

55. CHEMICAL ANALYSES OF INTERLABORATORY STANDARDS

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Two basalts and one basaltic glass were selected for an interlaboratory comparison of geochemical laboratories contributing analytical data to the Initial Reports Volumes of Legs 51, 52, and 53 of DSDP/IPOD.

I. SAMPLE 417A-44-3, 58-68 cm

This rock was selected from a massive unit of Hole 417A. It was ground in an agate mill and homogenized by repeated splitting.

II. AII 92-29-1²

This rock was provided by W.B. Bryan of Woods Hole Oceanographic Institution. It was taken from a fresh pillow dredged by the WHOI R/V *Atlantis II* near

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² Splits of Samples AII 93-11-5 and AII 92-29-1 can be obtained upon request from Dr. E. Jarosewich, Smithsonian Institution, Museum of Natural History, Washington, D.C., and the author.

the Mid-Atlantic Ridge at 23°02.63'N; 45°01.05'W; 2889 meters. In order to have sufficient material for future work, about 2 kg of rock was ground in a tungsten carbide mill and homogenized by repeated splitting and mechanical shaking for 45 minutes.

III. AII 93-11-5 = USNM 113716²

This sample was provided by J.S. Dickey and the Woods Hole Oceanographic Institution and selected for comparison of electron microprobe analyses of glasses. It was dredged by the WHOI R/V *Atlantis II* in the Indian Ocean at 24°58.85'S; 70°00.71'E; 3522 meters. Fresh glass was separated and sent to E. Jarosewich at the Smithsonian Institution, who kindly further separated, distributed, and analyzed the sample wet chemically.

Major element analyses of whole-rock Samples I and II are recalculated water free and listed in Table 1. Electron microprobe analyses of natural glass AII 93-11-5 are given in Table 2. Trace elements are summarized in Table 3.

TABLE 1
Adjusted Major Element Analyses of Interlaboratory Standards

	Sample AII 92-29-1											Sample 417A-44-3, 58-68 cm							
	Mean	2σ	USNM	COB	UKAR	USSR	SUNYB	NEWC	PARIV	TOKY	WHOI	BOSG	Mean	2σ	SUNYB	TOKY	WHOI	BOSG	SHIPB
SiO ₂	49.89	0.87	49.99	50.26	49.89	49.04	50.22	50.00	49.76	49.34	50.53	49.84	49.61	0.42	49.51	49.29	49.82	49.69	49.73
TiO ₂	1.78	0.10	1.74	1.78	1.79	1.88	1.82	1.73	1.73	1.83	1.76	1.75	1.49	0.11	1.55	1.54	1.47	1.43	1.45
Al ₂ O ₃	15.84	0.64	15.85	15.49	16.16	15.25	16.04	15.63	15.94	16.33	15.77	15.91	16.41	0.48	16.64	16.56	16.36	16.47	16.02
Fe ₂ O ₃	2.50	0.59	2.18	—	2.24	3.00	2.70	2.38	2.48	2.15	2.83	2.54	3.81	0.45	3.80	4.13	3.68	3.63	11.08
FeO	7.70	0.57	7.84	9.90	7.79	7.28	7.37	8.00	8.05	7.91	7.43	7.61	6.55	0.45	6.63	6.22	6.66	6.70	—
MgO	7.64	0.57	7.40	7.29	7.61	8.31	7.42	7.75	7.52	7.70	7.79	7.62	6.97	0.30	6.75	7.16	7.03	6.98	6.92
MnO	0.17	0.02	0.17	0.17	0.19	0.16	0.17	0.16	—	0.17	0.17	0.18	0.17	0.01	0.17	0.17	0.16	0.16	—
CaO	11.13	0.36	11.11	11.18	10.81	11.28	10.83	11.30	11.20	11.32	11.12	11.11	12.54	0.26	12.75	12.46	12.45	12.58	12.47
Na ₂ O	2.95	0.24	2.91	2.88	2.99	2.98	2.82	3.02	3.16	2.86	2.78	3.10	2.08	0.26	2.09	2.24	1.92	2.05	—
K ₂ O	0.16	0.06	0.15	0.17	0.20	0.18	0.17	0.10	0.15	0.17	0.12	0.17	0.07	0.04	0.09	0.08	0.04	0.08	0.08
P ₂ O ₅	0.19	0.06	0.16	0.20	0.19	0.18	0.16	0.19	—	0.26	0.19	0.17	0.14	0.03	0.12	0.14	0.16	0.14	—
CO ₂	0.23	0.50	0.55	0.63	0.12	0.11	0.01	—	—	—	0.09	0.10	0.18	0.14	—	—	0.23	0.13	—
Total	100.18		100.05	99.95	99.98	99.65	99.72	100.26	99.99	100.04	100.58	100.10	100.02		100.10	99.99	99.98	100.04	
LOI				0.01				0.42				0.004						0.42	0.25
H ₂ O+			0.50		1.00	0.74	0.24	0.55	1.13	0.78	0.72	0.56			0.42	0.80	0.58	0.88	
H ₂ O-						0.35	0.41			0.34		0.47			0.62			0.11	

Note: Analyses are recalculated to a water-free basis. Laboratory code, Institution, Analyst(s), Method(s) used (as given by analysts) are as follows: USNM: National Museum of Natural History, Smithsonian Institution, Julie Norberg/Eugene Jarosewich, classical chemical methods; COB: Centre Océanologique de Bretagne, Joël Etoubleau/Henri Bougault, XRF (X-ray fluorescence), ignition; UKAR: Universität Karlsruhe, Harald Puchelt, Phot. (Si, Fe, Ti, P), AA (atomic absorption) (Al, Mg, Ca, Na), Titr. (Fe²⁺), Grav. (CO₂, H₂O); USSR: Central Chemical Laboratory, Institute of Geology and Ore Deposits, N.N. Basargin, classical chemical methods; SUNYB: State University of New York at Binghamton, T. Donnelly/W. Budd, colorim. (Si, Al, Ti, P), AA (Fe, Mn, Mg, Na, K), conventional (CO₂, H₂O); NEWC: University of Newcastle, England, Gary Pritchard, XRF, AA (Na), Wilson method (Fe²⁺); PARIV: Université Pierre et Marie Curie, Catherine Mevel, XRF, classical chem. (Fe²⁺, Na); TOKY: University of Tokyo, Hiroshi Haramura, wet chem.; WHOI: Woods Hole Oceanographic Institution, Geoffrey Thompson/Bryan Schroder, XRF, gravimet. (FeO), CHN (H₂O, CO₂); BOSG: Bochum Ocean Study Group, Ruhr-Universität, Werner Tiegs/Walter Ohnmacht, XRF, AA (Na, Mn), Titr. (FeO, H₂O), coulomat (CO₂); SHIPB: shipboard analyses, XRF.

TABLE 2
Electron Microprobe Analyses of Basaltic Glass
Sample AII 93-11 5 (USNM 113716)

	USNM (wet)	MEAN (EMP)	2σ	ICOL (EMP)	MIT (EMP)	USNM (EMP)	UKAN (EMP)	UWAS (EMP)
SiO ₂	51.52	51.84	0.61	51.71	52.05	52.26	51.6	51.56
TiO ₂	1.30	1.31	0.05	1.32	1.30	1.31	1.28	1.35
Al ₂ O ₃	15.39	15.34	0.44	15.58	15.04	15.37	15.5	15.19
FeO*	9.12	9.11	0.19	9.04	9.20	9.09	9.00	9.21
Fe ₂ O ₃	1.12	—	—	—	—	—	—	—
FeO	8.12	—	—	—	—	—	—	—
MgO	8.12	8.08	0.23	7.93	7.99	8.21	8.13	8.12
MnO	0.17	0.15	0.03	0.14	—	—	0.14	0.17
CaO	11.31	11.41	0.59	11.18	11.19	11.34	11.9	11.46
Na ₂ O	2.48	2.60	0.10	2.61	2.52	2.62	2.60	2.66
K ₂ O	0.09	0.07	0.07	0.01	0.07	0.09	0.09	0.09
P ₂ O ₅	0.12	0.08	0.14	0.00	—	0.12	—	0.13
Cr ₂ O ₃	—	—	—	0.06	—	—	—	—
NiO	—	—	—	0.02	—	—	—	—
S	—	—	—	—	—	—	—	0.107
F=S	—	—	—	—	—	—	—	0.19
H ₂ O+	0.17	—	—	—	—	—	0.11	—
H ₂ O-	0.01	—	—	—	—	—	—	—
Total	99.92			99.60	99.36		100.35	100.24

*Total Fe

Note: Laboratory code, Institution, Analyst(s) are as follows: for classical chemical methods: USNM (wet): National Museum of Natural History, Smithsonian Institution, Julie Norberg/Eugene Jarosewich; for EMP (electron microprobe) analyses: UCR: University of California at Riverside, Paul Robinson (electron microprobe at Cal Tech); ICOL: Imperial College of Science and Technology, R. N. Thompson; MIT: Massachusetts Institute of Technology, Mark Sneeringer/John Dickey; USNM (EMP): National Museum of Natural History, Smithsonian Institution, T. O'Hearn; UKAN: Kanazawa University, Tadahide Ui; UWAS: University of Washington, Ed Mathez.

TABLE 3
 Trace Elements in Sample AII 92-29-1 and Sample 417A-44-3, 58-68 cm

	Sample AII 92-29-1						Sample 417A-44-3, 58-68 cm			
	COB	BCOL	KOBEU	SUNYS/ANU	WHOI/MIT	UKAR	USSR	KOBEU	SUNY/ANU	WHOI
La			4.12	4.10	3	4.6		2.40	2.13	
Ce			13.36	13.6	11.88	11		8.13	8.40	
Pr				2.02					1.32	
Nd			12.59	11.7	11.8	10.7		8.65	7.75	
Sm			4.30	3.82	4.16	4.13		3.21	2.69	
Eu			1.55	1.29	1.45	1.58		1.201	0.98	
Gd			5.93	5.0		5.26		4.71	4.11	
Tb				0.90	0.83	1.02			0.75	
Dy			6.94	5.85				5.81	5.03	
Ho				1.39	1.45	1.43			1.16	
Er			4.25	3.84				3.65	3.38	
Tm				0.54		0.52			0.48	
Yb			4.03	3.74	3.90	3.58		3.55	3.34	
Lu			0.606	0.58	0.59	0.55		0.541	0.52	
Hf				3.74	3.34	2.89			2.1	
Sc					31.06	37.5	n.10 ³			
V	293				304	340	330			337
Cr	233				235.7	235	230			223
Co	58				57.2	55.2	62			39
Ni	107				103	114	104			75
Cu					62	65	64			96
Zn					81	86	97			71
Rb	0.8	0.0			1.18		2			<1
Sr	127	126			132.8	138	n.10 ⁴			101
Y	45	39			43		1.10 ⁴			39
Zr	130	127		140	135	105	1.10 ⁴	85		101
Nb	3.1	6					1.10 ³	1.1		
Cs				2.3			4			
Ba								8.4		
Ta				6.2		0.43	1.10 ³			
Li						4				
B										
F						200				
Cd						0.076				
Tl						0.021				
Bi						<0.005				
Pb				0.82		0.64	1.10 ³		0.83	
Th				0.15		<0.36			0.08	
U				0.12		<0.28				
Str ^{87/86}					0.702451±37					

Note: Data are given in ppm. Laboratory code, Institution, Analyst(s), Method(s) used (as given by analysts) are as follows: COB: Centre Océanologique de Bretagne, Joël Etoubleau/Henri Bougault, XRF, ignition; BCOL: Bedford College, Regent's Park, Ian L. Gibson, XRF; KOBEU: Kobe University, Hiroshi Shimizu/Akimasa Masuda, isotope dilution; SUNYS/ANU: State University of New York at Stony Brook/Australian National University, A. E. Bence/S. R. Taylor, spark source mass spectrometry; WHOI/MIT: Woods Hole Oceanographic Institution/Massachusetts Institute of Technology, Bryan Schroder/Geoffrey Thompson/Hubert Staudigel, XRF, INAA (instrumental neutron activation analysis (rare earth elements, Hf, Sc, Cr, Co in AII 92-29-1), isotope dilution (Rb, Sr in AII 92-29-1)); UKAR: Universität Karlsruhe, Harald Puchelt, AAS (atomic absorption spectrometry) (Ca, Li, Ni, Sr, V, Zn, Cd, Tl, Bi, Pb), XRF (Ni, Cr, Zr), INAA (Sc, Cr, Co, Hf, Ta, Th, U); USSR: Central Chemical Laboratory/Institute of Geology and Ore Deposits, IGEM, Moscow, N. N. Basargin, N. V. Koraleva, A. F. Kartasheva, R. V. Kortman, potentiometric (V, Cr), AA (Co, Ni, Ca, Zn), emission spectrometry (Rb, Li, Cs), spectral (Sc, Sr, Y, Zr, Nb, Pb, B).