33. GRANITOPHILE TRACE ELEMENTS AND ALTERATION IN BASALTS AND SERPENTINITES FROM HOLES 332B AND 334, LEG 37 DSDP

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ABSTRACT

Preliminary study of 26 basalts and 2 serpentinites from Hole 332B and Site 334 shows typical ocean-floor basalt abundances of Li, Rb, Sr, Ba, and Tl and no correlation with depth below the sea floor.

INTRODUCTION

The purpose of this study is to follow the geochemical effects of alteration on the behavior of Li, Rb, Sr, Ba, and Tl, in the basalts and other rocks: the relationship with depth could be important in this connection, since it is uncertain how a spreading ridge grows.

METHODS

The powders supplied from Dalhousie University were analyzed by AAS (Table 1): in the case of Tl a chemical pre-enrichment was made following the method of Fratta (1974). Table 1 includes analyses of the standard reference rocks W-1 and BR; comparison with Flanagan's (1973) compilation suggests that our results are satisfactory.

Study of thin sections permitted a rough classification of the degree of alteration, in terms of feldspar, olivine, pyroxene and groundmass alteration, presence of chlorite, smectite, etc. (Table 2.)

RESULTS

Table 3 shows the mean contents of Li, Rb, Sr, Ba for the 26 Leg 37 basalts analyzed so far, compared with mean values determined at McMaster University (mostly unpublished, but see Shaw et al., 1974, a, b). As expected the element abundances are close to other ocean-floor basalts and show no sign of the Li enrichment characteristic of French spilitic rocks (Vatin-Pérignon and Shaw, 1972).

The relationship between LOI and degree of alteration is shown in Table 2. Comparison is impeded by the fact that the basalts are almost all vesicular and the vesicles are filled with smectite, carbonate, and often zeolites. Volatile components in these minerals contribute to the LOI, which therefore is not only a function of alteration, Nevertheless there is clearly no simple relationship between depth in the drill hole and degree of alteration (except for the two serpentinites). The same conclusion applies when the trace element analyses in Table 1 are examined.

If a spreading ridge is an environment of convective hydrothermal circulation as first proposed by Y. Bottinga and recently discussed by Spooner and Fyfe (1973), it is clear that alteration of such intensity must lie below the levels penetrated by the Leg 37 drilling program.

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TABLE 1
Analysis Results up to July 1975
in ppm except Tl (ppb)[a]

Sample Interval in cm	Li	Rb	Sr	Ba	Tl	Cr	Alteration Index
Hole 332B							
2, CC (1)	7.0	4.6	101	43	25	370	1
3-3, 126-128 (4)	4.6	0	97	37	59	380	1
4-1, 100-102 (1)	10	7.3	121	60	13	160	2
6-3, 34-36 (3)	13	8.2	130	64	17	300	2
8-3, 93-95 (11)	5.6	5.5	118	60	15	270	1
15-1, 73-75 (7)	9.3	2.7	118	53	44	270	1
16-1, 141-143 (19)	18.	3.7	94	56	16	630	1
18-1, 86-88 (9)	15	3.7	83	39	16	820	1
23-1, 15-17 (2A)	7.0	4.6	91	27	37	470	2
23-1, 78-80 (6A)	3.0	6.4	100	42	82	420	2
25-2, 95-97 (13)	22	4.6	101	50	19	470	2
33-1, 95-98 (10G)	7.0	1.8	132	61	8	150	3
35-2, 114-117 (10)	13	5.5	94	39	b	670	1
35-3, 61-64 (1H)	6.5	7.3	90	47	50	860	3
36-4, 99-101 (6B)	5.1	8.2	93	b	56	430	2
37-1, 78-80 (10)	7.0	7.3	110	b	24	370	4
37-3, 28-29 (3)	10	5.5	93	27	66	620	1
40-1, 30-32 (3B)	7.9	9.1	127	b	47	270	3
42-1, 56-58 (3D)	7.0	5.5	93	27	69	570	2
44-5, 68-70 (6B)	9.3	11	118	120	29	190	4
48-1, 30-33 (3)	5.1	5.5	127	54	39	390	2
48-1, 118-120 (9C)	4.6	5.5	118	0	46	430	4
Site 334							
15-2, 14-17 (2A	6.5	8.2	85	110	35	230	1
16-1, 40-42 (4)	7.0	2.7	93	45	b	230	1
19-3, 99-105 (12)	5.6	6.4	85	99	44	210	1
20-2, 26-28 (1B)	14	5.5	85	72	17	220	1
22-2, 80-82 (6B)							4
23-2, 78-82 (11)					22		4
Standard rock W-1							
Analysis 75020	12	22	194	170	154[c]	164	
Analysis 75062	13	21	190	140	123	144	
Flanagan (1973)	14.5	21	190	160	110	114	
Standard rock BR							
Analysis 75014	14	48	1410	1160	219[c]	490	
Analysis 75061	13	45	1360	1050	64	380	
Flanagan (1973)	9	45	1350	1050	–	420	

[a]Analyst: J. R. Muysson.

[b]Trace.

[c]Contaminated

TABLE 2
Loss on Ignition (LOI)[a] and Degree of Alteration, Samples Arranged for Each Drill Hole by Increasing Depth

Sample (Interval in cm)	LOI wt. %	Alteration index[b]	Rock type	Phenocrysts
Hole 332B				
2, CC (1)		1	Basalt	Plag
3-3, 126-128 (4)		1	Basalt	Plag
4-1, 100-102 (1)	2.03	2	Basalt	Plag
6-3, 34-36 (3)	1.55	2	Basalt	
8-3, 93-95 (11)	1.53	1	Basalt	Plag.
15-1, 73-75 (7)		1	Basalt	Plag
16-1, 141-143 (19)		1	Basalt	Oliv
18-1, 86-88 (9)		1	Basalt	Oliv
23-1, 15-17 (2A)	2.42	2	Basalt	
25-2, 95-97 (13)		2	Basalt	
33-1, 95-98 (10G)		2	Basalt	
35-2, 114-117 (10)	4.24	1	Basalt	Oliv.
35-3, 61-64 (1H)		3	Basalt	Oliv
36-4, 99-101 (6B)	2.52	2	Basalt	Oliv., plag.
37-1, 78-80 (10)	3.50	4	Basalt	Plag.
37-3, 28-29 (3)			Basalt	Oliv., plag
40-1, 30-32 (3B)	3.69	3	Basalt	Plag.
42-1, 56-58 (3D)	3.04	2	Basalt	Plag
44-5, 68-70 (6B)		4	Basalt	Plag
48-1, 30-33 (3)		2	Basalt	Oliv
48-1, 118-120 (9C)	2.93	4	Basalt	
Site 334				
15-2, 14-17 (2A)		1	Basalt	Plag
16-1, 40-42 (4)		1	Basalt	Plag
19-3, 99-105 (12)	0.90	1	Basalt	
20-2, 26-28 (1B)	1.49	1	Basalt	
22-2, 80-82 (6B)	11.21	4	Serpentinite	
23-2, 78-82 (11)	12.44	4	Serpentinite	

[a]LOI taken from Dalhousie University compilation of major element analyses dated 26 April 1975.

[b]Alteration index: 1 least, 4 most altered.

TABLE 3
Mean Values (ppm) of Some Trace Elements in Basic Volcanics

	Number of analyses	Li	Rb	Sr	Ba	Tl
Alkalic basalts	88	9.5	45	820	600	0.045*
Tholeiitic basalts	139	15	25	280	320	0.120*
Spilitic rocks	152	66	53	280	250	0.410
Ocean-floor basalts	50	7.5	6.2	130	65	0.076*
Leg 37 basalts	26	8.8	5.8	104	52	0.036

Note: All analyses by AAS. Analysts: J. R. Muysson and M. Fratta (values marked *).