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-mail:ivanovks@igg.uran.ru

19 2005 .

**TRACE-ELEMENTS DISTRIBUTION  
IN THE ROCKS OF DIFFERENTIATED SERIES  
(Tumen sill as an example)**

**K.P. Ivanov, K.S. Ivanov, V.A. Koroteev, O.P. Lepihina, Yu.L. Ronkin**  
*Institute of Geology and Geochemistry, Urals Branch of RAS*

The Tumen layered intrusion is one of the standards of small layered intrusions of continental tholeiite-basalt magma. Its formation occurred in a small near-surface magmatic camera and was accompanied by fractional crystallization of basalt melt with formation of differentiates strongly varying on mineral and chemical content – from highly magnesian troctolite dolerites to strongly siliceous and alkaline granophyre dolerite-pegmatites and granophyres. Chemical elements distribution along the section of differentiated series is quite regular in general and characterized by a large dispersion of their contents. The content of trace elements is more considerable and significative than the main ones. In common case the chemical element distribution in layered intrusion demonstrate that their inter-chambered differentiation in a small-depth chamber on their results is quite close to the prechambered one at the depth and can serve as a model of the tholeiite basalt magma evolution.

Key words: *trace element, differentiated intrusion, continental flood basalts, Ural, West Siberian Plate.*

, 1973].  
 ,  
 , 38  
 HR/ICP-MS.  
 CFB,  
 CFB-  
 1974].  
 [ , 1969; , 1974]  
 ( . . . ),  
 1- 9  
 3- , 2300-2508 . H  
 , 1857,5-1996  
 ( ) ) .  
 - 400 700  
 , 1500 .  
 (10-20). , 200-250 ,  
 ;  
 ( , , 500 800 .  
 . .).  
 [ , 1970], [Walker, 1969] [ , 1974, . 13].  
 [ , 30

200 , - , - : -  
 - ( An<sub>70-75</sub> ) -  
 : 1 - , - An<sub>43-34</sub>), -  
 ( ); 2 - , -  
 ( ) 3 - , -  
 ( ), -  
 / . ( -  
 ) -  
 . -  
 , -  
 , ( -  
 , , - ( ) , -  
 ( ) -  
 , -  
 ( ). 1,1-1,8  
 -  
 MgO (4- ) -  
 K<sub>2</sub>O ( 18 ). MgO, -  
 - 10-  
 (25-30 % ) 15-20 %). 11 %, - 2,5-  
 3,0 % . K<sub>2</sub>O , 0,1-0,2  
 , 2,0-2,4 % . , -  
 10 % . -  
 , , -  
 , ( (F = 100FeO'/(FeO' + MgO)) -  
 30 % ) (K = 100 (or + ab)/(or + ab + an)) -  
 [ , 1974, . 13]. -  
 30 % . -  
 FeTi- -  
 . ( 38 : Be,  
 Sc, Ti, V, Cr, Mn, Co, Ni, Cu, Zn, Ga, Rb, Sr, Y,  
 Zr, Nb, Mo, Cs, Ba, La, Ce, Pr, Nd, Sm, Eu, Gd,  
 Tb, Dy, Ho, Er, Tm, Yb, Lu, Hf, Ta, W, Th, U)  
 « ICP-MS -  
 » [ ..  
 [ , , 1970]. 2005 ]. -  
 , - 180° -  
 . 5 % -  
 , -  
 , -  
 « » (Thermo Finnigan MAT HR/ICP-  
 ( MS Element2), -  
 [ ..  
 . , 2005 ]. -

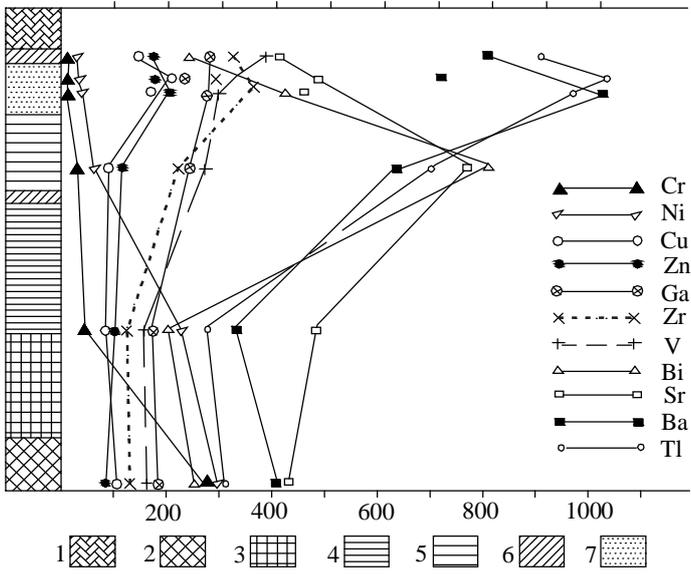
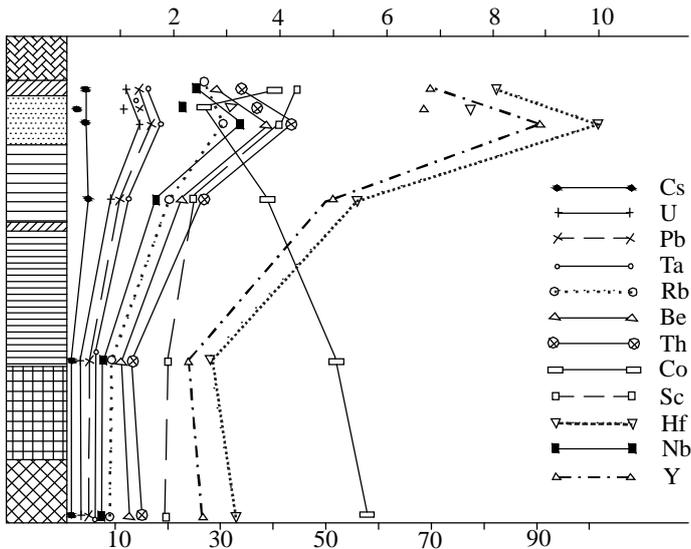
(Rh).  
 BCR-2 ( [Wilson, 1997]),  
 5-10  
 ( . . . )  
 . . . )  
 3 20 . % ( . . . )  
 , . . . )  
 Mg, Fe, (Fe + Mg).  
 ( . . . 1)  
 [ . . . , 1974, . . . 13]),  
 ( . . . ) ( . . . 1, 2)  
 , . . . )  
 ( . . . )  
 ( . . . : )  
 , . . . )  
 ( 300 / ),  
 [Walker, 1969],  
 Ni, Co, Cr);  
 (Mg, Cr ( 170 / )  
 ; ) [ . . . , 1970].  
 Sr,  
 ;  
 (Al, Ca, Sr, Ga, Cs); )  
 [ . . . , 1974)].  
 , . . . )  
 , . . . ;  
 - 700-750 /

( .%)

( / )

	38-61	4-61	10-61	22-61	14-61	15-61
SiO <sub>2</sub>	46,96	48,88	50,58	50,72	48,78	51,46
TiO <sub>2</sub>	0,83	0,94	1,83	2,74	2,86	2,38
Al <sub>2</sub> O <sub>3</sub>	14,78	17,65	17,13	13,03	13,33	13,03
Fe <sub>2</sub> O <sub>3</sub>	4,87	5,11	4,43	5,04	7,73	7,18
FeO	7,50	6,07	6,92	9,84	7,32	6,47
MnO	0,16	0,14	0,19	0,23	0,26	0,19
MgO	11,13	6,77	3,84	4,15	3,33	2,84
CaO	7,77	9,28	8,64	7,69	7,97	7,04
Na <sub>2</sub> O	2,34	2,94	2,40	3,33	3,19	3,26
K <sub>2</sub> O	0,28	0,13	1,33	1,66	1,94	2,42
P <sub>2</sub> O <sub>5</sub>	–	–	0,68	0,77	0,95	1,21
...	3,87	2,41	2,17	0,75	2,90	2,57
	100,33	100,32	100,11	100,45	100,56	100,00
Be	1,32	1,05	2,20	2,56	3,89	2,54
Sc	20	19	25	43	40	37
Ti	5500	5447	9314	14795	16403	16198
V	167	153	264	381	287	334
Cr	280	42	29	10,4	9,2	1,98
Mn	1113	890	901	1382	1563	1729
Co	58	51	38	41	36,5	30
Ni	289	224	55	23	14,8	9,2
Cu	101	89	97	141	172	187
Zn	94	92,	123	171	199	181
Ga	16,6	15,7	26	24	28	21
Rb	8,7	8,8	18,4	23	30	27
Sr	421	475	760	401	452	479
Y	27	24	49	68	89	67
Zr	133	118	222	325	367	291
Nb	9,0	7,7	17,8	23	33	23
Mo	1,25	1,34	2,3	3,1	3,5	2,7
Cs	0,31	0,26	0,41	0,327	0,269	0,196
Ba	401	320	629	793	1002	708
La	17,2	18,0	35	48	65	64
Ce	39	36	80	100	159	136
Pr	5,5	5,1	10,5	14,8	22	17,9
Nd	21	21	43	64	81	75
Sm	3,8	3,9	7,5	10,7	14,1	14,3
Eu	1,30	1,25	2,5	3,1	4,5	3,9
Gd	3,9	3,5	7,6	10,7	14,8	13,2
Tb	0,62	0,57	1,15	1,67	2,2	1,93
Dy	3,7	3,44	6,9	11,1	13,6	11,0
Ho	0,73	0,72	1,31	2,1	2,5	2,3
Er	1,93	1,77	3,5	5,0	6,8	6,2
Tm	0,31	0,27	0,53	0,76	1,00	0,91
Yb	1,86	1,68	3,1	4,9	6,1	5,5
Lu	0,30	0,26	0,51	0,72	0,95	0,82
Hf	3,2	2,6	5,6	8,0	9,8	7,7
Ta	0,45	0,44	0,89	1,33	1,69	1,24
W	0,46	0,47	0,65	0,80	1,13	0,73
Pb	4,2	4,4	10,0	12,8	15,3	14,0
Bi	0,026	0,018	0,079	0,039	0,027	0,020
Th	1,33	1,04	2,6	3,2	4,3	3,5
U	0,45	0,34	0,90	1,10	1,47	1,09

38-61 – , 3- , 2507-2508 ; 4-61 – , 1- ,  
 1982 ; 10-61 – , 1906-1907 ; 22-61 – -  
 , 1868-1870 ; 14-61 – , 1894 ;  
 15-61 – , 1880 .



( . 10-61, . 1),

Ga

Sr,

- Ti, V, Sc, Mn.

Ti

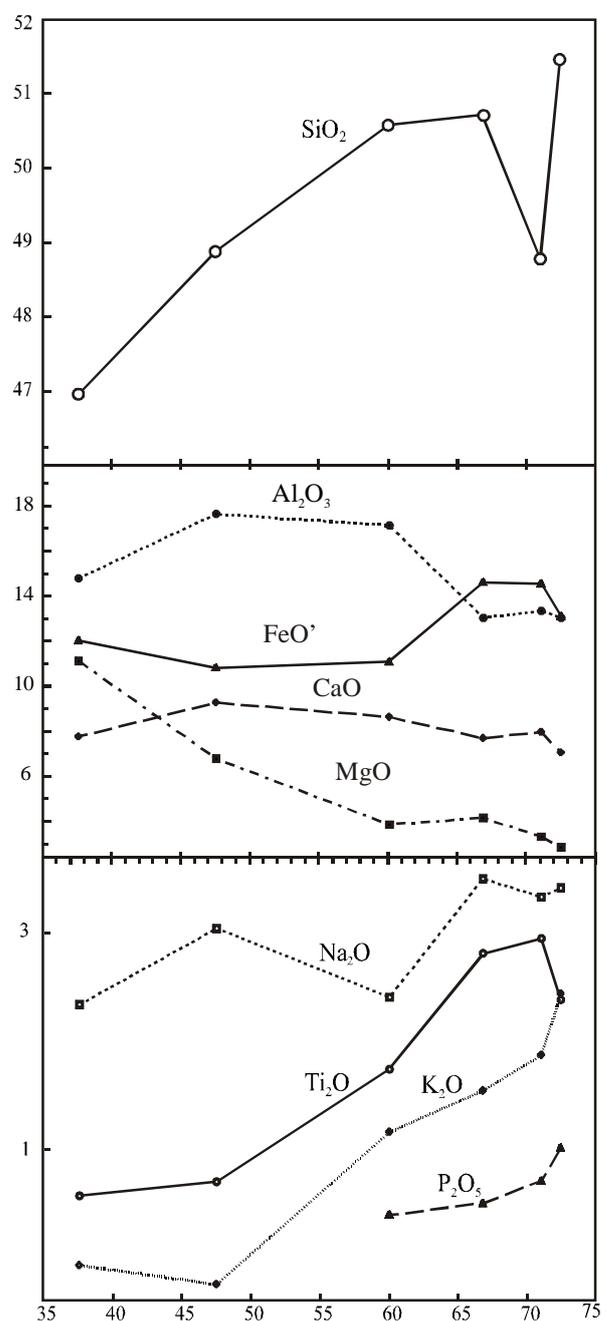
1965].

: ;

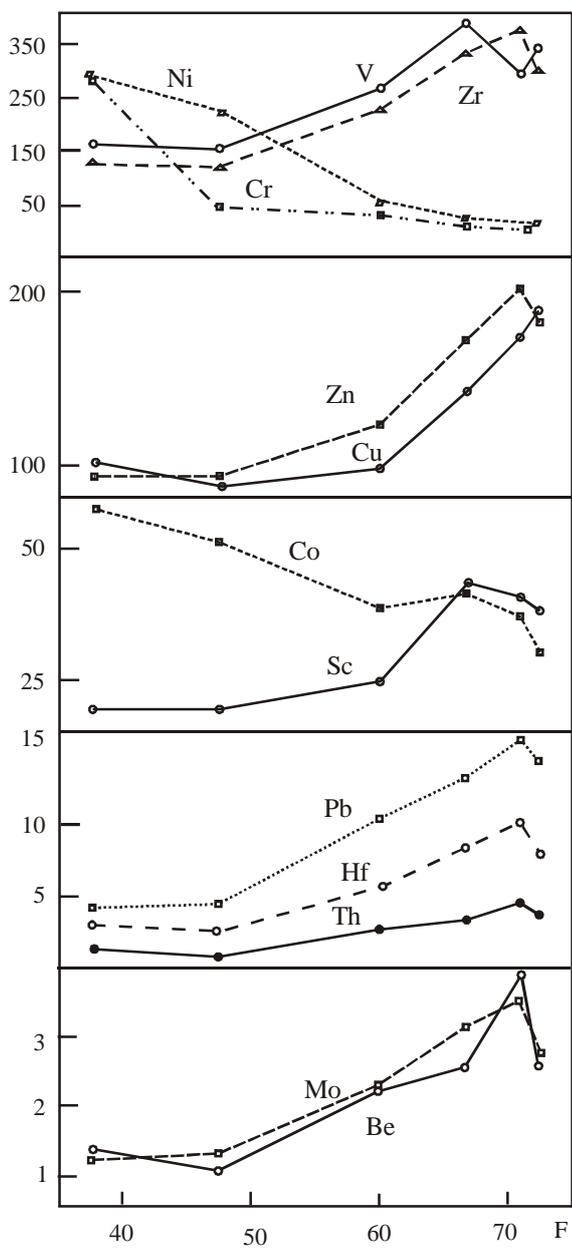
« »

V Sc

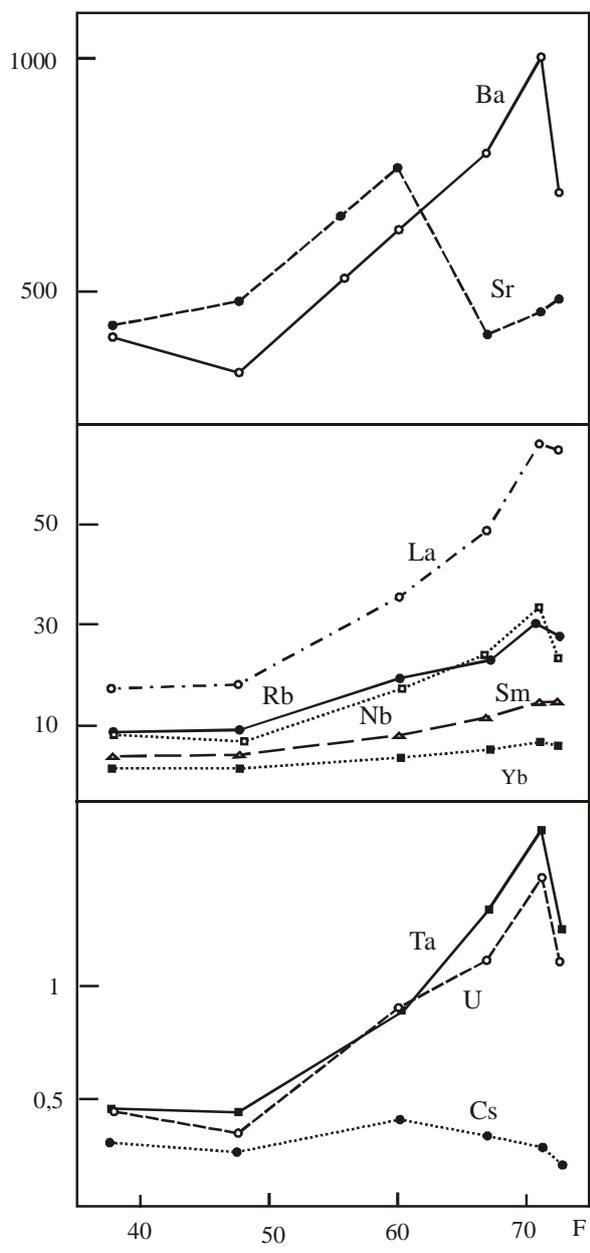
«  
 (Cu, Zn, Cd, Ga, Mo, Pb)  
 :  
 ( Ga)  
 Cu ( . 10-61, . 1),  
 ( . 15-61, . 1),  
 (Ti, Mn  
 ),  
 [Walker, 1969;  
 1970; , 1973,  
 (Rb, Cs)  
 (Ba, Sr, Be)  
 Rb  
 Rb  
 (8-10 / ),  
 ( 25-30 / ).  
 Ba,  
 300-400 700-1000 / ,  
 . 2.  
 ( . %)  
 F



... , ... , ... , ... , ...  
 , 1970; Leeman et.al., 1976].  
 (« » [ , 1969]).  
 Rb Ba,  
 K/Cs  
 K/Rb  
 : Cs  
 [ 1986] , [



. 3.



( / )

[ , , 1970] ( . 1, 3).  
 CFB-  
 [Leeman et al., 1976]. - , Pb, U Th. -  
 , - ( Y),  
 , -  
 ..+) , (0,79), .  
 ( ). - ( . 38-61, . 1) -  
 2,67 126 / ,  
 - ( . 14-61, .  
 Ti 1) 3,10 476 / .  
 ( , - ,  
 ). Cu Zn - 1,1-1,2 . -  
 , -  
 (100- : -  
 130 / ) , - ( ) 1,1 1,6  
 ( 300-350 / ). Hf, ,  
 65-70 / 260 / ,  
 Zr/Hf , - 0,7-0,9  
 , - 1,7-2,5 70-80 230-290 / [ ,  
 ( 41-46 37-38). , 1973, . 40].  
 Nb Ta, -  
 (7,7-8,9 0,44-0,45 / -  
 ), - , , , ,  
 ( 22-33 1,2-1,7 / ), - ,  
 Nb/Ta ,  
 (17-20). - ,  
 Rb, -  
 Nb Ta - U Th -  
 Nb ( 15- ,  
 ), Ta, .  
 [ , , 1973]. - c K, ,  
 : -  
 ~ 1 ( -  
 Nb Ta Ti, , - 1,33). -  
 , 1,06. - , -  
 ,

... , ... , ... , ... , ... ;  
 - ;  
 ( , ) ( , Sr - , Cr , Ti, P, U, Th - -  
 . .) [ , , 1970;  
 , 1973, .].

( U Th).  
 , U Th  
 [1966].

( . 1),  
 ( . 3)  
 (K, Rb),

[1970]  
 ( P<sub>2</sub>O<sub>5</sub>)

(Cu, Zn, V, Sc .)  
 2-3-

- Ni (30- ) Cr (140-  
 ); (Rb, Sr .) 2-  
 4- ( ) - 3-4-

- 1,1-  
 1,8 , MgO (6 ) K<sub>2</sub>O (18  
 ). ( 05-05-62201, 06-05-64133).

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C. 40-56. . . . . , 1970. 551 .

( . . . . . ) . . . . . , 1973. 197 .

P . . . . . , *Sindern S.* . . . . .

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Element2 // . . . . .

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