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*ghorbani@modares.ac.ir*  
( // : // : )

(LT )

(HFSE)

.K, Ba, Sr

(LILE)

LT

LT

(HT )

: LT

Ta, Nb, Ti

HT

Ta Nb

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( ) : ,  
(-b, c, d) ( )  
" " Alavi ( ) .( a )

Berberian *et al.*, (1982)

Berberian and Berberian (1981)

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Zr, V, Y Ga, Sc, Ba, Ce ,Co

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Rb, Sr, Ba, Nb, Zr,

(LLD)

Hf ,Th

(LLD)

(

XRF ( ) Y, U, Mo

Phillips PW2400

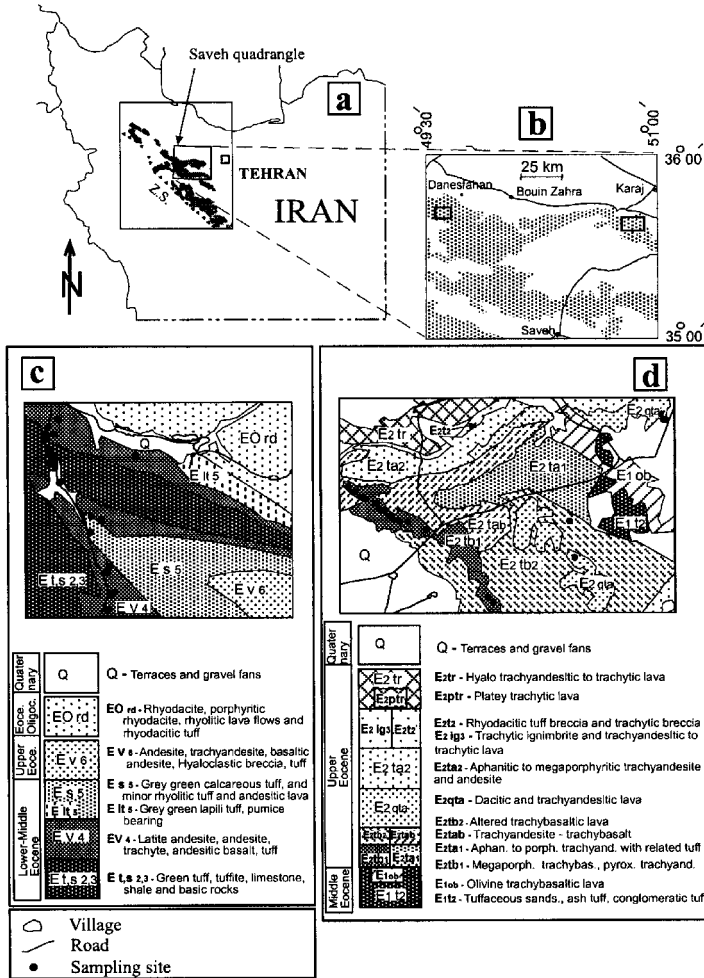
NAA

( ) La ,Ce, Nd ,Sm ,Yb

HIFAR

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( " " )



( ) (a)

(Z.S.)

(b (Alavi, 1994 )

(c

( ) :

(d

( ) :

(REE )

	SW Danesfahan volcanic rocks							SW Karaj volcanic rocks			
	DS1	DS2	DS3	Ds4	Ds5	Ds6	DS7	KJ1	KJ2	KJ3	KJ4
<b>SiO<sub>2</sub></b>	51.74	51.79	52.94	55.22	59.09	63.88	62.19	54.93	58.20	61.89	67.40
<b>TiO<sub>2</sub></b>	0.58	0.72	0.72	0.76	0.70	0.67	0.53	1.14	1.05	1.01	0.65
<b>Al<sub>2</sub>O<sub>3</sub></b>	20.64	19.68	16.79	20.15	18.55	16.44	17.92	19.16	17.05	16.27	15.21
<b>FeO<sub>t</sub></b>	8.48	10.11	8.68	7.81	5.05	6.05	3.70	7.87	7.43	6.51	4.53
<b>MnO</b>	0.14	0.13	0.14	0.12	0.11	0.16	0.15	0.11	0.27	0.14	0.10
<b>MgO</b>	4.49	4.52	5.96	2.58	1.78	1.59	0.47	2.69	2.12	2.11	1.02
<b>CaO</b>	9.00	8.44	9.42	8.17	6.59	4.49	3.63	7.57	7.57	3.85	1.46
<b>Na<sub>2</sub>O</b>	3.31	4.02	2.70	3.25	3.24	3.82	4.39	3.54	3.73	3.52	3.84
<b>K<sub>2</sub>O</b>	0.85	0.40	2.29	1.69	4.48	2.62	6.76	2.54	2.17	4.26	5.57
<b>P<sub>2</sub>O<sub>5</sub></b>	0.71	0.14	0.27	0.18	0.34	0.23	0.20	0.40	0.33	0.37	0.16
<b>S</b>	0.05	0.06	0.08	0.06	0.07	0.04	0.06	0.06	0.08	0.07	0.05
<b>Total</b>	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
<b>L.O.I.</b>	1.65	3.83	2.00	1.54	1.89	1.12	3.54	1.63	2.95	1.83	1.56
<b>Mg#</b>	0.39	0.35	0.49	0.32	0.36	0.30	0.20	0.34	0.30	0.35	0.31
<b>Trace elements (XRF, ppm)</b>											
<b>Rb</b> (1, 0.9)	24.7	7.4	52.2	34.6	150	62.9	186	75.1	50.5	141.5	176.5
<b>Sr</b> (0.9, 0.8)	288	713	525	465	455	380	307	508.8	442	319.5	178.6
<b>Ba</b> (8, 8)	298	292	575	446	730	827	872	437.2	526.5	759.1	1040
<b>Nb</b> (1, 0.2)	3.1	4.5	6.3	6.7	11.3	7.6	15.8	12	1.5	17.9	21.7
<b>Zr</b> (1, 0.3)	48.7	69.9	96.6	91	172	119	222	184.9	142.5	270.7	336.2
<b>Y</b> (1, 0.6)	13.9	17.8	19.2	19.2	21.5	31	27.2	31.4	30.4	42.8	46.6
<b>U</b> (2.9, 0.9)	-0.2	0.3	0.8	-1.1	2.6	2.7	4.4	1.6	-0.1	2.4	5.3
<b>Mo</b> (1.8, 0.5)	1	1.7	1.9	1.6	6.1	2.9	2.7	2.6	2.5	4.9	5.8
<b>REE &amp; Trace elements (NAA, ppm)</b>											
<b>La</b> (0.05, 0.2)	5.61	7.54	16	15.6	24.3	19.4	38.4	26.1	25.2	37.1	43.7
<b>Ce</b> (0.5, 0.4)	12.2	17	30.5	29.5	45.6	39.1	68.8	51	49.3	73.8	84.9
<b>Nd</b> (1.0, 0.4)	6.59	9.64	14.8	15	21.1	19.3	30	24.2	24.7	36.1	39.4
<b>Sm</b> (0.01, 0.04)	1.72	2.4	3.36	3.45	4.21	4.63	5.86	5.71	5.59	7.5	8.16
<b>Yb</b> (0.03, 0.02)	1.32	1.75	1.69	1.83	2.2	3.04	2.78	2.89	2.74	4.19	5
<b>Ta</b> (0.5, 0.4)	-0.5	-0.5	-0.5	-0.5	0.82	0.54	0.93	0.84	0.65	1.11	1.47
<b>Hf</b> (0.2, 0.05)	1.3	1.66	2.65	2.53	4.66	3.52	6.02	5.12	4.06	7.83	9.79
<b>Th</b> (0.2, 0.07)	1.85	1.9	5.62	3.59	11.4	6.09	14.2	8.19	6.29	13.7	17.3

(LLD)

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TAS

( ) ( )

Al

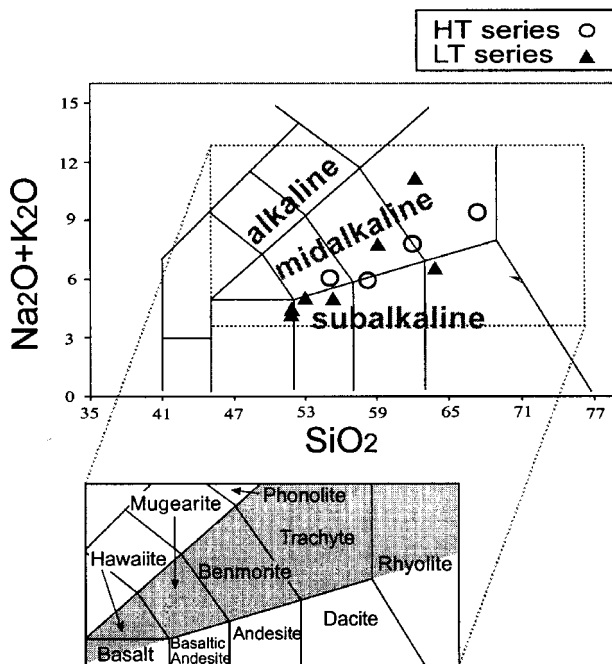
Ti

SiO<sub>2</sub>-TiO<sub>2</sub>

Ti

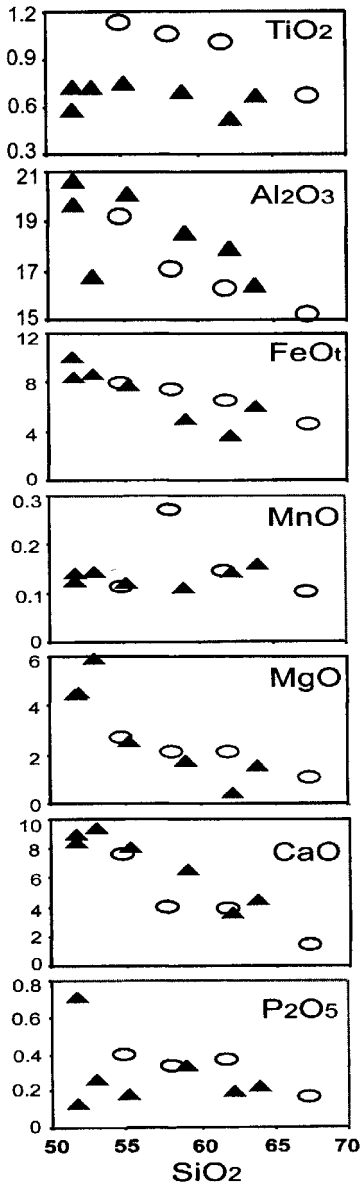
(LT)

(HT)

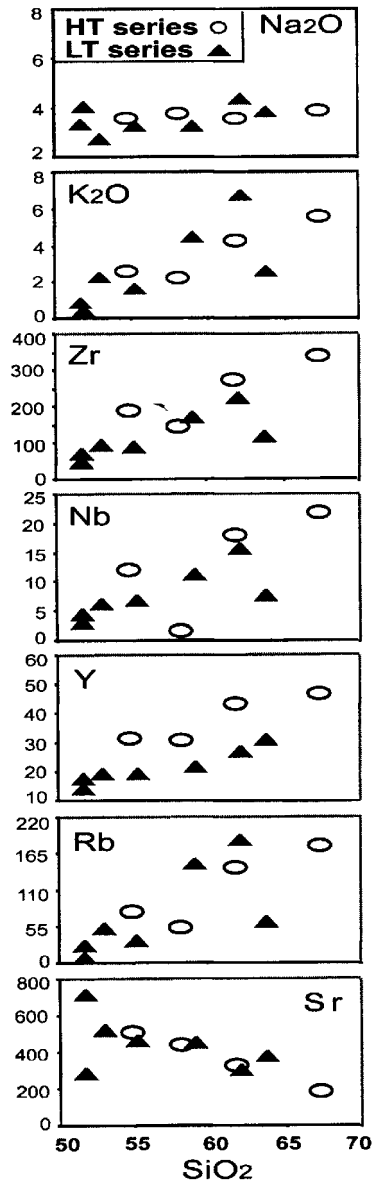


Le Bas et al., 1986 TAS

Middlemost (1997)



( ) HT (

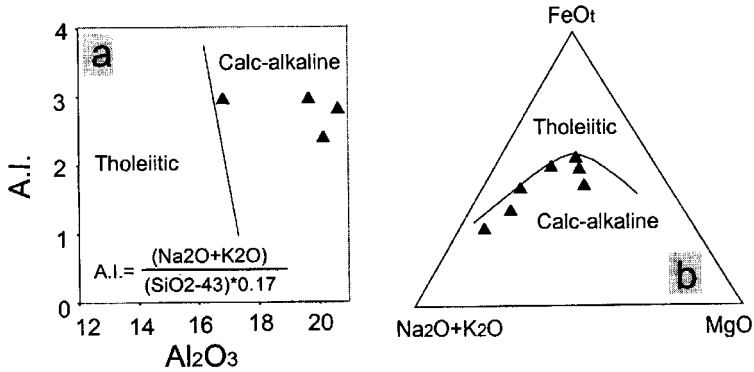


) LT

ppm

Mg ( ) / Mg  
Jaques and Green (1980)  
/ / Mg  
(Loss on Ignition) LOI  
( )  
( )  
( )  
LT  
( -a ) Al<sub>2</sub>O<sub>3</sub> .A.I  
AFM LT  
( -b )  
( ) " " LT  
HT  
) HT  
( )  
Al, Fe, Mg Ca  
+ + +





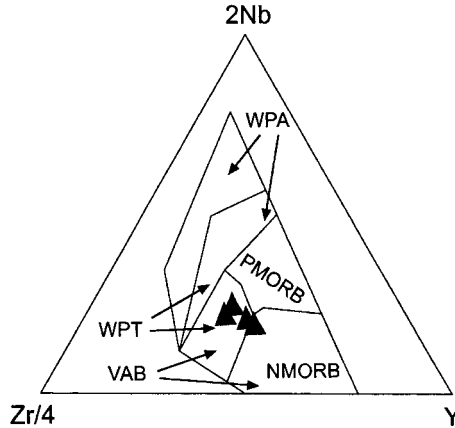
(Middlemost, 1975) A.I.  
Irvine and AFM

$Al_2O_3$   
LT

LT  
(b)

(a)

(Baragar, 1971)



(Meschede, 1986) "2Nb-Zr/4-Y"

LT

(VAB)

(PMORB)

(WPT)

(WPA)

(NMORB)

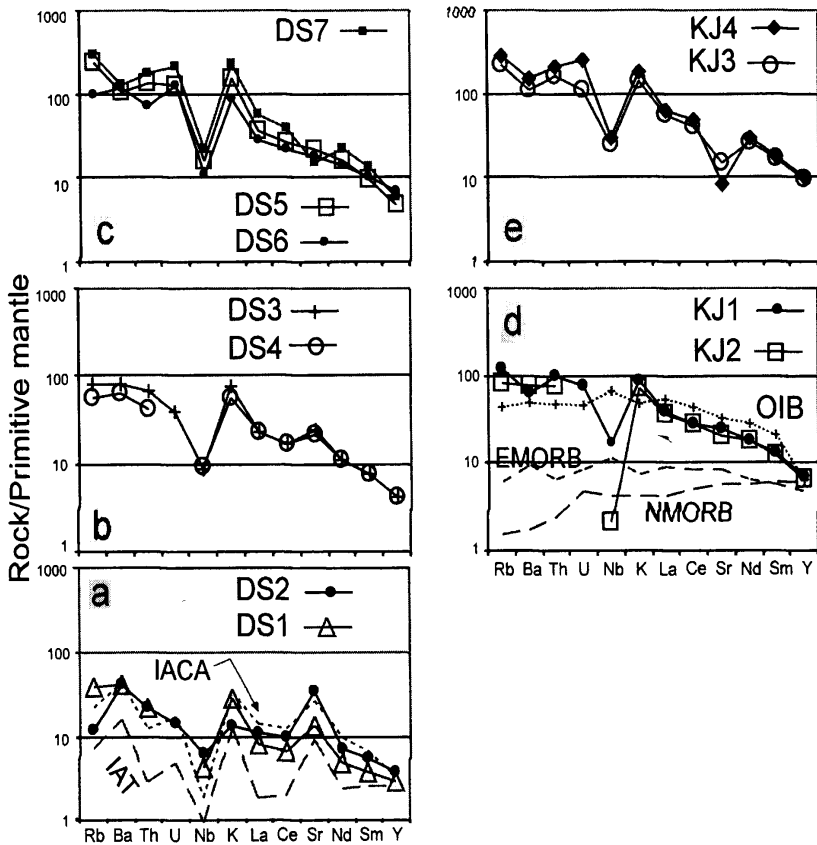
HT LT  
(Sun and McDonough, 1989)  
K LT Nb Ba ,Sr  
HT  
( -a )  
LT  
a , b d ) HT  
Th, U, Ta, Zr, Hf, Nb  
HT  
(  
HT  
(Jacob and Foley, 1999; Wilson, 1989)  
LT HT

LT (Sun and McDonough, 1989)  
( -a )  
HFSE LREE LILE Nb, Ta, Ti  
(Gill, 1981;Thompson *et al.*, 1984; White and Patchett, 1984 ;Saunders *et al.*, 1980)

NMORB  
(rock/MORB) MORB (BVSP, 1981; Pearce, 1982)  
) MORB  
(  
Sr, Ba, K

S Danesfahan volcanics

S Karaj volcanics



(Sun and McDonough, 1989)

SiO<sub>2</sub> < 52 %wt

a

>58

c e

SiO<sub>2</sub> = 52-58 % wt

b d

(IACA)

SiO<sub>2</sub> %wt

(OIB)

Sun (1980) (IAT)

(EMORB)

(NMORB)

Sun and McDonough (1989)

Berberian *et al.*, (1982)

" "

/

-a

LT

Ba/Rb

Rb/Sr

(DS1)

( a ) (DS2)

(Furman and Graham, 1999)

DS1

Th/U

(Reid and Ramos, 1996)

)

/ Gpa

Gpa :

(

(Tatsumi and Kogiso, 1997)

( )

°C

Tronnes (2002)

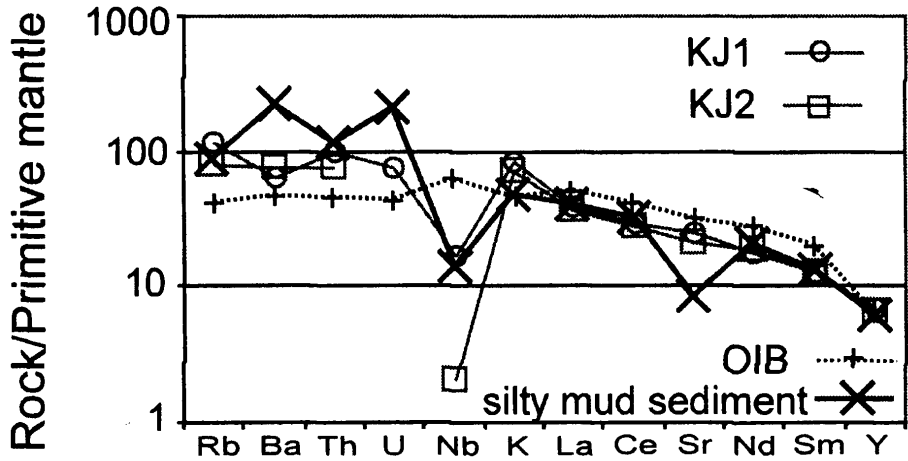
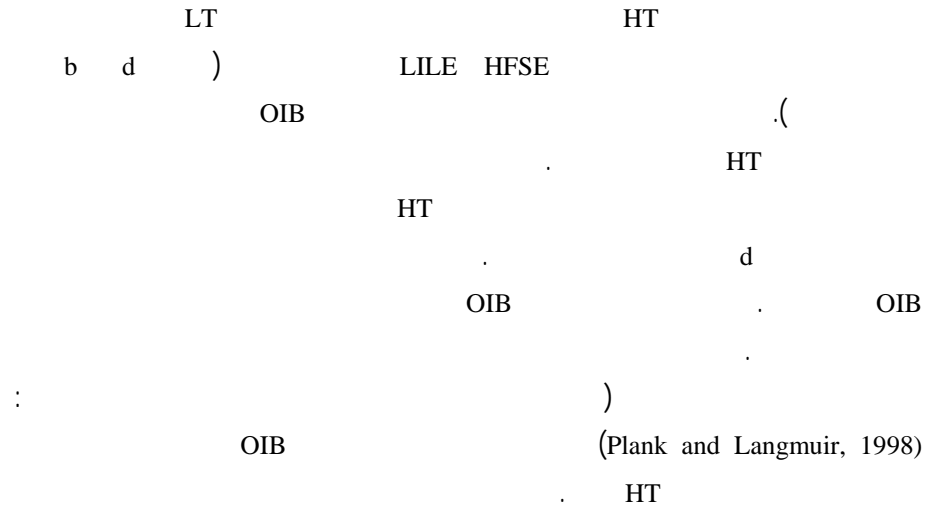
Gpa

(Wyllie, 1984 " " )

Finero

(Zanetti *et al.*, 1999)

( % ) ( % )



(Sun and McDonough, 1989)

(Plank and

OIB

HT

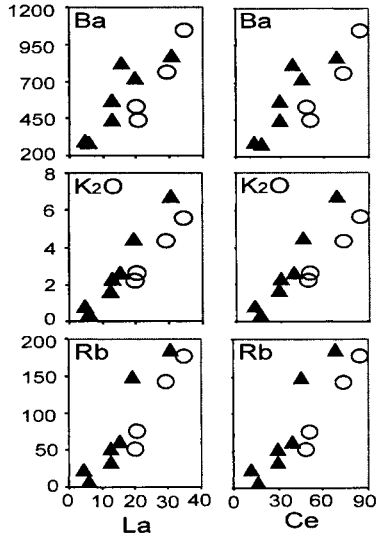
OIB

Langmuir, 1998)

HT

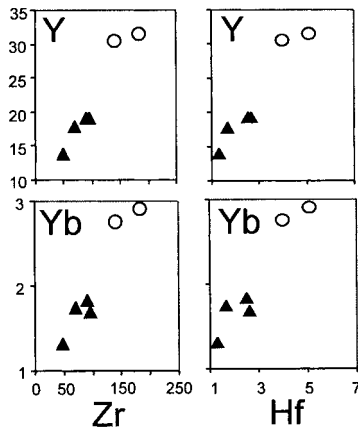
LT HT  
HT LILE  
Carpathians  
(Seghedi *et al.*, 2001)  
Nb LILE  
LILE Seghedi  
( )  
LILE LT HT  
LT LILE LREE  
( ) LREE  
( )  
( )  
( SiO<sub>2</sub>-TiO<sub>2</sub>)  
**HT**  
( b KJ2 ) HT Nb  
Mn  
U  
( )  
Mn Nb  
(Calvert, 1978; Hekinian *et al.*, 1982)  
KJ2 U  
(Gerth, 1990)

...



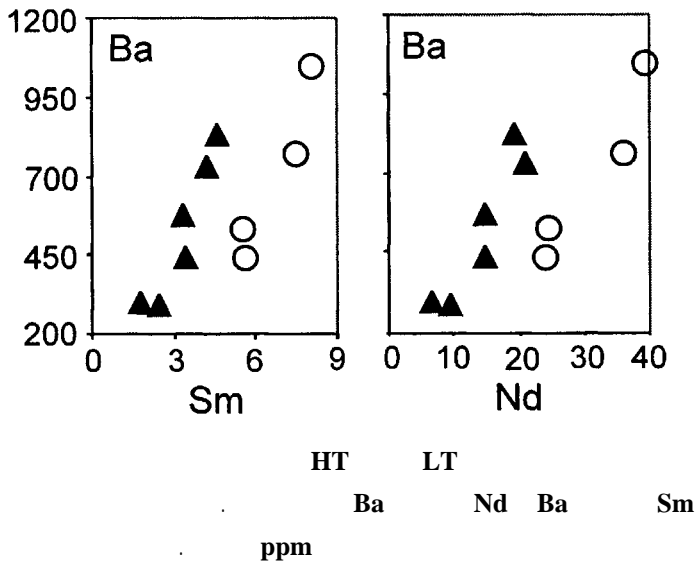
) Ba Rb ,K<sub>2</sub>O (LREE ) Ce La  
 ( ) HT ( ) LT (LILE

ppm



. Yb Y (HFSE ) Zr Hf  
 ( ) LT ( ) HT

ppm



( )

( )

(Briggs and McDonough, 1990; Wendt *et al.*, 1997; Kita *et al.*, 2001)

LT

(HT )



(OIB)

LT

Mantle Plume

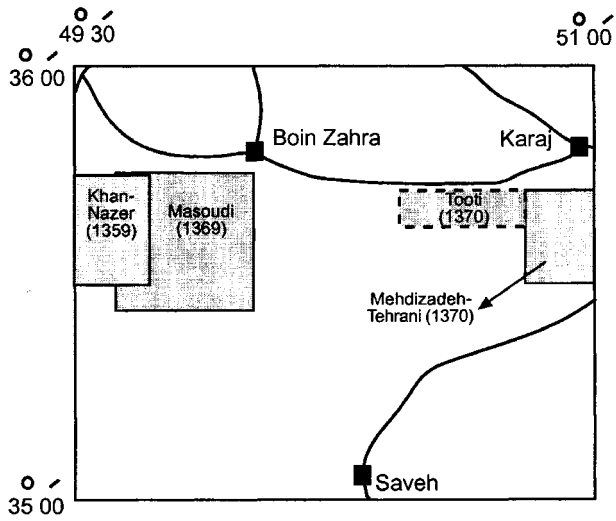
HT

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