Name:

GEO2004 – Lab#2

Chemical Petrology

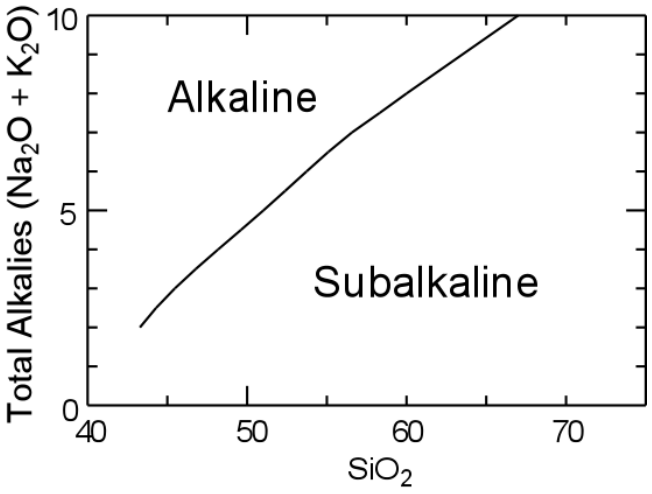
1 Chemical Classification

1- Using Figure 1 to determine whether the rocks analyzed in Table 1 are correct named.
2- Using Figure 2: give the nomenclature of the same rocks as question 1 (Table 1) but considering it as plutonic rocks.

2 Magma type

During the lecture, we saw that the igneous rocks can be divided into two categories of magma types: alkaline and subalkaline magma. The subalkaline magma can be classified further to calc-alkaline and thoeliitic magma. Further; the alkaline magma can be classified into: Na-series, K-series and High-K-series. Granitic/acidic magma can be classified to peraluminous, metaluminous and peralkaline.

3- Plot the line from the opposite figure on the TAS diagram (Fig. 1).
4- Then plot the chemical analyses of Table 2, and comment on both the nomenclature and the magma types.
5- Using the chemical data of Table 2 and different diagrams (Figs 3, 4, 5), classify the magma type (note: classify the magma further into: calc-alkaline, tholeiitic, Na-series, K-series, High-K-series, peraluminous, metaluminous and peralkaline.



3 Tectonic setting

6- Using the different tectonic setting diagrams (Figure 6). Determine the tectonic setting of the rocks in Table 3.

4 CIPW Norm

7- Calculate the CIPW norm of the Rhyolite sample of Table 1. Then plot the normative composition on Figure 7 and give the nomenclature of these sample.

5 Spidergrams

8- Plot incompatible element enrichment diagram (spidergram) for the analyses given in Table 3 and discuss the pattern of the curves.

9- Do you need the data in Table 4 in order to finish the question# 8? And Why?

6 Lavas from Kilauea, Hawaii

You already plotted the Lavas from Kilauea, Hawaii (Table 2) on different magma type diagrams (question# 4).

10- Use the AFM diagram (figure 5) and compare the magma type of these samples with the previous results (question# 4), and comment on it?

Note: 1- A is (Na_2O + K_2O), M is (MgO) and F is (total iron).

2- Total iron may be expressed in two alternative forms:

- Sum Fe_2O_3 = (1.11 x FeO) + Fe_2O_3
- Sum FeO = FeO + (Fe_2O_3 / 1.11)

Oxide	Peridotite	Basalt	Andesite	Rhyolite	Phonolite
SiO_2	44.8	49.2	57.9	72.8	56.2
TiO_2	0.19	1.84	0.87	0.28	0.62
Al_2O_3	4.16	15.7	17	13.3	19
Fe_2O_3	1.36	3.79	3.27	1.48	2.79
FeO	6.85	7.13	4.04	1.11	2.03
MnO	0.11	0.2	0.14	0.06	0.17
MgO	39.2	6.73	3.33	0.39	1.07
CaO	2.42	9.47	6.79	1.14	2.72
Na_2O	0.22	2.91	3.48	3.55	7.79
K_2O	0.05	1.1	1.62	4.3	5.24
H_2O+	0	0.95	0.83	1.1	1.57
Total	99.36	99.02	99.27	99.51	99.2

Table 1

Oxide	1	2	3	4	5	6	7	8	9	10	11
SiO_2	48.05	48.43	47.92	48.21	49.16	49.20	49.71	50.10	50.37	50.56	53.42
TiO_2	2.04	2.00	2.16	2.24	2.29	2.57	2.65	2.71	3.09	3.16	3.36
Al_2O_3	10.33	10.70	10.75	11.37	13.33	12.77	13.65	13.78	14.02	13.92	13.75
Fe_2O_3	1.34	1.15	1.08	1.50	1.31	1.50	1.19	1.89	1.88	1.78	1.96
FeO	10.19	10.08	10.65	10.18	9.71	10.05	9.72	9.46	10.07	10.18	10.45
MnO	0.17	0.17	0.18	0.18	0.16	0.17	0.17	0.17	0.17	0.18	0.18
MgO	17.39	16.29	15.43	13.94	10.41	10.00	8.24	7.34	6.75	6.33	3.92
CaO	8.14	8.67	9.33	9.74	10.93	10.75	11.59	11.46	10.39	10.24	7.75
Na_2O	1.66	1.71	1.79	1.89	2.15	2.12	2.26	2.25	2.35	2.61	3.34
K_2O	0.36	0.35	0.44	0.44	0.51	0.51	0.54	0.57	0.62	0.64	1.10
P_2O_5	0.19	0.18	0.23	0.22	0.16	0.25	0.25	0.27	0.32	0.33	0.59
Total	99.86	99.73	99.96	99.91	100.1	99.89	100.0	100.0	100.03	99.93	99.82

Table 2: Analyses of lavas from Kilauea, Hawaii (Wright and Fiske, 1971)

	Sample C	Sample D
SiO_2	50.77	48.18
TiO_2	0.67	1.9
Al_2O_3	18.97	15.06
Fe_2O_3	1.55	1.87
FeO	7.95	9.55
MnO	0.19	0.19
MgO	6.32	6.97
CaO	11.8	12.15
Na_2O	1.69	2.76
K_2O	0.13	0.67
P_2O_5	0.03	0.29
ppm (concentration)		
Rb	2.7	13
Ba	29	403
Th	0.3	2.31
Nb	0.21	25
La	1.1	22.4
Ce	2.84	43.6
Sr	120	460
Nd	2.97	24.5
Zr	19.2	110
Sm	1.06	5.17
Gd	1.52	b.d.l
Tb	b.d.l	0.9
Y	13.3	29
Yb	1.41	2.51
Lu	0.2	b.d.l

Table 3

Primitive mantle (ppm)	
Rb	0.635
Ba	6.989
Th	0.085
Nb	0.713
La	0.687
Ce	1.775
Sr	21.1
Nd	1.354
Zr	11.2
Sm	0.444
Gd	0.596
Tb	0.108
Y	4.55
Yb	0.493
Lu	0.074

Table 4

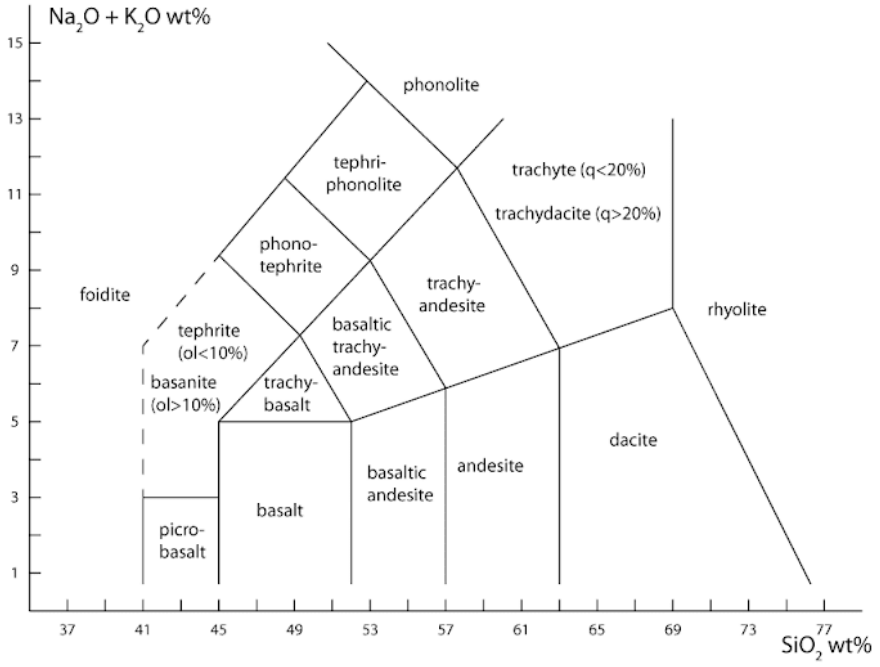


Figure 1: TAS classification volcanic rocks

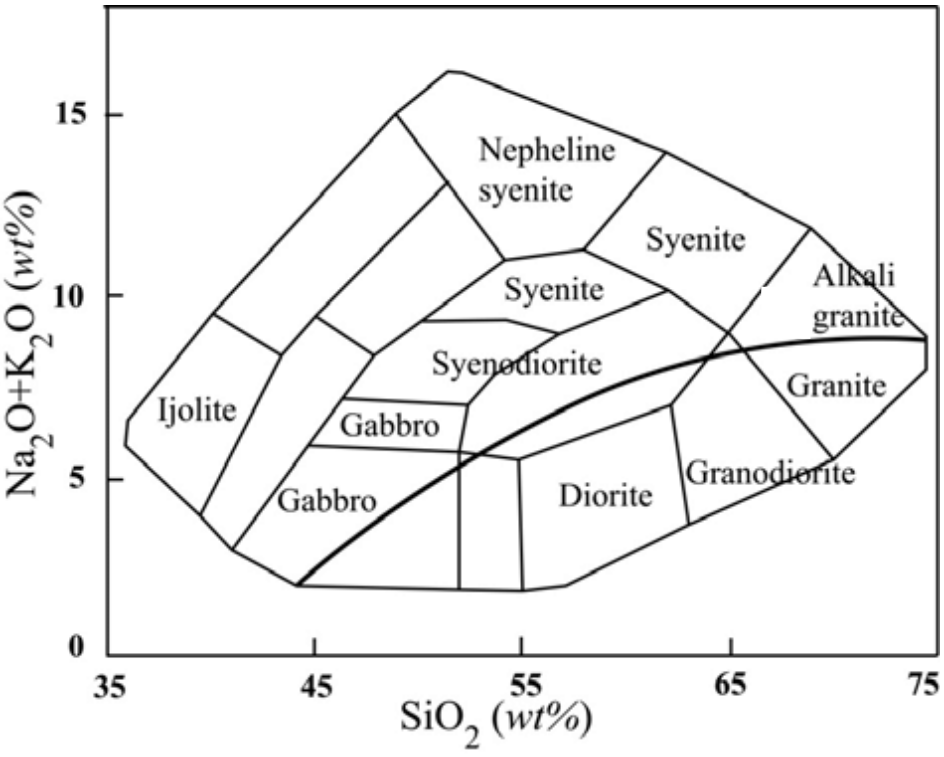


Figure 2: TAS classification plutonic rocks

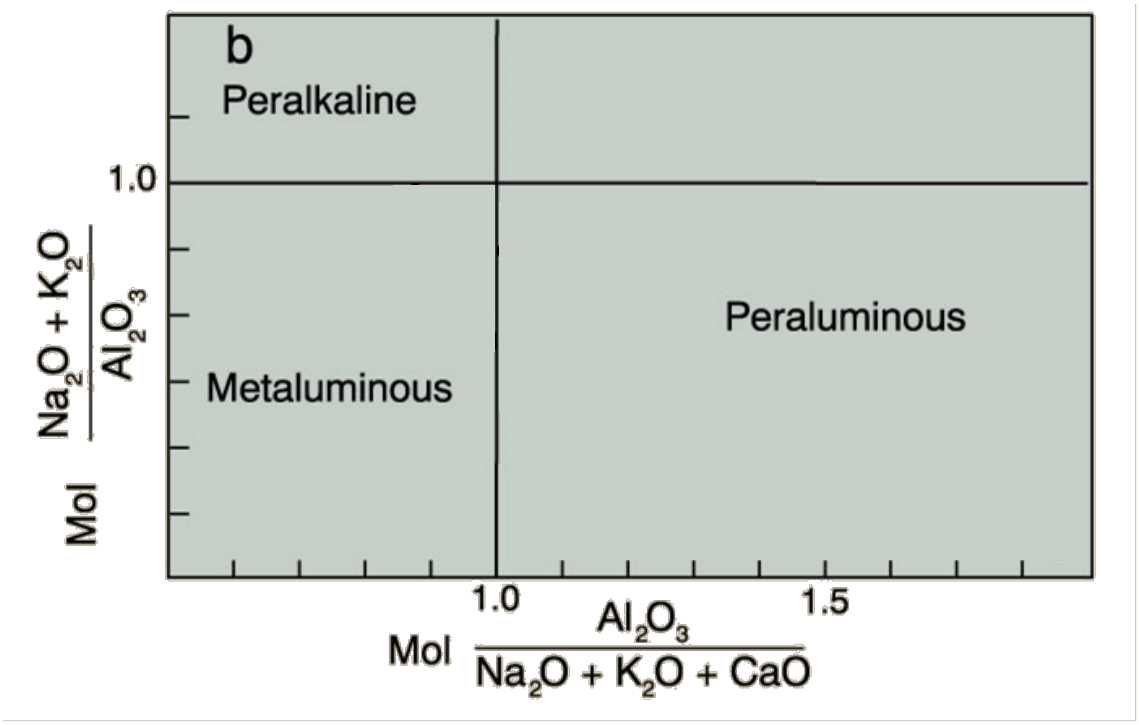


Figure 3

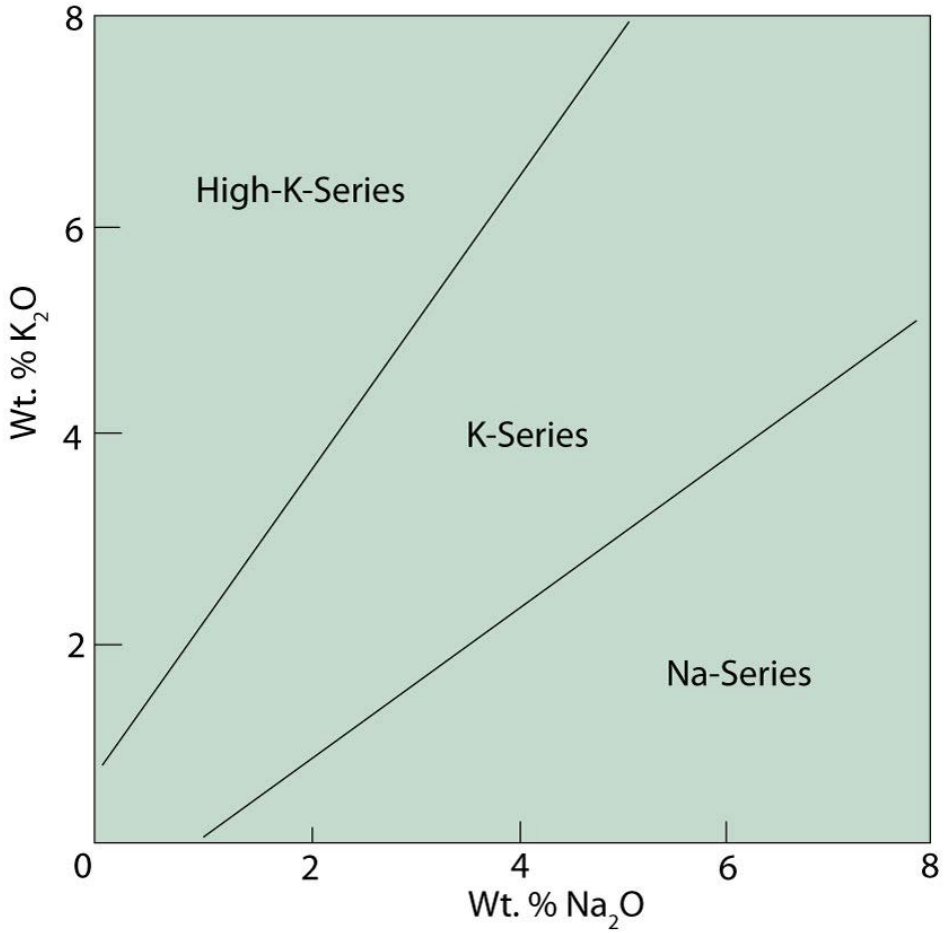


Figure 4

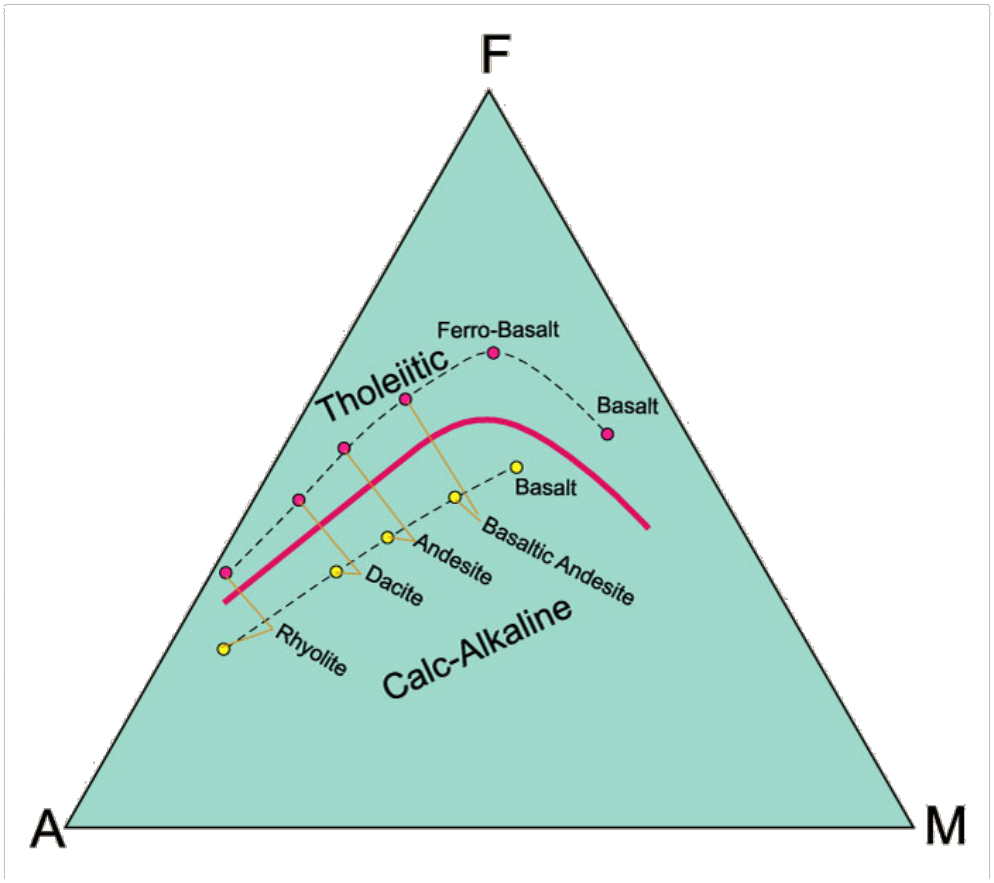


Figure 5

A is ($Na_2O + K_2O$), M is (MgO) and F is (total iron)

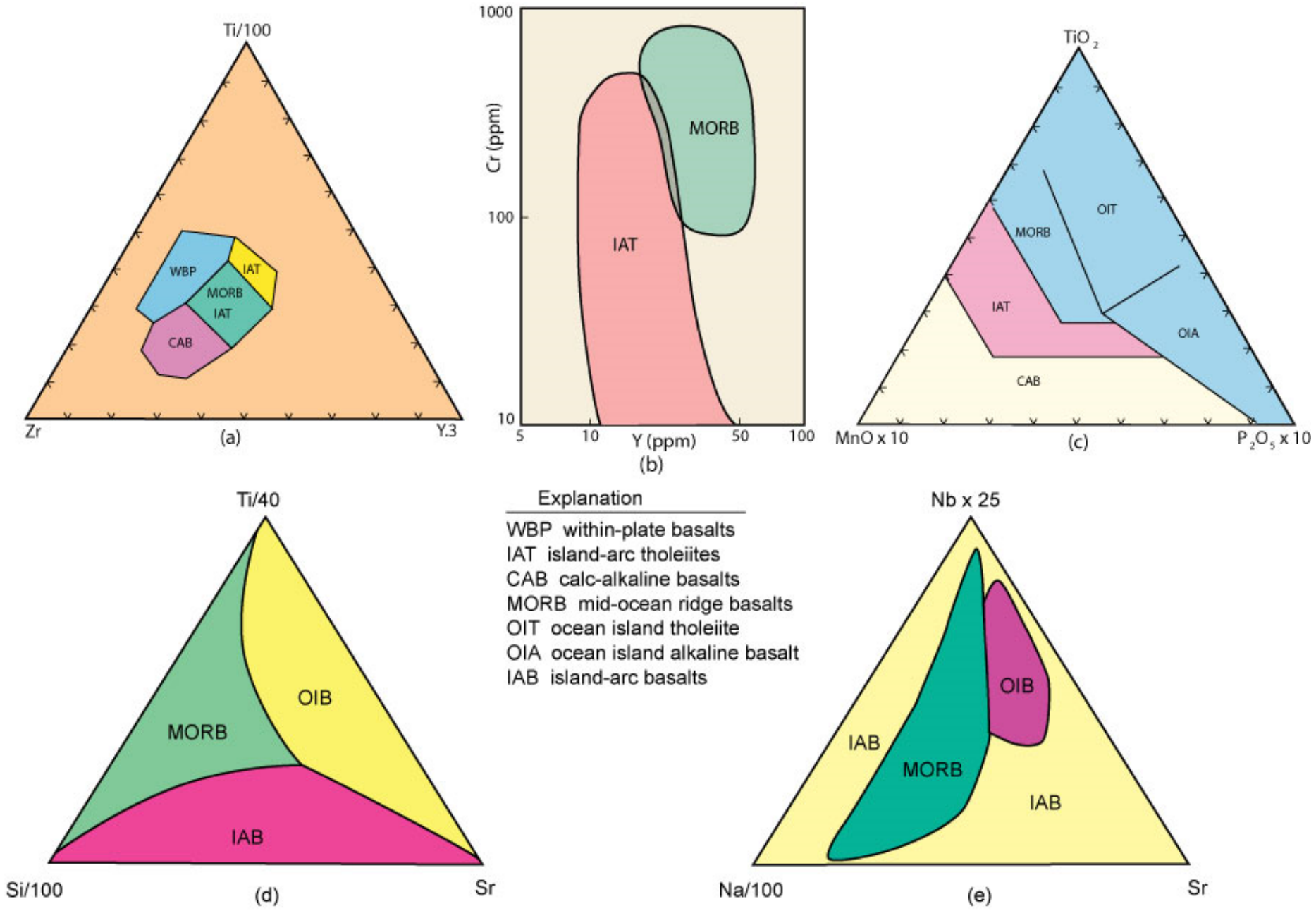

Ti/100
WBP
IAT
MORB
IAT
CAB
Zr
Y3
(a)
1000
100
10
Cr (ppm)
MORB
IAT
5
10
Y (ppm)
50
100
(b)
TiO 2
OIT
MORB
IAT
OIA
CAB
MnO x 10
P2O5 x 10
(c)
Ti/40
MORB
OIB
IAB
Si/100
Sr
(d)
Explanation
WBP within-plate basalts
IAT island-arc tholeiites
CAB calc-alkaline basalts
MORB mid-ocean ridge basalts
OIT ocean island tholeiite
OIA ocean island alkaline basalt
IAB island-arc basalts
Nb x 25
OIB
IAB
MORB
IAB
Na/100
Sr
(e)

Figure 6

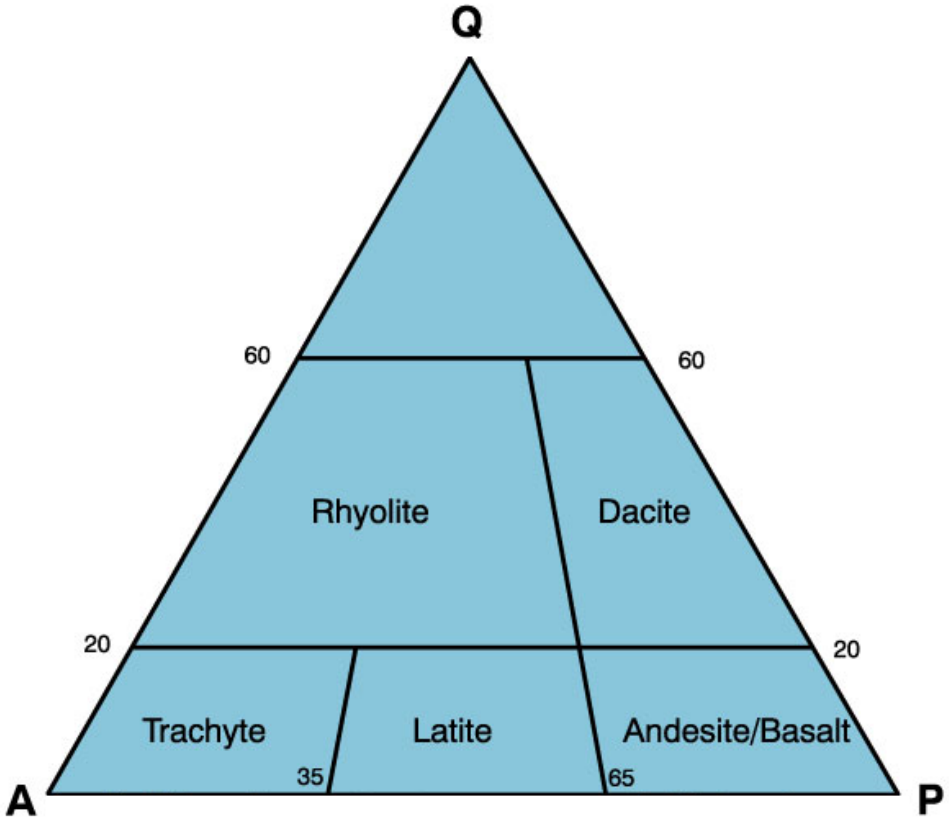


Figure 7

A = alkali feldspar, P = plagioclase and Q = quartz