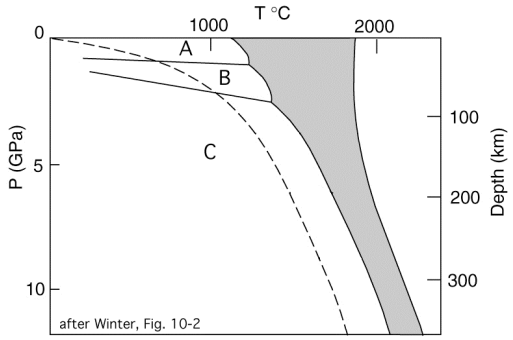
Geology 422 Answer in blue book provided
Petrology Sample Exam 2 NDSU

1. Short Definitions. You may wish to use diagrams to illustrate your answer: [20 pts]
   a. equilibrium melting vs. fractional melting
   b. decompression melting
   c. incompatible element
   d. distribution coefficient
   e. lherzolite

2. Refer to the phase diagram below.
   a. Describe three ways to melt a piece of mantle. Draw diagrams if necessary. [24 pts]
   b. Name the stable Al-bearing phases at locations A, B, and C. [9 pts]
   c. Why do these different phases exist at different depths? [9 pts]
   d. Provide a balanced (idealized) equation for one of these transitions, of your choice. [10 pts]

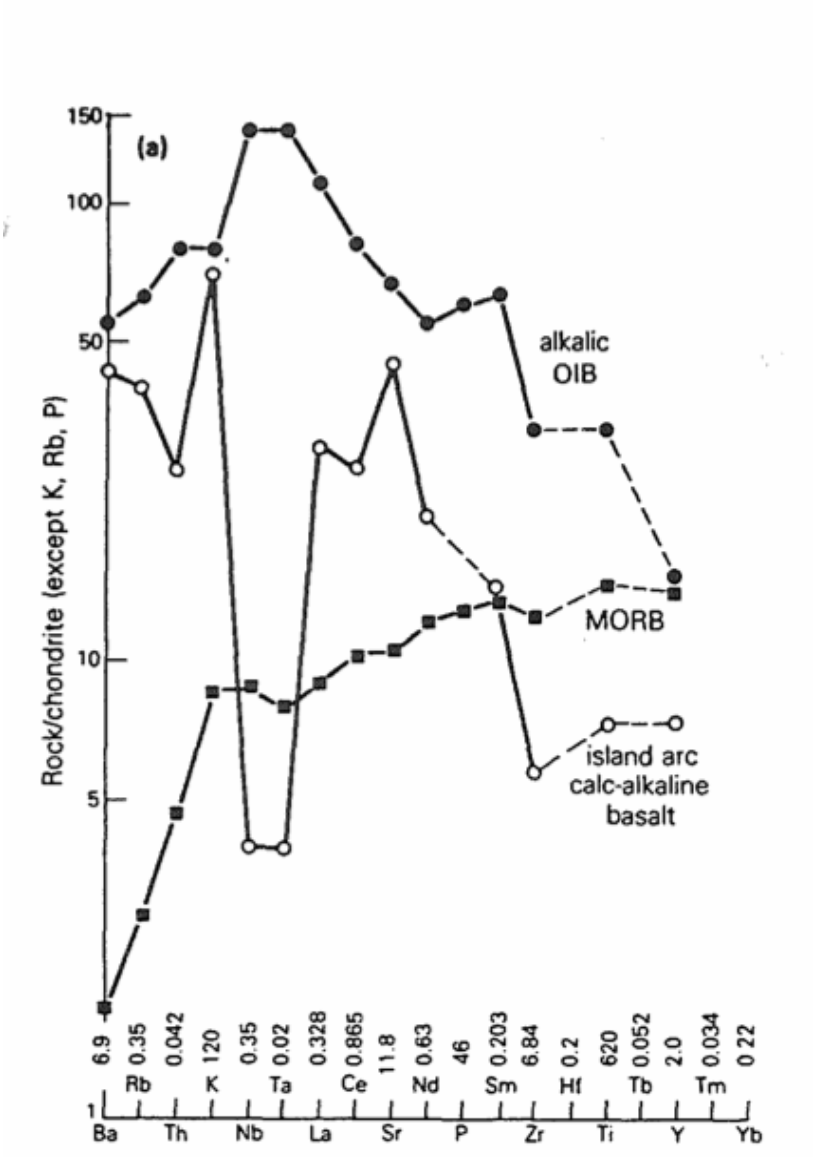


3. Why do magmas derived from Earth's mantle have present day $^{87}Sr/^{86}Sr$ ratios generally < 0.706, whereas those derived from melting or assimilation of continental crust have ratios > 0.706? [10 pts]

(over)

4. Consider the spidergram below. [18 pts]

a. Why are the elements along the x-axis in the order they are?
b. What is chondrite, and why are most of the elements normalized to chondrite?
c. Provide a reasonable explanation for the differences in the normalized trace-element abundances between alkalic ocean island basalt (OIB) and MORB.



Typical spiderdiagram pattern for mid-ocean ridge (MORB), oceanic-island (OIB) and island-arc basalts normalized according to Thompson et al. (1984). Values of the normalization constants used are given as ppm at the foot of the diagram.

From Wilson, "Igneous Petrogenesis."

Extra credit: What could reasonably explain very low chondrite normalized Nb and Ta values in the island-arc calc-alkaline basalt pattern? [5 pts]