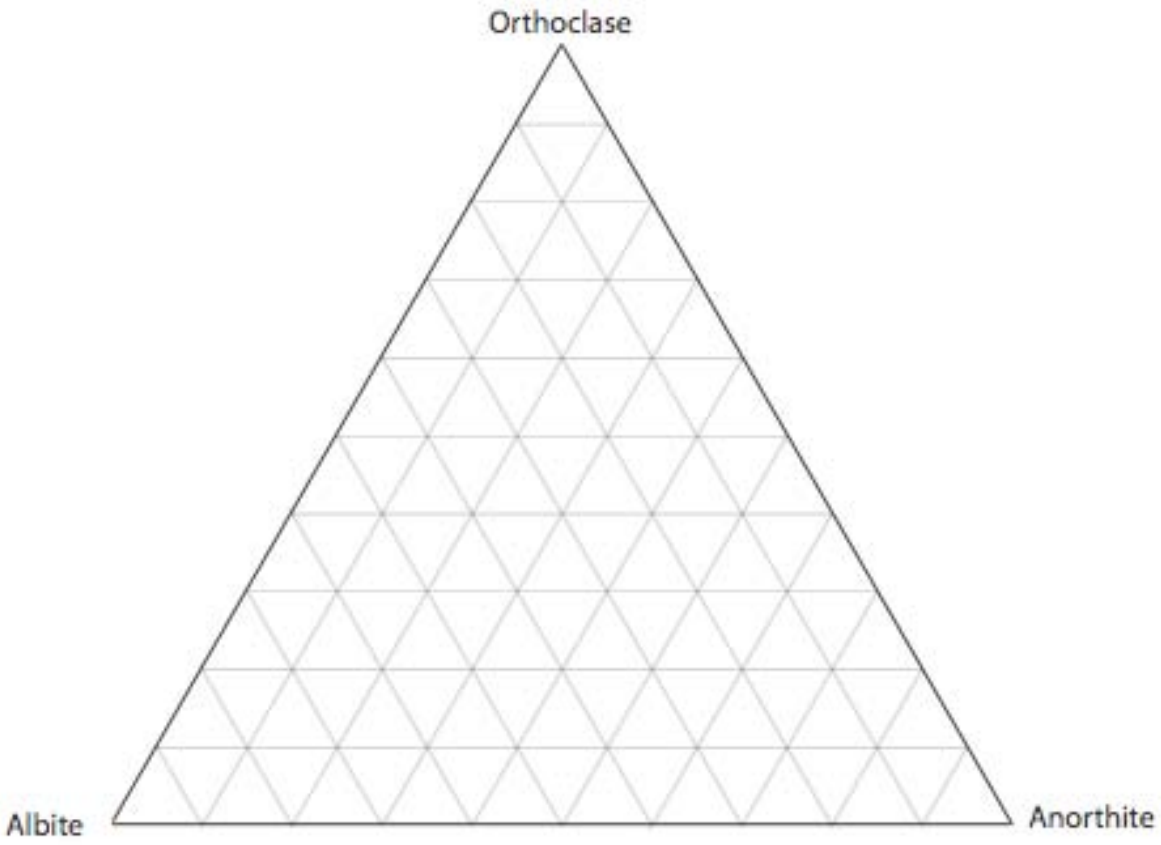
12.001 Introduction to Geology
Spring 2008

Feldspar problem set
12.001 Due Friday. Feb. 22



1. Write the chemical formula for each of the end-member compositions next to their names.

2. Which solid-solution series is called the “plagioclases”? (Label on the ternary diagram.)

3. Write the chemical equation for and explain the double substitution of ions that changes an albite unit to an anorthite unit.

4. Plot the following equilibrium pairs of feldspars:

At 900°C: Orthoclase 70%, anorthite 10% *and* orthoclase 20%, albite 23%.
At 600°C: Orthoclase 58%, anorthite 20% *and* orthoclase 5%, anorthite 70%

What does the data imply about the relationship between solid solution and temperature?

Second problem:

The velocity of a particle in a fluid, where velocity is caused by density differences, and viscous forces are important but inertial forces are not, is given by the Stokes equation:

$$v = \frac{2r^2 g\left(\rho_p - \rho_f\right)}{9\eta},$$

where r is particle radius,
g is gravity,
ρ_p is particle density,
ρ_f is fluid density, and
η is fluid viscosity.

	1	2	units
r	1	1	cm
g	9.8	9.8	m/sec^2
ρ_p	2,700	2,700	kg/m^3
ρ_f	2,800	2,200	kg/m^3
η	100	10^7	Pas

1. Imagine a magma chamber 100m high. Calculate the settling time for a crystal of plagioclase for the two cases given above. Case 1 represents a basaltic magma, and case 2 represents a rhyolitic magma.

2. What does this tell you about the likelihood of a volcano erupting magma out of a magma chamber, and having the magma carry phenocrysts of plagioclase onto the surface?