Name:_____

Radiogenic Isotope In-Class Exercises

Problem 1. Consider a rhyolite magma that contains 100 ppm Rb, 100 ppm Sr, and sparse crystals of plagioclase, sanidine, biotite, and quartz. Here are appropriate D values (= C_S/C_L):

	Plagioclase	Sanidine	Hornblende
Rb	0.04	1.7	0.014
Sr	4.4	5.4	0.022

Before eruption all phases in the rhyolite were in isotopic equilibrium and had the same $^{87}Sr/^{86}Sr$ ratio of 0.70400 (remember though that at equilibrium they had different Rb/Sr ratios). The rhyolite was erupted 150 million years ago, at which time isotopic exchange between the minerals stopped and radiogenic in-growth began, continuing to the present day.

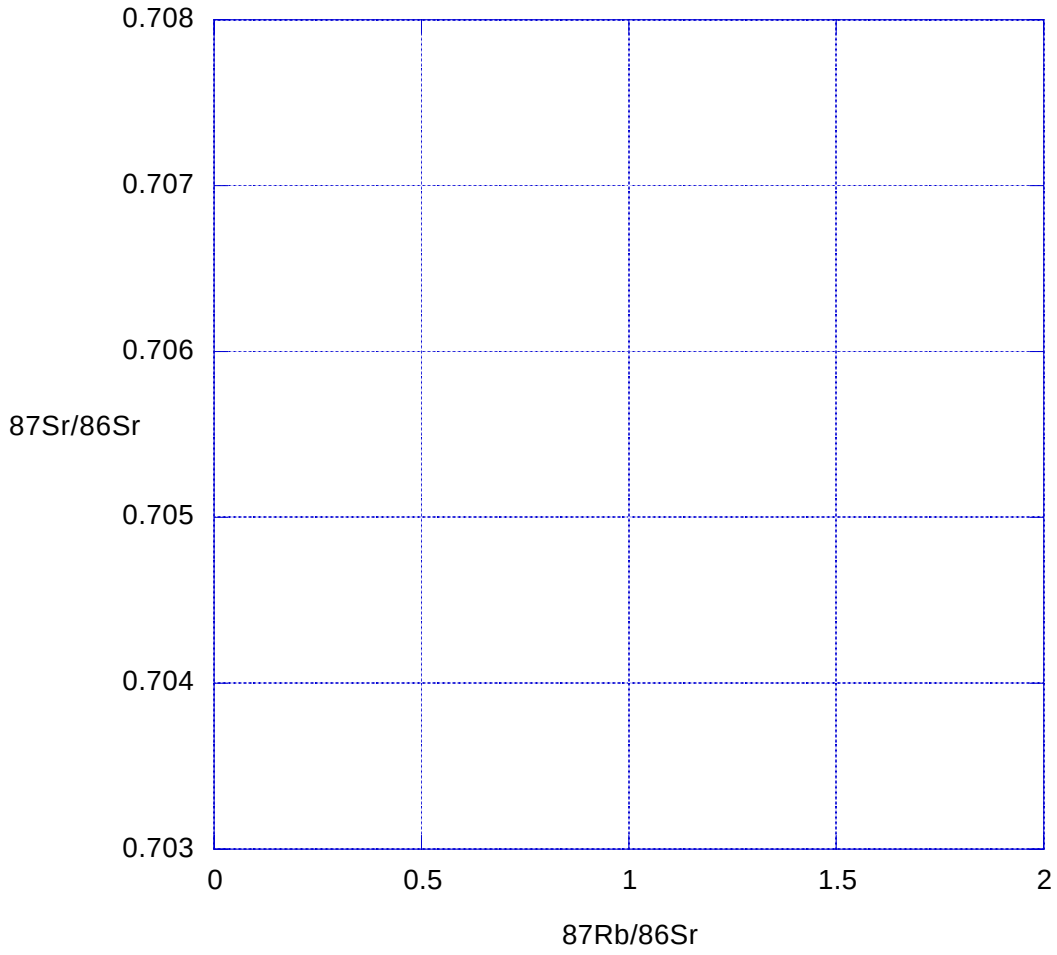
The decay equation for this system is

$$\frac{^{87}Sr}{^{86}Sr} = \left(\frac{^{87}Sr}{^{86}Sr}\right)_0 + \left(\frac{^{87}Rb}{^{86}Sr}\right)\left(e^{\lambda t} - 1\right)$$; the decay constant for ^{87}Rb (λ) is 1.42×10^{-11} a^{-1}.

You may use the *very useful* approximation that the $^{87}Rb/^{86}Sr$ atomic ratio of natural samples is very close to 2.89 times the Rb/Sr weight ratio. This will save you a great deal of calculating!

Fill in the following table and plot the resulting data on the provided axes. Each group will calculate data for one mineral.

mineral	Rb/Sr wt ratio	$^{87}Rb/^{86}Sr$	$^{87}Sr/^{86}Sr$
plagioclase			
sanidine			
hornblende			



Problem 2. You collect a sample of granite from the Piedmont and measure the following:

Rb: 250 ppm
Sr: 125 ppm
$^{87}Sr/^{86}Sr$: 0.75448

Calculate the age of this pluton assuming that the initial $^{87}Sr/^{86}Sr$ ratio was (a) 0.704 and (b) 0.708.

Note: this sort of calculation, in which the initial ratio is assumed, is called a *model age*.

Problem 3. What is the Rb-Sr isochron age of the Eagle Peak pluton? An isochron is shown in Fig. 9-12.

Problem 4. You visit a young volcanic area and find volcanoes erupting magmas that range in composition from basalt to dacite. There are two hypotheses for how this range of magmas arose:

1. Crystal fractionation from a parent basaltic magma.

2. Mixing of basaltic magma with rhyolite magma derived by partial melting of Precambrian granite.

Devise a geochemical test, using isotopic data, for evaluating these hypotheses. What does each predict about isotopic variability in the suite?