ESS103A Name_____
Igneous Petrology, Spring 2006 **Due: April 17, 2006**

Homework 1
CLASSIFICATION OF IGNEOUS ROCKS

This exercise is designed to familiarize you with the various igneous classification schemes that you will use the rest of this quarter. Use of a spreadsheet program like excel will make this homework much easier! (note: chemical data is available as .xls file on course web page).

1. **For all <u>extrusive</u> rocks from Lab 1 and Lab 2**, use the chemical composition provided for each rock to:

(a) Classify each sample by its chemical series (alkaline vs. subalkaline; Fig 8-11)
(b) If the sample is subalkaline distinguish whether it is tholeiitic or calc-alkaline. If the sample is alkaline determine if it is sodic or potassic.
(c) Give its chemical rock name using the TAS (total alkalis + silica) diagram (Figure 2-4). Insert this information into the summary table.
(d) In general, how well do the field name (from the lab!) and IUGS rock name compare to the two chemical rock names for each sample? In general, how compatible are the chemical names and terms for each sample? Which sample(s) was/were the most difficult to accurately categorize with chemical methods? Why? This exercise should make you aware of the importance of recording complete chemical analyses and methods of rock classification in scientific papers.

2. **For all <u>extrusive</u> rocks from Lab 1 and Lab 2**, use the normative mineralogy provided to determine whether rocks are

a) silica under-saturated, saturated, or over-saturated (Fig 8-12), and
b) peraluminous, peralkaline, or metaluminous (Figure 8-10b).
If A= Al_2O_3, CNK=CaO+Na_2O+K_2O, NK=Na_2O+K_2O in **molar** units;
A rock is peraluminous if A>CNK; metaluminous if CNK>A>NK; peralkaline if NK>A.

Record your answers in the summary chart.

3. **Calculating a CIPW norm.** This problem is modified from Problem 2 on p.152 in your text. Use the spreadsheet available at http://www.union.edu/PUBLIC/GEODEPT/COURSES/petrology/norms.htm instead of the one quoted in the text. Read the procedure described on this web site for determining a norm, and appreciate the fact that we have computer spreadsheets! Include the following in your answer to this problem:

a) Calculate the normative mineralogy (wt%) for the basalt in Table 8-3. Write or print out your results.
b) Are the minerals appropriate for a basalt? Justify your answer.
c) What is the composition of the plagioclase for this sample?
d) Change the wt% SiO_2 to 52%. Write or print out the normative mineralogy.
e) Now change the wt% SiO2 to 44%. Write or print out the normative mineralogy.
f) Explain the effect of changing SiO_2 wt% on the norm. Figure 8-12 may help.
g) Now return to the original SiO_2 concentration, and vary the Na_2O from 2% to 5% in 1% increments. Explain the resulting changes in the norm – no need to write down the norm for each increment.

Chemical Compositions and Normative Mineralogies

	Lab 2 Samples		Lab 1 Samples		
	1) 214/s-251c	2) L-95-11	2) 214/s-148B	3) L-11-74	4) R00LV62
Chemical Compositions (wt%)					
SiO_2	59.44	55.74	65.40	43.97	70.10
TiO_2	1.82	0.85	1.10	3.53	0.50
Al_2O_3	15.00	18.26	14.60	15.63	15.10
FeO	5.45	1.51	5.80	14.004	3.30
Fe_2O_3	2.02	4.63			
MnO	0.21	0.25	0.20	0.19	0.20
MgO	1.76	1.01	1.80	6.38	0.80
CaO	4.00	2.57	4.80	10.06	2.70
Na_2O	4.97	8.53	4.50	3.59	5.60
K_2O	3.27	4.82	1.20	1.16	1.60
P_2O_5	0.48	0.41	0.10	0.53	0.10
Normative Mineralogies (wt%)					
Ap (Apatite)	1.14	0.95	0.23	1.23	0.23
Il (Ilmenite)	3.51	1.61	2.09	6.74	0.95
Mt (Magnetite)	3.57		1.87	6.80	1.06
Hm (Hematite)					
Or (Orthoclase)	19.62	28.6	7.09	6.91	9.46
Ab (Albite)	42.73	31.08	37.99	18.16	47.39
An (Anorthite)	9.08		16.08	23.21	11.31
Di (Diopside)	6.52	8.67	5.87	19.06	1.21
Hy (Hypersthene)	6.02		7.54		5.17
Ol (Olivine)		4.15		11.19	
Ac (Acmite)		3.67			
Ne (Nepheline)		19.61		6.71	
Q (Quartz)	7.82		20.73		23.24
Na2SiO3		0.23			

	Rock Name (field)	Rock Name (IUGS classification)	Chemical Series (alkaline or subalkaline)	If Subalkaline (tholeiitic or calc-alkaline) If Alkaline (sodic or potassic)	Chemical Rock Name (TAS diagram)	Silica Saturation (undersaturated, saturated or oversaturated)	Alumina Saturation (peraluminous, peralkaline or metaluminous)
Lab 2 Samples							
1) 214/s-251c							
2) L-95-11							
3) PR-13							

HW2 Summary Chart (page 2)

	Rock Name (field)	Rock Name (IUGS classification)	Chemical Series (alkaline or subalkaline)	If Subalkaline (tholeiitic or calc-alkaline) If Alkaline (sodic or potassic)	Chemical Rock Name (TAS diagram)	Silica Saturation (undersaturated, saturated or oversaturated)	Alumina Saturation (peraluminous, peralkaline or metaluminous)
Lab 1 Samples 1) 254L-2-7							
2) 214/s-148B							
3) L-11-74							
4) R00LV62							