.001		0.000		
Cr	0.000		0.000		0.001		0.000		
Mg	1.404		1.527		1.223		1.546		
Fe	0.593		0.470		0.765		0.428		
Mn	0.009		0.006		0.011		0.006		
Ca	0.009		0.008		0.008		0.004		
Total	3.008		3.006		3.004		2.992		
ΣM1	2.015		2.012		2.009		1.984		
Fe/(Fe+Mg)	0.297		0.235		0.385		0.217		
		N = 7		N = 5		N = 8		N = 8	
		avg.	s.d.	avg.	s.d.	avg.	s.d.	avg.	s.d.
Sc		8.8	0.7	8.4	0.8	9.8	0.9	5.3	0.1
Ti		213	28	146	13	184	12	79	11
V		12.1	1.1	11.3	7.4	14.2	2.2	3.5	0.4
Cr		407	169	228	81	293	36	102	9
Mn		3021	1494	2916	1318	3154	801	2830	33
Co		273	68	310	68	345	28	315	3
Ni		2527	492	2871	269	3154	575	3700	28
Y		0.0	0.0	0.5	0.5	0.0	0.0	0.0	n.m.

Table A-1. Average composition of olivine from planetary basalt samples

Thin section Suite	10020		10062		12022		12063	
	AP 11 Low-K		AP 11 Low-K		AP 12 Ilmenite		AP 12 Ilmenite	
	N = 30		N = 31		N = 48		N = 45	
	avg.	s.d.	avg.	s.d.	avg.	s.d.	avg.	s.d.
SiO <sub>2</sub> (wt.%)	37.4	0.2	36.8	0.2	36.7	0.4	36.3	0.8
Al <sub>2</sub> O <sub>3</sub>	0.04	0.01	0.04	0.01	0.05	0.02	0.04	0.02
TiO <sub>2</sub>	0.13	0.02	0.11	0.02	0.07	0.03	0.10	0.06
Cr <sub>2</sub> O <sub>3</sub>	0.18	0.02	0.16	0.02	0.31	0.08	0.21	0.05
MgO	35.5	0.8	33.8	0.5	32.9	1.5	29.9	3.0
FeO	25.2	0.9	26.9	0.5	29.0	1.8	32.8	3.6
MnO	0.29	0.03	0.30	0.03	0.26	0.03	0.30	0.05
CaO	0.29	0.01	0.28	0.02	0.31	0.03	0.31	0.04
Total	99.0	0.3	98.5	0.2	99.6	0.6	99.9	0.7
Si	0.998		0.998		0.994		0.997	
Al	0.001		0.001		0.002		0.001	
Ti	0.003		0.002		0.002		0.002	
Cr	0.004		0.003		0.007		0.004	
Mg	1.412		1.367		1.328		1.221	
Fe	0.564		0.610		0.655		0.757	
Mn	0.006		0.007		0.006		0.007	
Ca	0.008		0.008		0.009		0.009	
Total	2.997		2.997		3.001		2.999	
ΣM1	1.997		1.998		2.006		2.001	
Fe/(Fe+Mg)	0.285		0.309		0.331		0.383	
	N = 8		N = 8		N = 7		N = 7	
	avg.	s.d.	avg.	s.d.	avg.	s.d.	avg.	s.d.
Sc	11.6	0.3	13.3	0.5	10.6	0.3	10.7	0.4
Ti	612	44	627	39	500	36	492	73
V	32.1	1.8	22.9	1.7	60.5	2.1	50.2	5.0
Cr	1245	60	811	26	1650	36	1242	276
Mn	2855	73	3120	65	3157	74	3582	217
Co	78	2	70	3	199	2	192	4
Ni	17	3	13	2	297	27	211	82
Y	0.0	0.0	0.7	0.1	0.0	0.0	0.1	0.0

Table A-1. Average composition of olivine from planetary basalt samples

Thin section Suite	12009		12020		12075		15016	
	AP 12 Olivine		AP 12 Olivine		AP 12 Olivine		AP 15 Olivine	
	N = 27		N = 29		N = 35		N = 52	
	avg.	s.d.	avg.	s.d.	avg.	s.d.	avg.	s.d.
SiO <sub>2</sub> (wt.%)	37.9	0.2	37.6	0.4	37.9	0.3	34.2	0.9
Al <sub>2</sub> O <sub>3</sub>	0.06	0.01	0.03	0.01	0.04	0.01	<0.02	0.00
TiO <sub>2</sub>	0.06	0.01	0.04	0.02	0.04	0.02	0.06	0.05
Cr <sub>2</sub> O <sub>3</sub>	0.43	0.05	0.36	0.05	0.42	0.03	0.12	0.04
MgO	36.0	0.7	36.1	1.5	37.0	1.2	21.4	3.5
FeO	24.4	0.9	24.2	1.8	23.8	1.5	43.6	4.4
MnO	0.26	0.03	0.26	0.03	0.26	0.03	0.35	0.05
CaO	0.28	0.02	0.26	0.02	0.25	0.02	0.33	0.04
Total	99.3	0.4	98.9	0.4	99.7	0.3	100.0	0.4
Si	1.003		1.000		0.997		0.993	
Al	0.002		0.001		0.001		0.000	
Ti	0.001		0.001		0.001		0.001	
Cr	0.009		0.008		0.009		0.003	
Mg	1.420		1.432		1.451		0.925	
Fe	0.541		0.539		0.525		1.063	
Mn	0.006		0.006		0.006		0.009	
Ca	0.008		0.007		0.007		0.010	
Total	2.990		2.994		2.997		3.004	
ΣM1	1.985		1.993		1.999		2.010	
Fe/(Fe+Mg)	0.276		0.274		0.266		0.535	
	N = 6		N = 7		N = 6		N = 6	
	avg.	s.d.	avg.	s.d.	avg.	s.d.	avg.	s.d.
Sc	10.2	0.4	10.9	0.4	10.3	0.4	8.9	0.4
Ti	304	13	315	15	299	13	352	112
V	70.0	4.3	65.4	3.1	64.0	1.4	29.4	10.6
Cr	2121	18	2117	316	1997	124	703	125
Mn	2941	129	2745	221	2806	160	5074	654
Co	207	5	194	3	196	4	251	16
Ni	464	44	452	42	445	52	200	37
Y	0.3	0.0	0.3	0.0	0.3	0.0	1.9	1.1

Table A-1. Average composition of olivine from planetary basalt samples

Thin section Suite	15545		70215		74275		DaG 476		
	AP 15 Olivine		AP 17 VHT		AP 17 VHT		Mars		
	N = 58		N = 37		N = 35		N = 15		
	avg.	s.d.	avg.	s.d.	avg.	s.d.	avg.	s.d.	
SiO <sub>2</sub> (wt.%)	33.9	1.3	37.5	0.5	38.3	0.4	37.3	0.7	
Al <sub>2</sub> O <sub>3</sub>	0.03	0.01	0.04	0.06	0.06	0.01	0.09	0.17	
TiO <sub>2</sub>	0.03	0.02	0.12	0.06	0.15	0.03	<0.03	0.00	
Cr <sub>2</sub> O <sub>3</sub>	0.14	0.04	0.18	0.27	0.26	0.03	0.06	0.02	
MgO	20.3	5.3	34.3	1.8	37.9	1.4	34.4	2.9	
FeO	44.5	6.5	27.1	2.2	23.0	1.7	27.1	3.4	
MnO	0.35	0.08	0.35	0.05	0.28	0.03	0.57	0.08	
CaO	0.34	0.05	0.28	0.08	0.26	0.02	0.22	0.05	
Total	99.6	0.5	99.9	0.4	100.2		99.7	0.7	
Si	0.995		1.000		0.998		0.998		
Al	0.001		0.001		0.002		0.003		
Ti	0.001		0.003		0.003		0.000		
Cr	0.003		0.004		0.005		0.001		
Mg	0.883		1.364		1.471		1.371		
Fe	1.099		0.607		0.503		0.608		
Mn	0.009		0.008		0.006		0.013		
Ca	0.011		0.008		0.007		0.006		
Total	3.002		2.995		2.995		3.000		
ΣM1	2.006		1.993		1.996		1.999		
Fe/(Fe+Mg)	0.555		0.308		0.255		0.307		
		N = 6		N = 5		N = 6		N = 5	
		avg.	s.d.	avg.	s.d.	avg.	s.d.	avg.	s.d.
Sc		10.5	1.1	16.9	5.1	12.2	0.4	15.0	3.4
Ti		290	51	1762	1502	676	56	159	79
V		38.5	11.5	23.4	10.7	31.6	7.2	32.8	6.2
Cr		788	272	1397	419	1628	246	599	247
Mn		5038	592	3309	362	2624	281	6038	1516
Co		256	12	105	5	88	3	195	27
Ni		213	53	24	5	22	5	755	296
Y		0.8	0.5	2.0	2.9	0.6	0.1	0.0	n.m.

Table A-1. Average composition of olivine from planetary basalt samples

Thin section Suite	ALHA77005		LEW88516	
	Mars		Mars	
	N = 25		N = 28	
	avg.	s.d.	avg.	s.d.
SiO <sub>2</sub> (wt.%)	37.9	0.3	36.6	0.5
Al <sub>2</sub> O <sub>3</sub>	0.03	0.01	<0.02	0.00
TiO <sub>2</sub>	<0.03	0.00	<0.03	0.00
Cr <sub>2</sub> O <sub>3</sub>	0.04	0.02	0.03	0.02
MgO	36.2	1.1	31.6	1.4
FeO	24.2	1.3	29.7	1.6
MnO	0.52	0.04	0.63	0.07
CaO	0.23	0.04	0.19	0.05
Total	99.1	0.3	98.7	0.5
Si	1.004		1.003	
Al	0.001		0.000	
Ti	0.000		0.000	
Cr	0.001		0.001	
Mg	1.433		1.290	
Fe	0.537		0.681	
Mn	0.012		0.015	
Ca	0.007		0.006	
Total	2.995		2.996	
ΣM1	1.989		1.992	
Fe/(Fe+Mg)	0.273		0.345	
		N = 11		N = 6
	avg.	s.d.	avg.	s.d.
Sc	10.4	1.7	12.9	3.5
Ti	139	32	163	60
V	11.6	3.3	14.1	8.1
Cr	284	83	304	182
Mn	5793	461	6776	706
Co	178	5	191	5
Ni	876	89	797	146
Y	0.1	0.0	0.3	0.1