Model answer

GEO2004 – Lab#2

Chemical Petrology

1 Chemical Classification

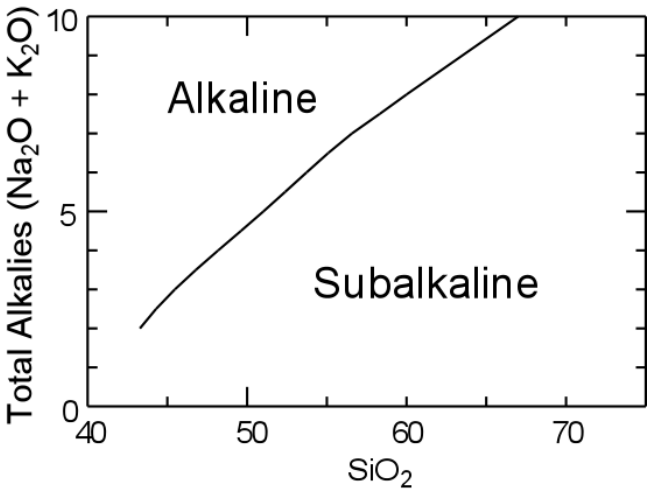
1- Using Figure 1 to determine whether the rocks analyzed in Table 1 are correct named.
2- Using Figure 2: give the nomenclature of the same rocks as question 1 (Table 1) but considering it as plutonic rocks.

Oxide	Peridotite	Basalt	Andesite	Rhyolite	Phonolite
Q1.1	**Out site of the range**	**Correct**	**Correct**	**Correct**	**Correct**
Q1.2	**Out site of the range**	**Gabbro**	**Diorite**	**Granite**	**Nepheline Syenite**
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

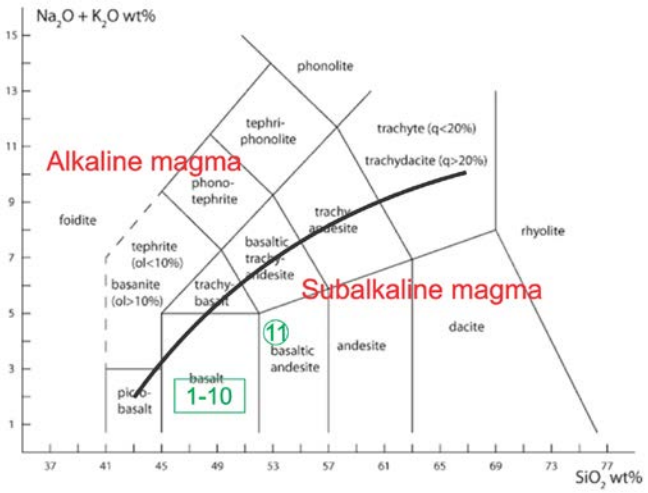
2 Magma type

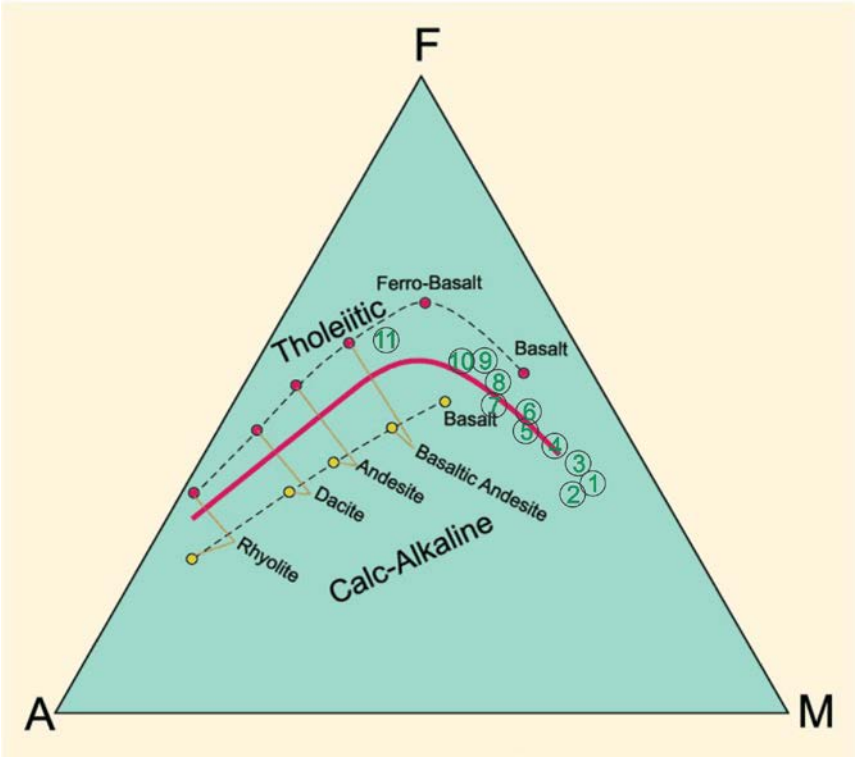
During the lecture, we saw that the igneous rocks can be divided into two categories of magma types: alkaline and subalkaline magma. The subalkaline magma can be classified further to calc-alkaline and thoeliitic magma. Further; the alkaline magma can be classified into: Na-series, K-series and High-K-series.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

1- Plot the line from the opposite figure on the TAS diagram (Fig. 1).
2- Then plot the chemical analyses of Table 2, and comment on both the nomenclature and the magma types.
Samples 1 to 10 are basalt. Sample 11 is Basaltic andesite. All the sample formed From subalkaline magma.
3- 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.



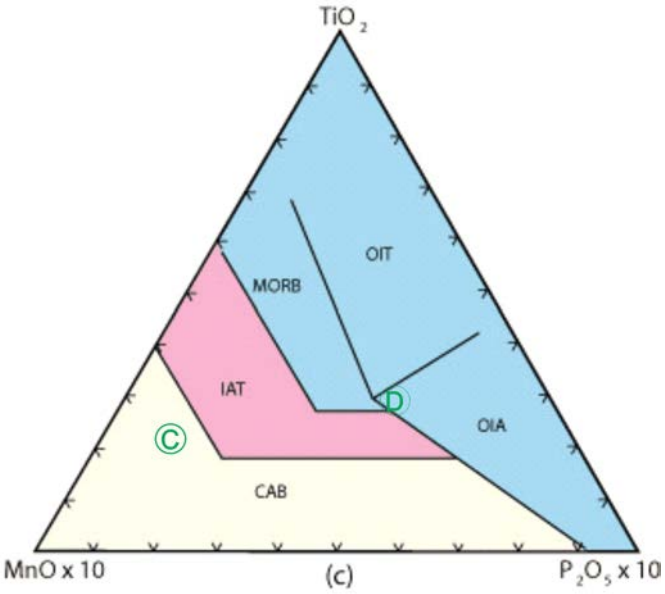


Samples 2 is calc-alkaline. Samples 6, 8,9, 10 and 11 are tholeiitic. Samples 1,3,4,5,7 are transition between the calc-alkaline and the tholeiitic.

3 Tectonic setting

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

Sample C is calc-alkaline basalt (formed at convergent plate margin)
Sample D is Oceanic island alkaline basalt



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

4 CIPW Norm

1- 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.

Normative Minerals	Weight % Norm	Volume % Norm
Quartz	31.70	32.01
Plagioclase	36.31	36.79
(Albite)	30.56	31.22
(Anorthite)	5.75	5.58
Orthoclase	25.85	27.03
Corundum	0.75	0.50
Hypersthene	4.37	3.12
Ilmenite	0.54	0.30
Magnetite	0.48	0.25
Total	100.00	100.00

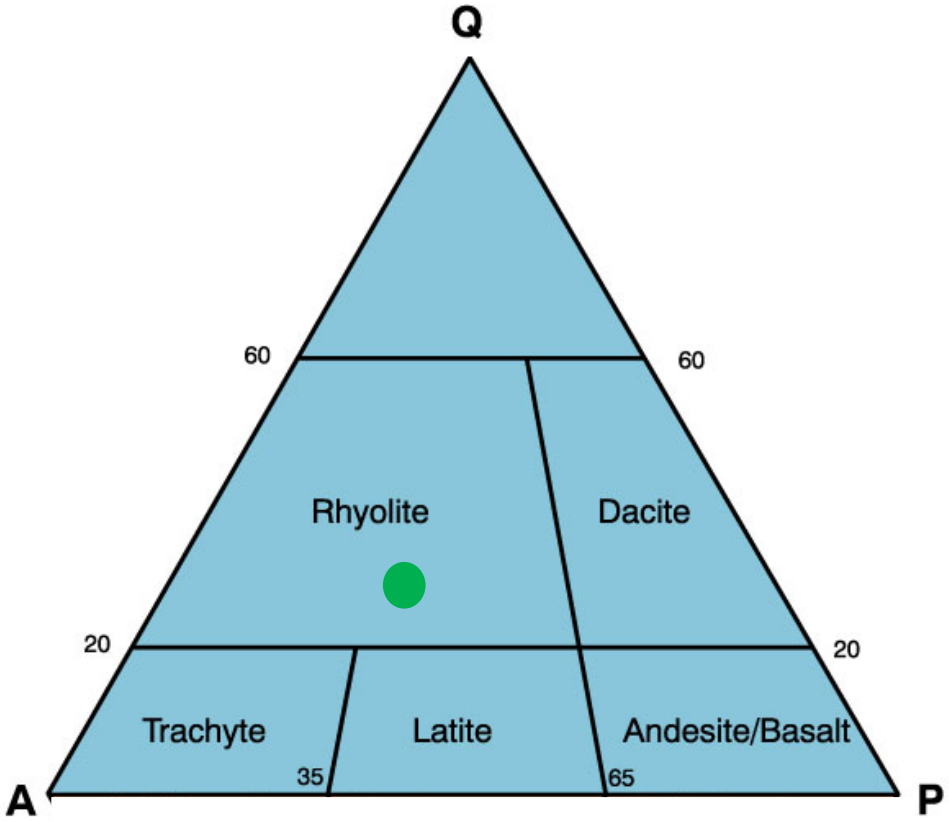


Figure 7

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

Quartz	**33.77**
Plagioclase	**38.69**
Orthoclase	**27.54**

The sample plotted in the Rhyolite field.

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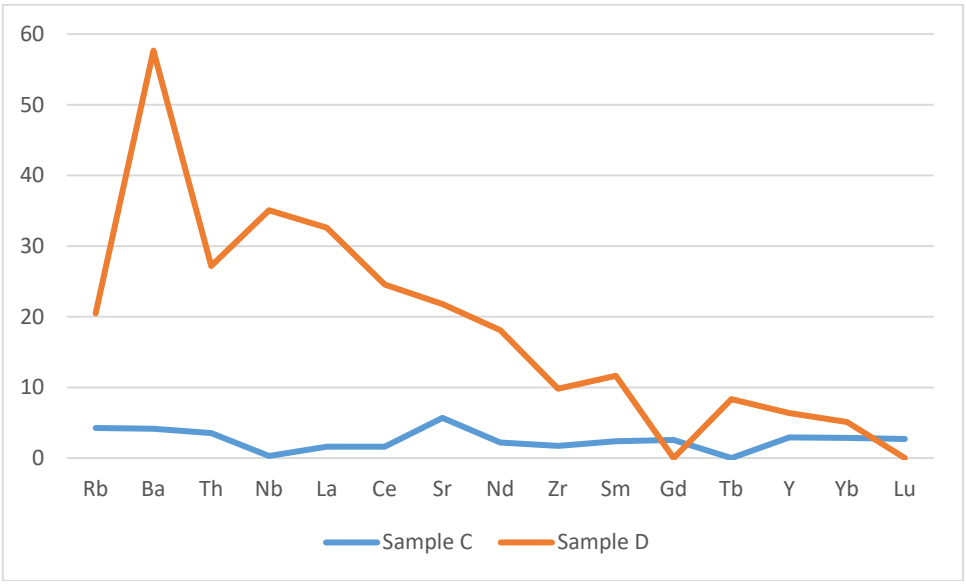
5 Spidergrams

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



2- Do you need the data in Table 4 in order to finish the question# 8? And Why? **Yes we need the data in table 4 in order to draw the spidergram, this data is need to calculate sample/chondritic value to eliminate Oddo-Harkins effect**

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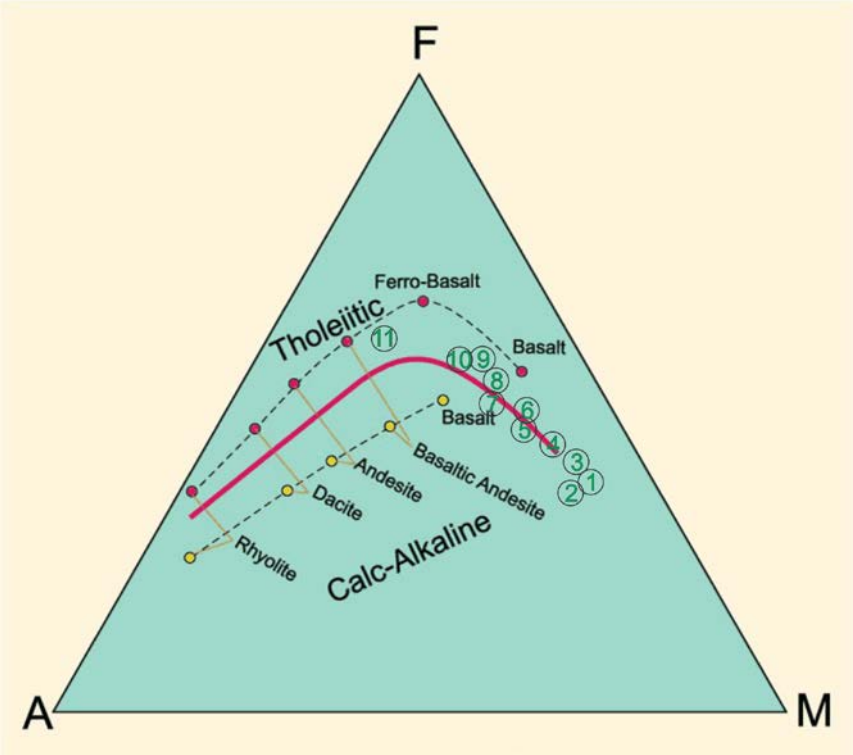
6 Lavas from Kilauea, Hawaii

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

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



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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)