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210016,
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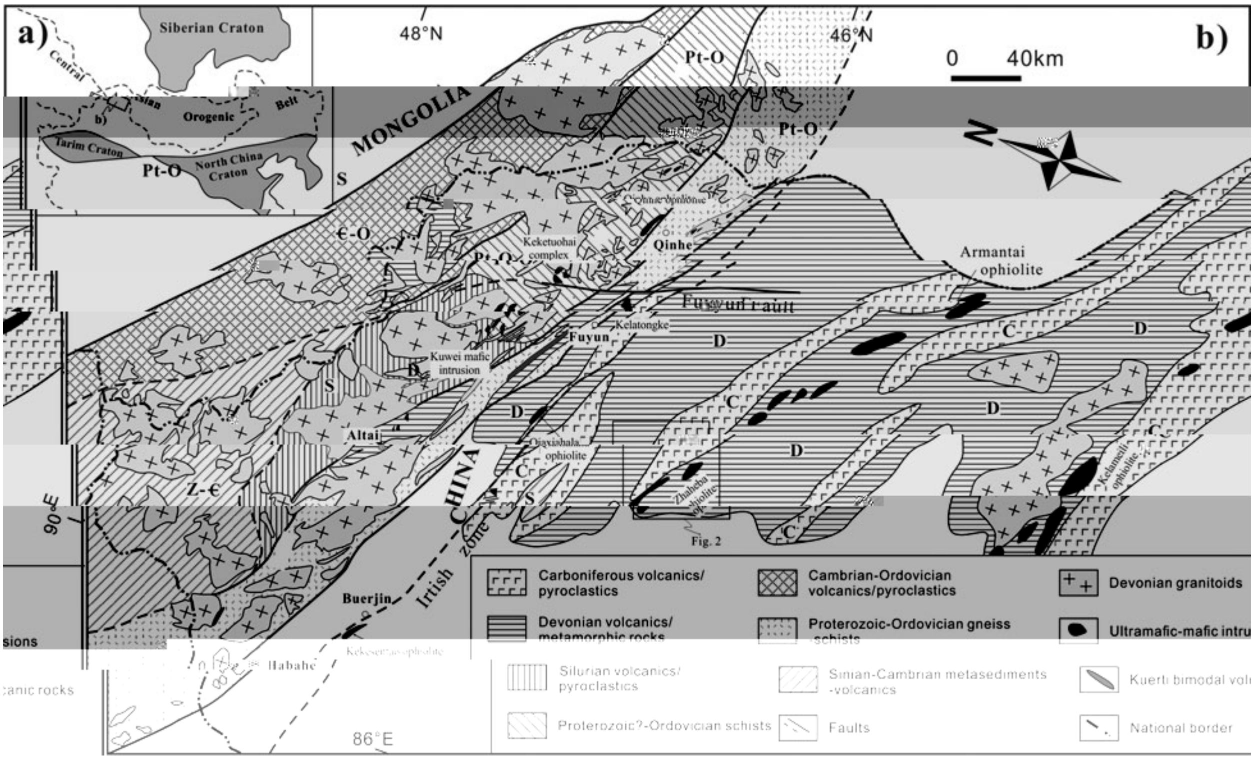
Abstract ~4 5 ~400 ε (*t*) (13 20) δ (+5.3 ‰)),

1. Introduction

(*et al.* 200 & , 200 *et al.* 2012 *et al.* 2012, 2013 *et al.* 2013), *et al.* 200 *et al.* 200 a). (*et al.* 2000 , & , 2003 *et al.* 200 , 2014). & (2011) ( ), (2014)

), & , 2000 *et al.* 2002 *et al.* 2004, 200 a) (*et al.* 200 a,b & , 2012). (*et al.* 2003 *et al.* 2003 *et al.* 200 a) ( ).



1. ( ) ... ( ) ( ) ... *et al.* 200).

... (1) ... (2) ...

2. R a , b a a a

... (. 1, 2) ... (. 3) ... 15 ... (. 2, ...) 1 ... 5 ... 1 ...

... > 0 % ... (. 3 ,). ... (*et al.* 2013) ... (40 0 %) ... (30 50 %) ... (5 10 %) ... (. 3) ... *et al.* 2006) ... (. 2) ... (1 , 3) ...

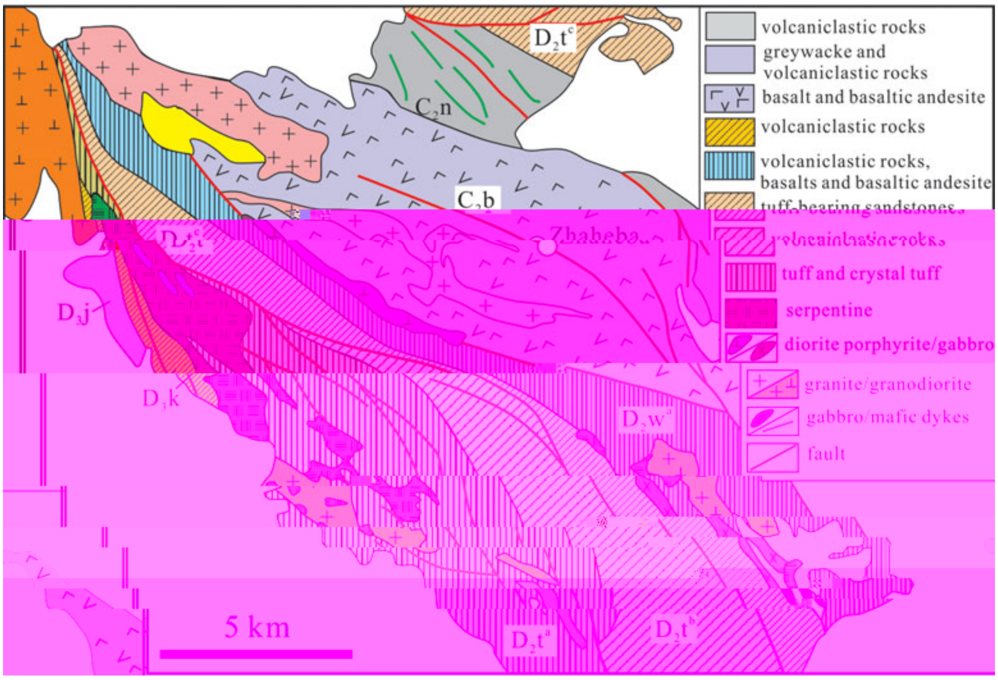


Figure 2. [illegible] *et al.* 200[illegible], 200[illegible] *a*[illegible] 1[illegible], 3).

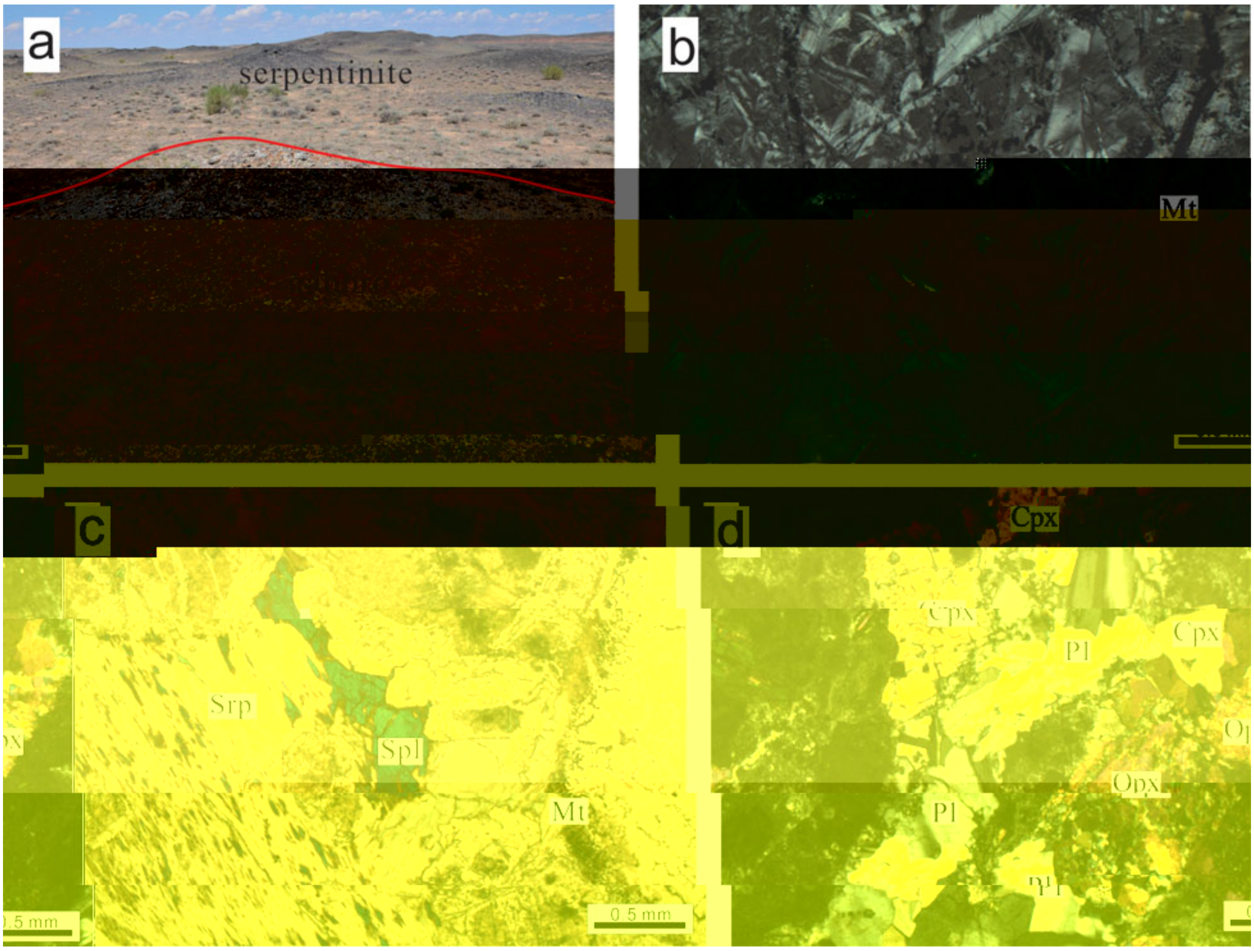


Figure 3. [illegible] 0% [illegible]

3. A a ca c

3.a. Z c U Pb a a H O a a

(2013 01, 46° 32′ 51 ... °2′ 4 ...) (2013 02, 46° 33′ 2 ... °2′ 36 ...)

... ( ) ... ( ) ... et al. (2011). ... (et al. 2010) ... (2003). ... 5 % ... 1 ... 2, ... 12 0 ... et al. (2010a). ... = 0.0020052), ... ( ) ... δ ... 5.31 ‰ (et al. 2010b). ... δ ... 5.44 ± 0.21 ‰ (2), ... 5.4 ± 0.2 ‰ (et al. 2013). ... 3 ...

3.b. M a a a

... 00 ... 15 ... 15 ... 20 ... 4 ... 5 ...

3.c. W - c a a

... 100 ... et al. (2004). ... 2 %. ... 6000 ... et al. (2004). ... 50 ... 3 ... -1, ... -2, ... -2, ... -1 ... 3, ... 3 5 %. ... 1.

... 3 ... ( ) ... et al. (2004). ... = 0.11 4 ... = 0. 21 ... 0. 102 ... 0. 0506 ... -1, ... 0.512104 ... 0.5126 1 ... -1. ... 2.

4. A a ca

4.a. Z c U Pb a

... 100 ... 150 μ ... 1 1 ... 2 1. ... (. 4). ... (22 123) ... (5) ... 0.4 ... 0. ... 30 ... 4 5. ± 2.5

[illegible] 1. [illegible]

[illegible]	2013 01-1	2013 01-3	20132 01-4	2013 01-5	2013 01-6	2013 01-	2013 01-	2013 01 1	2013 01 2	2013 01 4
					Major elements (%)					
[illegible] $_2$	3 . 0	4 .20	3 .41	3 .62	3 .22	3 . 2	3 .05	4 .22	46.4	51.2
[illegible] $_2$	0.05	0.20	0.05	0.05	0.04	0.05	0.04	0.14	0.12	0.2
[illegible] $_3$	0.61	1. 6	1.04	0.6	0. 0	0. 4	0. 0	1 .2	1 .64	1 .33
[illegible] $_3$	.44	4.6	.	.36	.5	.16	. 4	3.6	3.24	3.
[illegible]	0.0	0.10	0.11	0.11	0.11	0.0	0.11	0.0	0.0	0.0
[illegible]	3 .21	24.5	3 . 2	3 .	3 .0	3 .31	3 .44	10.04	.03	5.
[illegible]	0.12	15.42	0.15	0.14	0.2	0.10	0.14			

3. (3 .21161 0.0). 10 5. - .1431 ( ). ; 0 5.4 1. 3.5 4.12 142.5 5 4.312

1. [illegible]

[illegible]	2013 01-1	2013 01-3	20132 01-4	2013 01-5	2013 01-6	2013 01-	2013 01-	2013 0L 1	2013 0L 2	2013 0L 4
[illegible]	0.005	0.064	0.00	0.005	0.00	0.003	0.003	0.051	0.044	0.222
[illegible]	0.021	0.34	0.044	0.042	0.0 2	0.031	0.033	0.310	0.25	1.450
[illegible]	0.004	0.04	0.00	0.00	0.011	0.005	0.005	0.04	0.043	0.21
[illegible]	0.011	0.232	0.036	0.044	0.012	0.034	0.00	0.123	0.0 0	0. 3
[illegible]	0.0 0	0.036	0.03	0.03	0.06	0.026	0.025	0.046	0.031	0.06
[illegible]	0.26	1. 10	6.600	1. 0	0. 3	0.233	1.150	1.5 0	0.516	0.1 5
[illegible]	0.406	0.0 2	0.12	0.112	0.0	0.1	0.054	0.16	0.1 1	0.6 5
[illegible]	0.046	0.034	0.014	0.02	0.050	0.030	0.010	0.050	0.02	0.130
[illegible]	0.1 1	0.144	0.203	0.364	0.042	0.0 4	0.0	0.066	0.042	0.0 3
[illegible]	2013 0L 5	2013 0L 6	2013 0L (1)	2013 0L (1)	2013 0L (1)	2013 03 2 (1)	2013 03 3 (1)	2013 03 4 (1)	2013 03 5 (1)	2013 0L 3 (2)
					Major elements (%)					
[illegible]	4 .1	45.	4 .	53.1	51. 1	50.40	50.54	50.52	51.22	52.3
[illegible]	0.34	0.15	1.40	1.24	1.31	1. 0	1.63	1.31	1.1	0.33
[illegible]	1	1 .5	16.5	16.1	15. 3	15.	16. 6	15.55	15.4	1 .61
[illegible]	4.52	3.34	.	.11	.43	.0	.50	.42	. 2	3.44
[illegible]	0.0	0.0	0.11	0.10	0.11	0.13	0.11	0.14	0.12	0.0
[illegible]	6.	.42	4. 0	4.2	4.41	5.	3.2	6.06	.14	4.
[illegible]	11.03	12.61	6.22	5. 5	6.3	6. 5	4.52	.4	.26	. 0
[illegible]	4. 6	.3	. 2	.3	.00	4.52	.31	4. 0	4.0	.11
[illegible]	0.13	0.11	0.3	0.31	0.42	2.04	0.33	1.2	2.03	0.1
[illegible] 5	0.04	0.02	0.62	0.62	0.65	0. 4	0.6	0.4	0.44	0.04
[illegible]	3. 2	3.26	4.24	2.54	2. 3	2.2	5.14	2.65	1. 3	2.
[illegible]	. 5	. 2	. 6	. 0	.4	.40	. 1	.6	.6	. 1
[illegible]	4.	.4	.11	. 0	.42	6.56	.64	6.0	6.11	.2
[illegible] #	5	1	55	54	54	56	41	56	64	4
					Trace elements (ppm)					
[illegible]	.0	4. 5	1.16	1.12	1.4	.0	40.4	5.2	6. 2	5. 1
[illegible]	0.22	0.135	1.2 4	1.6 3	1.316	1. 53	1.034	1.100	0.5 5	0.62
[illegible]	25.0	23.	1 .6	1 .5	1 .5	.5	1 .2	25.2	1	1 .0
[illegible]	11	3.	1 6	166	1 2	22	22	254	1	5.
[illegible]	34.	163	60.5	62.6	64.1	116	1	0.	203	23.
[illegible]	24.2	21.6	26.	23.6	24.6	2 .	2 .5	2 .0	2 .0	16.4
[illegible]	4.	1 5	63.6	50.	51.4	6.	2 .	5 .3	132	1.1
[illegible]	52. 4	55.5	(1. 0 1 23.). 3(21.6)-6240 0.34							

Table 1. [illegible]

[illegible]	2013[illegible]01[illegible]5	2013[illegible]01[illegible]6	2013[illegible]01[illegible] ([illegible]1)	2013[illegible]01[illegible] ([illegible]1)	2013[illegible]01[illegible] ([illegible]1)	2013[illegible]03[illegible]2 ([illegible]1)	2013[illegible]03[illegible]3 ([illegible]1)	2013[illegible]03[illegible]4 ([illegible]1)	2013[illegible]03[illegible]5 ([illegible]1)	2013[illegible]01[illegible]3 ([illegible]2)
[illegible]	3[illegible]	1.20	3[illegible].60	46.[illegible]0	4[illegible].30	23.40	43.00	25.20	32[illegible]0	6.56

Table 1. [illegible]

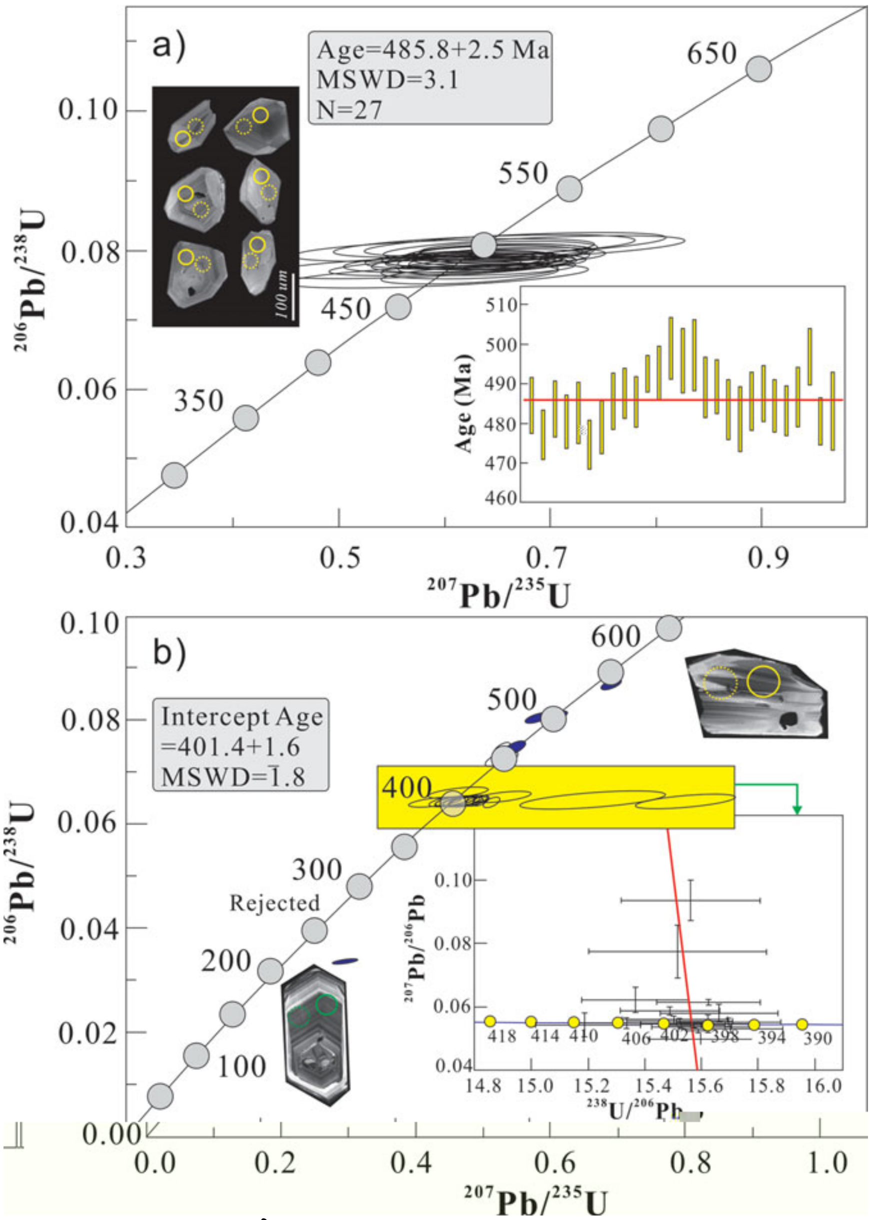
[illegible]	2013 01 11 (2)	2013 02 1 (2)	2013 02 2 (2)	2013 03 1 (1)	2013 03 6 (1)	2013 01 10 (2)	04 06 (1)	04 24 (1)	04 2 (1)	03 1 (1)
					Trace elements (ppm)					
[illegible]	1 .4	36.	42.4	26.0	32.4	1 .	/	/	/	/
[illegible]	0.3 5	0.153	0.35	1.1	0. 4	0.46	/	/	/	/
[illegible]	32.5	33.2	34.5	25.1	26.3	32.1	13.4	20.5	1 .	20.3
[illegible]	1 4	203	21	33	341	1 5	144	1 4	214	265
[illegible]	56.5	44.2	4 .	1 .	22.2	53.	15	162	214	265
[illegible]	34.	3 .5	3 .3	23.1	24.	33.	20.6	30.	2 .	20.2
[illegible]	66.4	4.6	6.4	25.4	2 .1	66.6	.1	114	5.5	.02
[illegible]	6.4	236.4	256.	205.4	20 .	114.20	/	/	/	/
[illegible]	4 .0	44.1	4 .0	4.	103	44.1	/	/	/	/
[illegible]	12.0	11.1	11.2	14.	13.6	12.0	/	/	/	/
[illegible]	0.5	1.420	1.0 0	3.130	3.2 0	0.5 3	4.	1 .1	22.0	1 .2
[illegible]	1	1 50	5	2 0	24	6 6	1	31	111	6
[illegible]	13.0	13.0	13.2	21.1	22.	12.5	13.2	13.2	14.	20.1
[illegible]	54.	42.3	41.5	144	154	52.	243	133	164	151
[illegible]	1.2	0. 4	0. 55	11.315	11. 5	1.25	20.2	12.	21.	12.2
[illegible]	0.025	0.030	0.02	0.051	0.052	0.02	/	/	/	/
[illegible]	0.3 1	0.2 6	0.32	1.560	1.450	0.360	/	/	/	/
[illegible]	0.2	1. 20	1.030	0.365	0.406	0.336	/	/	/	/
[illegible]	11	3 2	346	25	50	4.3	/	/	/	/
[illegible]	10. 0	. 40	.610	26.40	26. 0	10.50	30.6	32.2	40.1	26.4
[illegible]	23.00	1 . 0	1 .40	51.50	54. 0	22.30	5 .	62.	2.3	52.5
[illegible]	2. 0	2.520	2.510	5. 50	6.1 0	2.6 0	6.	. 4	10.5	6.4
[illegible]	11. 0	11. 0	11.60	22.30	24.30	11.60	2 .5	31.2	43.1	24.4
[illegible]	2.540	2. 00	2.6 0	4.4 0	4. 00	2.3 0	4.5	5.2	6.	4. 5
[illegible]	0. 6	0. 1	0. 0	1.163	1.25	0. 3	1.45	1.5	2.0	1.03
[illegible]	2.4 0	2. 13	2. 54	4.14	4.46	2.522	3.56	4.01	5.35	4.23
[illegible]	0.3 6	0.3	0.3	0.612	0.660	0.3 4	0.4	0.54	0.64	0.63
[illegible]	2.1 0	2.150	2.220	3.420	3.6 0	2.130	2.5	2.	3.24	3. 5
[illegible]	0.46	0.446	0.444	0. 2	0. 5	0.46	0.4	0.52	0.5	0.
[illegible]	1.350	1.230	1.240	2.120	2.2 0	1.310	1.32	1.3	1.45	2.25
[illegible]	0.1 0	0.16	0.1 5	0.304	0.32	0.1 4	0.1	0.2	0.2	0.34
[illegible]	1.210	1.050	1.120	1. 60	2.110	1.210	1.25	1.23	1.24	2.13
[illegible]	0.1 4	0.164	0.165	0.2 1	0.323	0.1 3	0.20	0.1	0.1	0.34
[illegible]	1.3 0	0. 41	1.040	3.2 0	3.510	1.460	5.3	3.2	4.16	3. 2
[illegible]	0.0 4	0.062	0.051	0.5	0.644	0.0	1.35	0.6	1.16	0.6
[illegible]	0.151	2.0	1.50	2. 5	1.	0.33	/	/	/	/
[illegible]	0.3 4	0.206	0.200	45.20	35.10	0.41	.13	.0	4.1	21.06
[illegible]	1. 0	0. 61	0. 1	. 60	.2 0	1. 0	4.50	2.63	3.20	.41
[illegible]	0.500	0.304	0.302	2. 30	3.4 0	0.501	1.	0.6	1.46	2.5

[illegible] 04 06, 04 26, 04 2 [illegible] 04 1 [illegible] *et al.* (200 *a*).

[illegible] 2. [illegible]

		[illegible]	[illegible] ( )	[illegible] ( )	[illegible] / 6	/ 6 (1σ)	(/ 6)	( )	( )	14 / 144	143 / 144 (1σ)	(143 / 144)	ε (t)
2013 [illegible] 01 3	[illegible] (2)	0.36	3 2	0.002	0. 04030(2)	0. 04015	2.4	10.	0.13 4	0.512 3 (40)	0.5124 4	6.
2013 [illegible] 01 10	[illegible] (2)	0.5	6 6	0.0024	0. 04 5 (23)	0. 04 45	2.3	11.6	0.1235	0.512 0 (43)	0.5124 6	.1
2013 [illegible] 03 1	[illegible] (1)	3.13	2 0	0.0335	0. 06324(20)	0. 06133	4.4	22.3	0.121	0.512533(4)	0.512214	1.
2013 [illegible] 03 2	[illegible] (1)	2.	1320	0.0063	0. 042 (20)	0. 04255	4. 5	2 .6	0.1046	0.512 1 (51)	0.512445	6.3
2013 [illegible] 03 3	[illegible] (1)	.06	516	0.0452	0. 0536 (43)	0. 05111	5.	36.	0.0	0.512 0 (30)	0.512450	6.4
2013 [illegible] 03 4	[illegible] (1)	.65	14 0	0.01	0. 0422 (51)	0. 04120	4.55	24.5	0.1123	0.512 03(53)	0.51250	.5

ε (t) = 10 000((143 /144) (t)/(143 /144) [illegible] (t)−1) ε (t) [illegible] (/ 6) [illegible] 401 [illegible].



[illegible] 4. ([illegible]) [illegible] 1σ [illegible] 2σ ([illegible]) [illegible].

([illegible] 4 [illegible] = 2 , [illegible] = 3.1). [illegible] 4 ± 4 [illegible] ([illegible] *et al.* 2003). [illegible] 100 [illegible] 200 μ [illegible]

[illegible] 1 3. [illegible] 1 (1), [illegible] 0% [illegible] (2) [illegible]

(2, . 4). 2 450 500 21 206 23 1 401 ± 2 (= 3.3) 206 23 20 235 401.4 ± 1.6 (= 1.) 206 23 . 4), (, 1 3).

4.b. M a c

4.b.1. Spinel composition

(. 3). 100 300 μ 4 3 2 (100 / (+)) 44 60 (100 / (+)) 25 61. *et al.* 2010). ( ) *et al.* 2013).

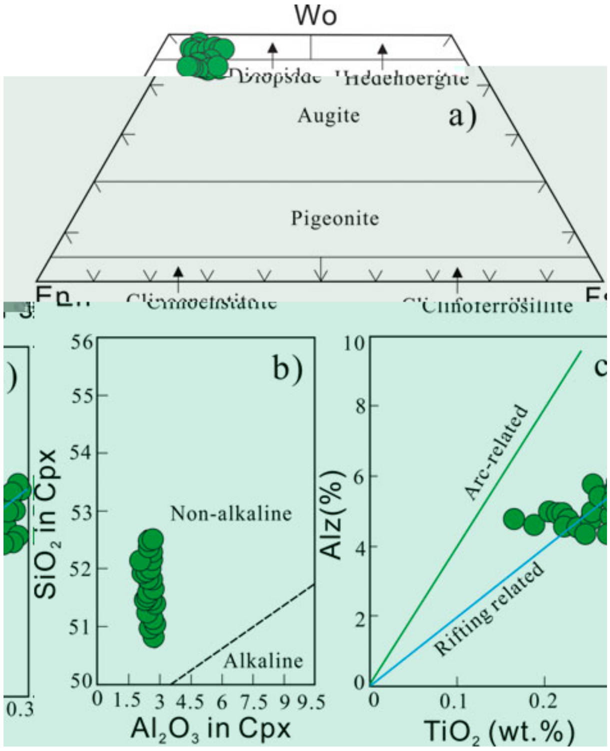
4.b.2. Pyroxene compositions

(= 4 6). 2 (0.5 %) 5). 41 4 , 46 55 1 (. 5). 3 2 2 (. 5).

4.c. W - c a c

4.c.1. Serpentinites and cumulates

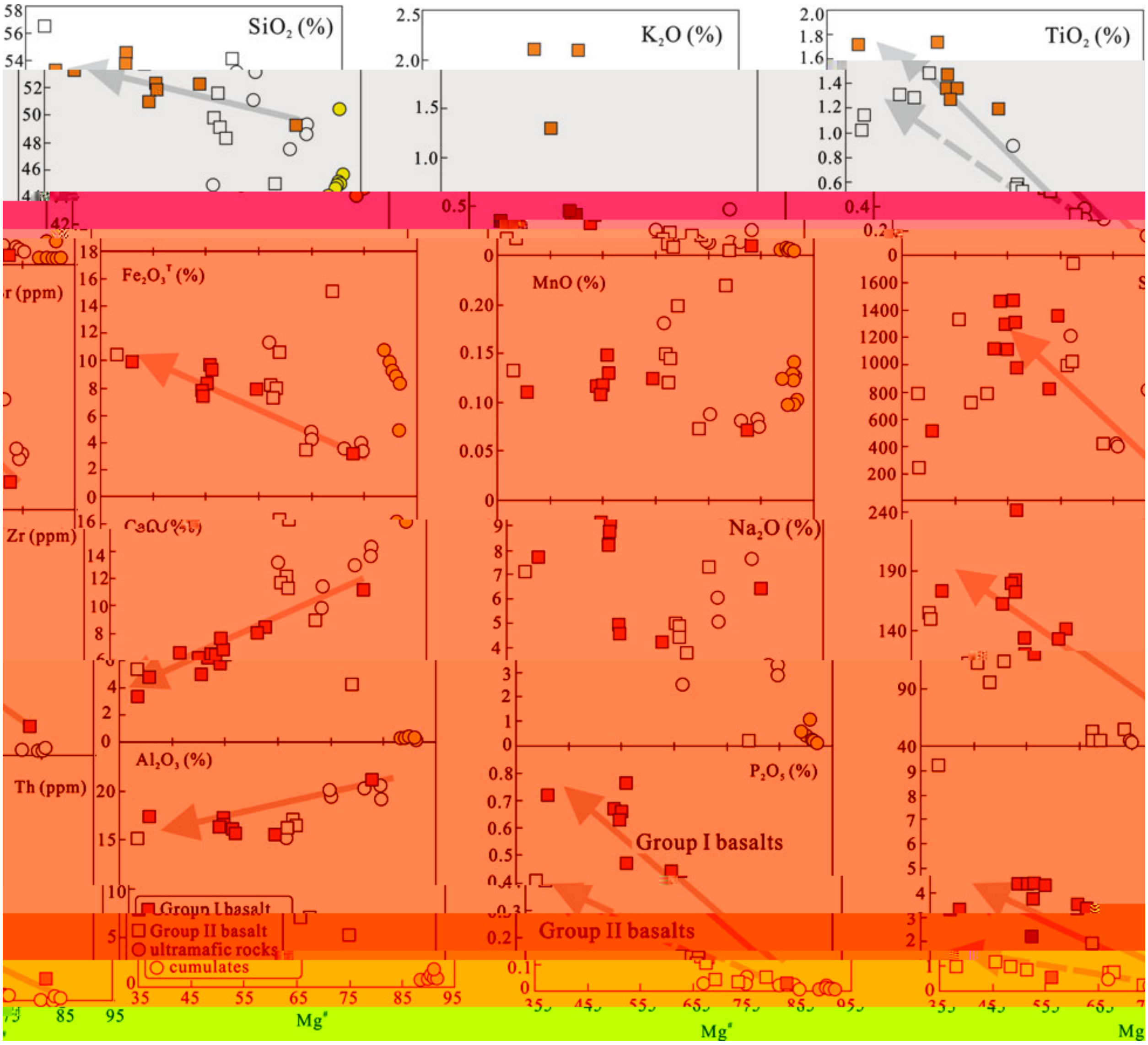
( ) (> 12 %,) 2 (40 %) 3 (1.0 %), (0.03 0.06 %), (0.04 0. 2 %) 2 (0.04 0.05 %). 3



5. ( ) ( ) . ( ) 2 (%) 3 (%) ( ) ( ) 2 (%)

1 (. 1) . 6). (3 103) (5) (. 1). (> 12 %) ( ) ( ) ( ). 3 3 2, ( ) (. 1). (.), , 2014 & 1).

2 45. % 51.2 %, 3 (3.24 4.6 %), 3 (1 .3 1 .6 %, 2013 01-3), (.54 15.42 %), 2 (0.12 0.34 %), (2. 1 .3 %, 2013 01-3) (0.11 0.46 %), (. 1).

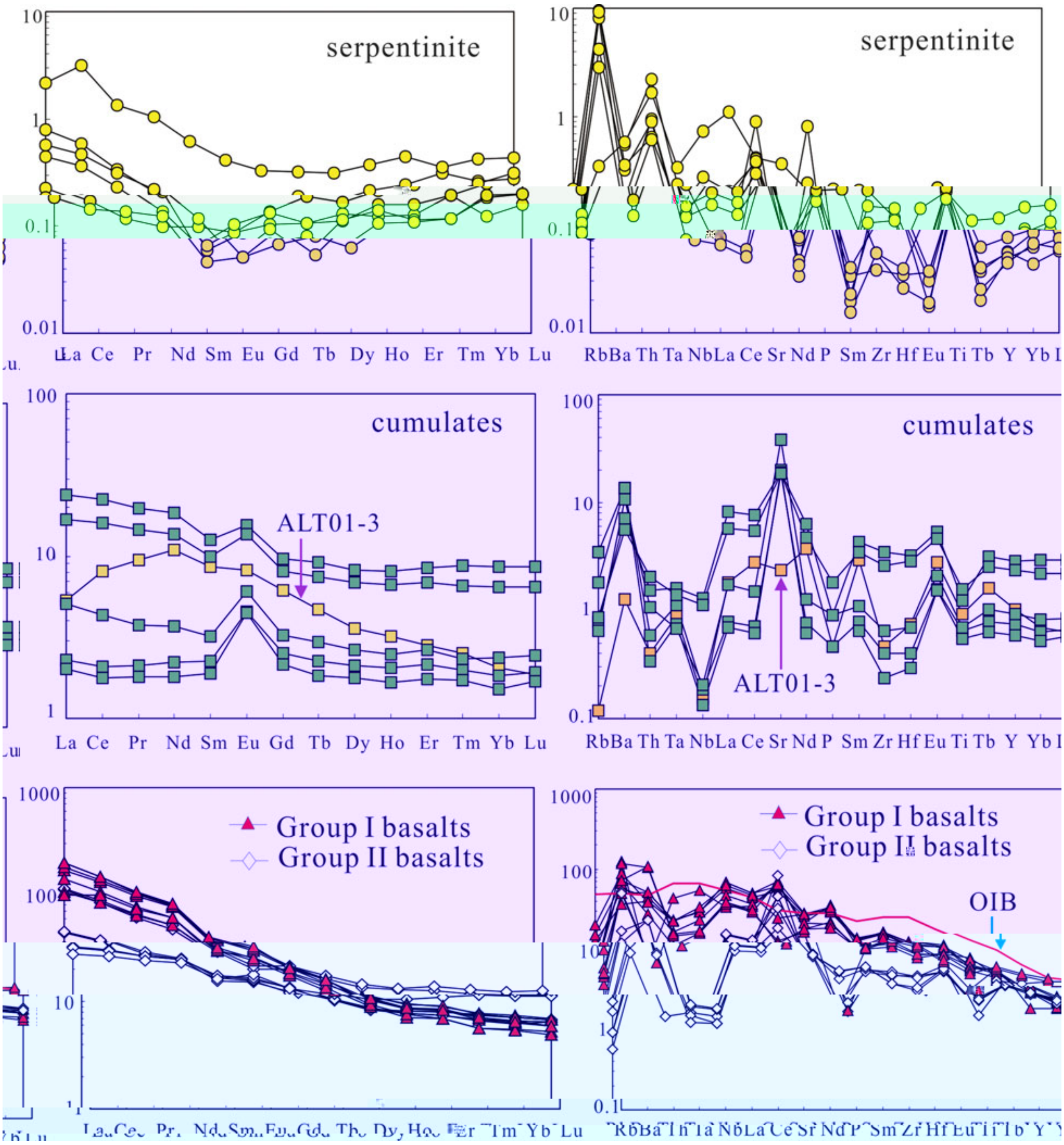


6. [illegible] *et al.* 200 [illegible]

[illegible] 6). [illegible] 41 [illegible] = 1.3 [illegible] 2. [illegible] = 1.1 [illegible] 2.2). [illegible] 2013 [illegible] 01-3 [illegible] = 0.2 [illegible] 0.4) [illegible]

4.c.2. Basalts

[illegible] 43.15 % [illegible] 5 .65 % [illegible] 52 %, [illegible] 1) [illegible] 1 (1) [illegible] 2 (2). [illegible] 6). [illegible] 124 [illegible] 205 [illegible] 50 [illegible] 60 [illegible] 10 [illegible] 30 [illegible] 20) [illegible]

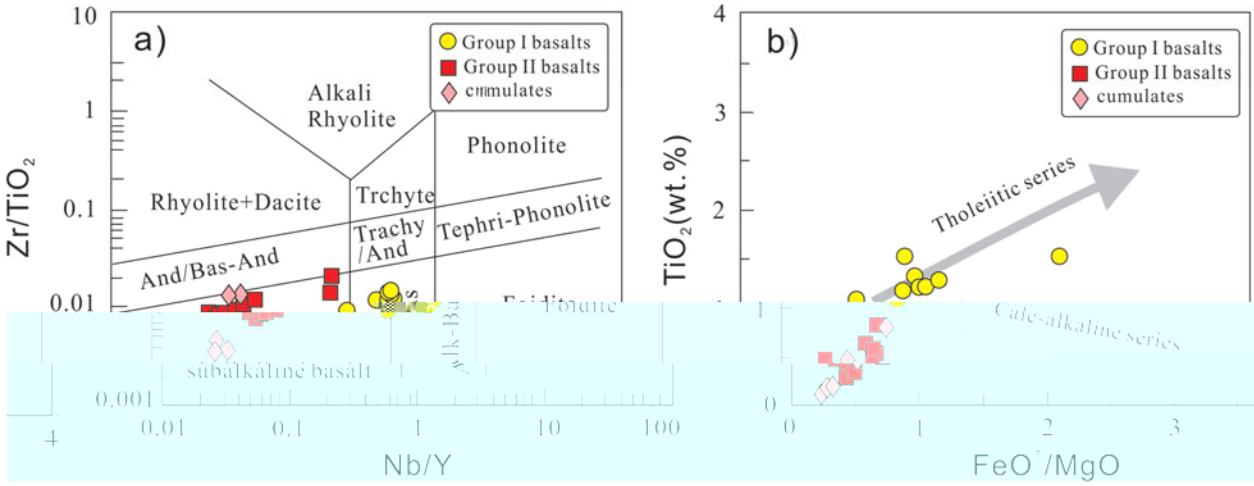


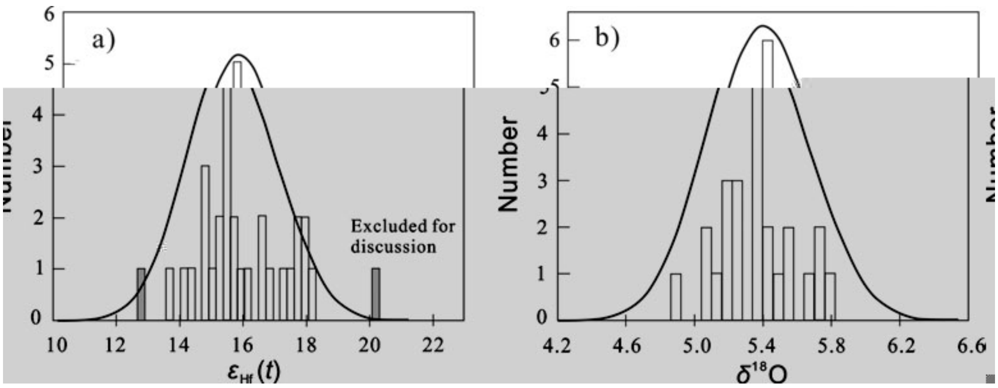
( ) & (1).

(/ = 0. 0 1.14) ( ). 2. (/) 4 6 (/ = 1.02 1.21) ( ). 1. 0.44 0. 2. 1. (~0.11). ( ).

4. . W - c S N a c H O

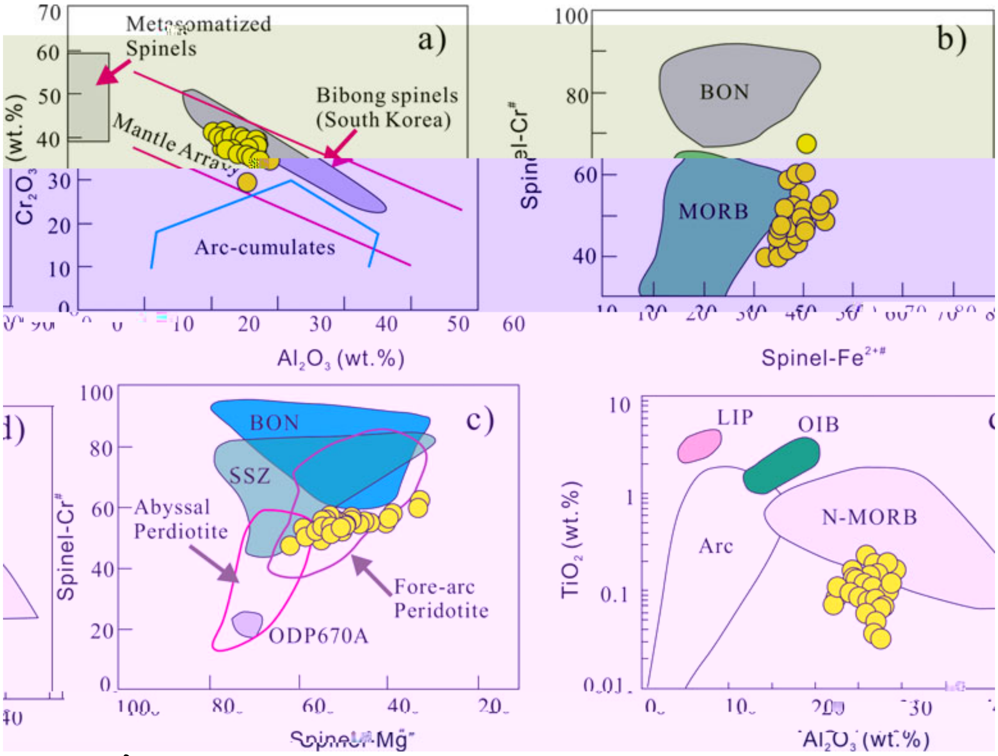
2. 1. 2. / (0.0024 0.0452) / (0. 04030 0. 0536), / (0. 04015 0. 05111, 2013 03 1). 14 /144 0.0 0.13 4 143 /144 0.512 0 0.512 3 (*t*) +6.3 + .5 (2013 03 1 +1.).





5. D c

5.a. T a b Z a ba

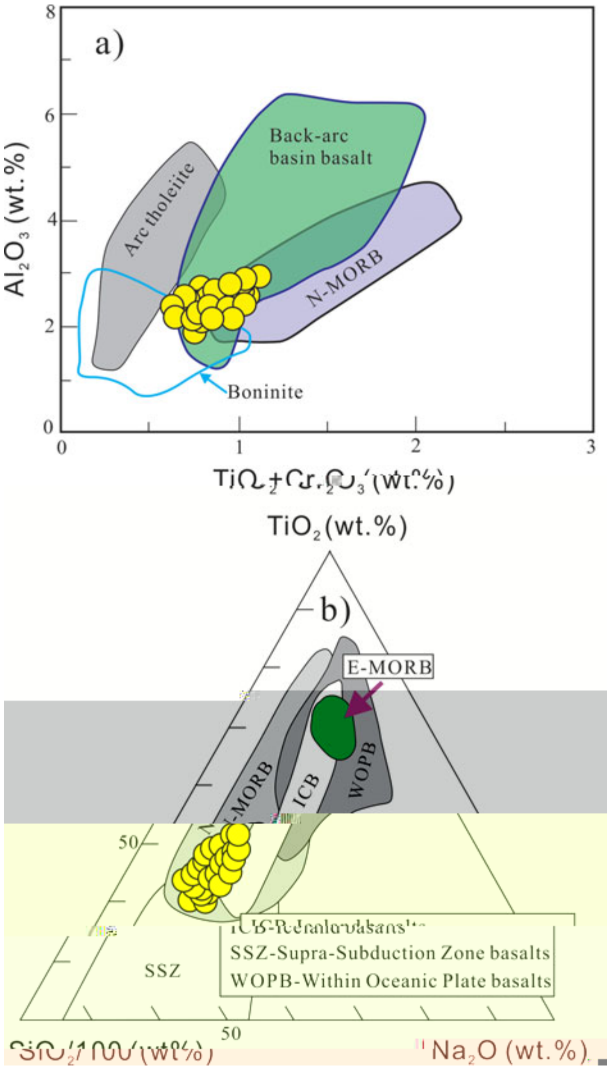


10. (… ( ) … $_3$ … $_3$ (%) … (… & … , 2000). ( ) … (100 … /(… + …)) … $^{2+}$ … (100 … $^{2+}$/(… $^{2+}$ + …)) … (… , 1 … 4 … & … , 2001). ( ) … (100 … /(… + …)) … (100 … /(… + …)) … (… et al. 1 … 5). ( ) … $_2$ … $_3$ … (… & … , 2001). …

… (500 … 4 … 0 …) (… et al. 2003 … et al. 2015 …), … (430 … 400 …) (… et al. 200 … b, 2014 …) … (3 … 0 … 350 …) (… et al. 2003 … et al. 2006).

5.b. O … a … c … a

… & … , 2002 … et al. 2010



11. ( ) ( ) $_3$ $_2$ + $_3$ ( ) $_2$ $_2$/100

5 $_3$ $_2$ + $_3$

(. 11) $_2$/100 $_2$

(. 11)

(. 12),

(. 12).

et al. (2002)

5.c. P D a ba a

2. 1. (11 24 15), $_5$ (0.4 0.6 %) (11 15, 60)

& , 2001) (. 13). (1) & , 2002) (2) & , 1 2 & , 1 3 *et al.* 1 6). 1.

& , 200 *et al.* 2011) (0. 04120 0. 06133) (*t*) (+1. + .5). (3.44 20.4) (1.51 2.54) & 1 6). 1

et al. 1 6 1 6).

& 2000).

& 1 2 *et al.* 1 6). *et al.* (200

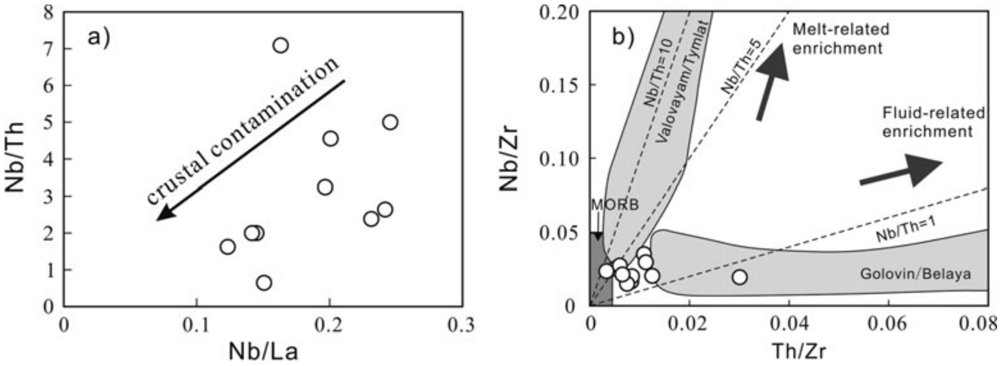


Fig. 12. [illegible]

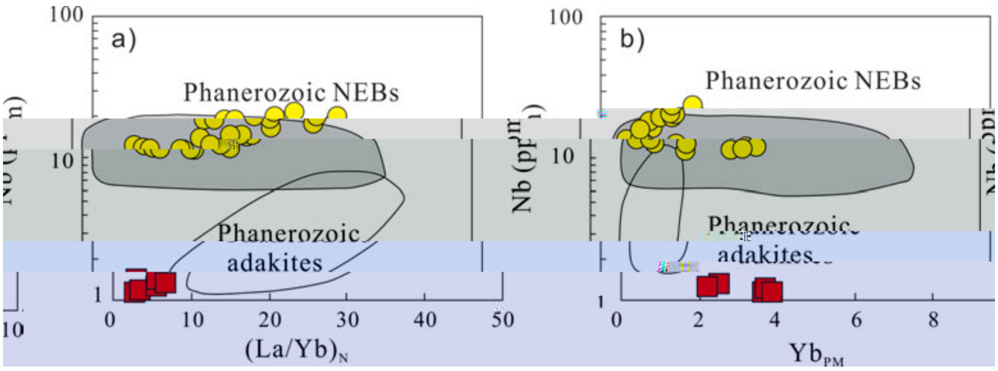


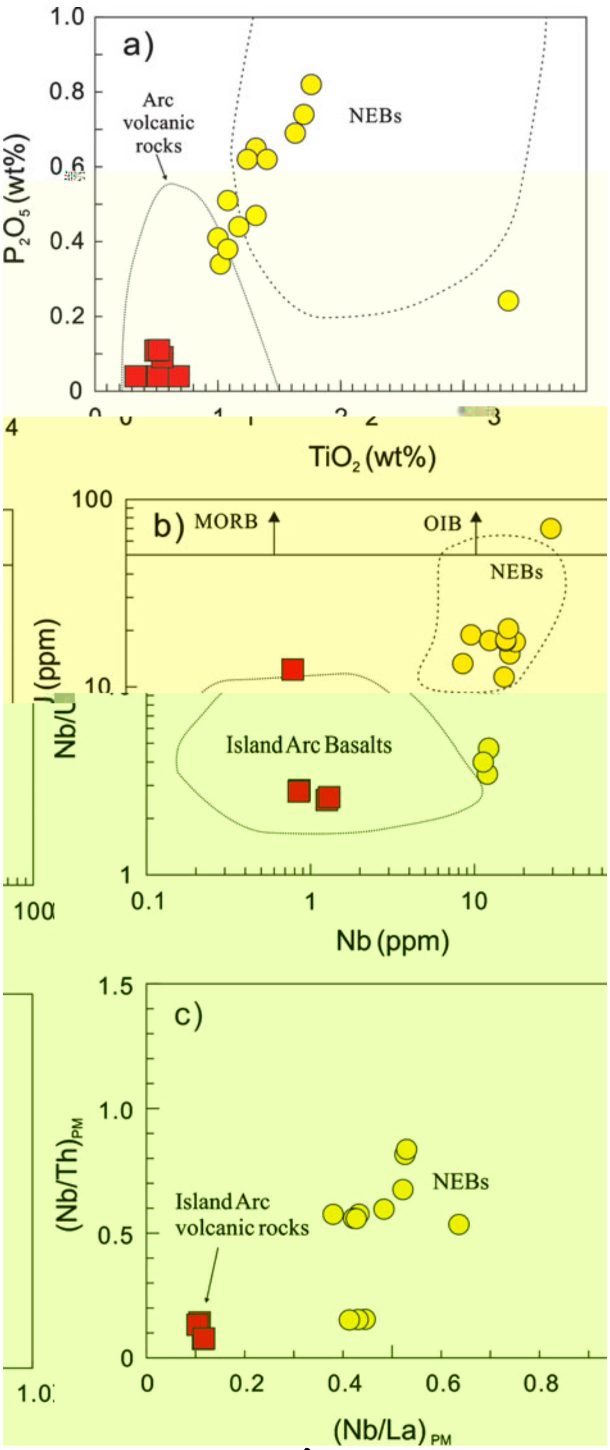
Fig. 13. [illegible]

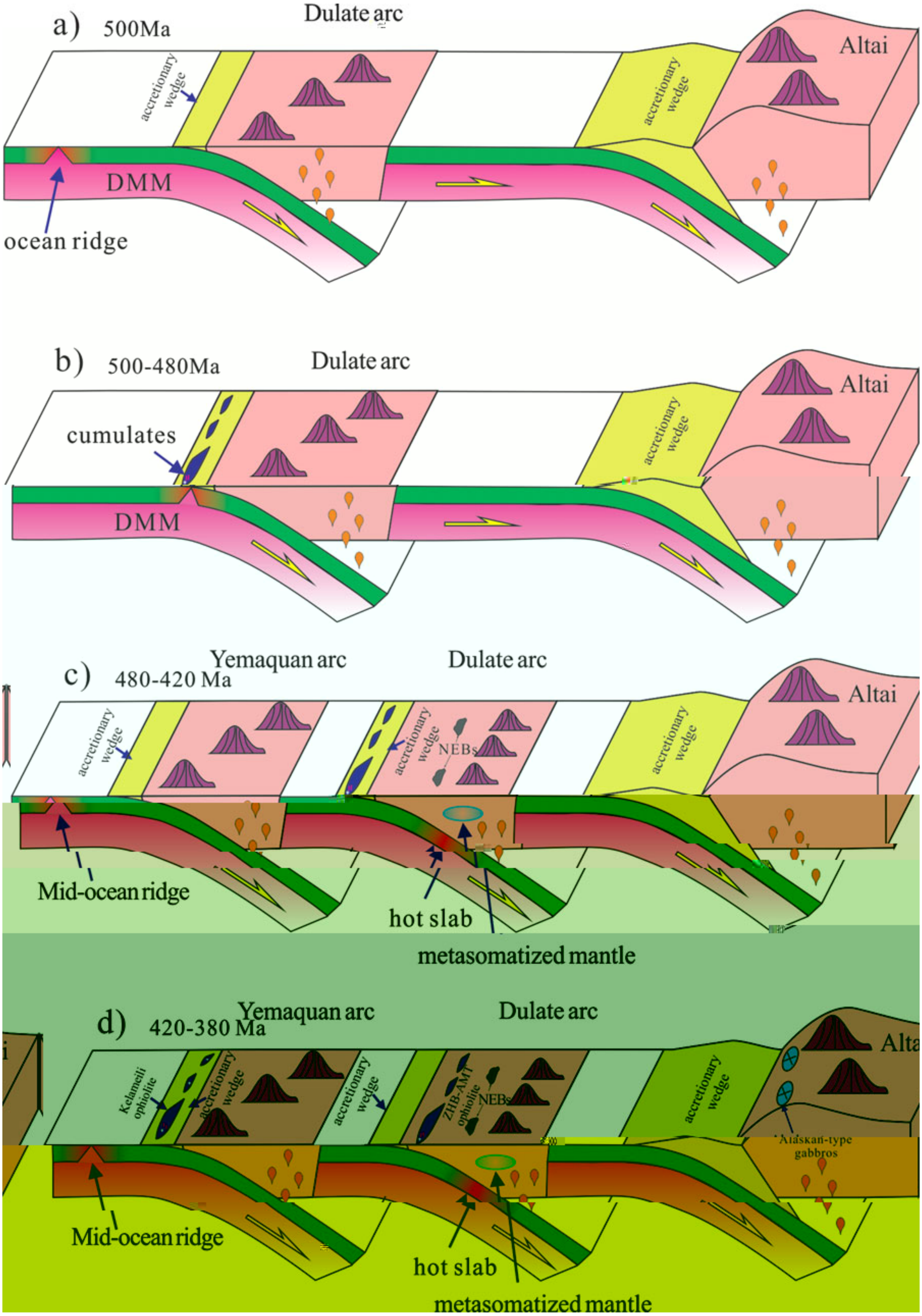
[illegible] $\varepsilon_{Nd}(t)$ (1. [illegible] .5) [illegible] (0. 04120 0. 06133) [illegible] 2). [illegible] $\varepsilon_{Nd}(t)$ [illegible] 1. [illegible] 2. [illegible] (< 0.3) [illegible] 2002). [illegible] 2. [illegible] (0. 1.0), [illegible] (0.1 0.2) [illegible] (0.6 1.0) [illegible] 2. [illegible] 6). [illegible] 2. [illegible] 14). [illegible]

[illegible] 14). [illegible] 2. [illegible] 1 [illegible] 2. [illegible]

5. [illegible]

[illegible] (416 [illegible] *et al.* 2014 [illegible] *et al.* 2015), [illegible] (503 4 5 [illegible] *et al.* 2003 [illegible] *et al.* 2015 [illegible] (400 [illegible] 1 [illegible] *et al.* 2014), [illegible] *et al.* 200 [illegible], 200 [illegible] a,b [illegible] *et al.* 200 [illegible] a). [illegible] *et al.* 200 [illegible] b). [illegible]


a)
1.0
0.8
0.6
0.4
0.2
0
P_2O_5 (wt%)
Arc volcanic rocks
NEBs
TiO_2 (wt%)
b)
MORB
OIB
NEBs
Island Arc Basalts
100
10
1
Nb/U (ppm)
0.1
1
10
Nb (ppm)
c)
1.5
1.0
0.5
0
$(Nb/Th)_{PM}$
Island Arc volcanic rocks
NEBs
0
0.2
0.4
0.6
0.8
$(Nb/La)_{PM}$


a) 500Ma
Dulate arc
Altai
accretionary wedge
accretionary wedge
DMM
ocean ridge
b) 500-480Ma
Dulate arc
Altai
cumulates
accretionary wedge
DMM
c) 480-420 Ma
Yemaquan arc
Dulate arc
Altai
accretionary wedge
accretionary wedge
NEBs
accretionary wedge
Mid-ocean ridge
hot slab
metasomatized mantle
d) 420-380 Ma
Yemaquan arc
Dulate arc
Kelameili ophiolite
accretionary wedge
accretionary wedge
ZHB-AMT ophiolite
NEBs
accretionary wedge
Alaskan-type gabbros
Mid-ocean ridge
hot slab
metasomatized mantle

[illegible] 15. ([illegible]). [illegible]

(4) [illegible] (420 3 0) ([illegible] *et al.* 2014 [illegible] *et al.* 2015). [illegible] 1. [illegible] 2. [illegible] (. 15). [illegible] (400 3 0). [illegible]

6. C c

(1) [illegible] ~4 5 [illegible] *c.* 400 [illegible]

(2) [illegible]

(3) [illegible]

Ac [illegible] 305 [illegible] (2011 [illegible] 06 03-01).

S a a a

[illegible] /10.101 / 0016 56 16000042.

R c

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