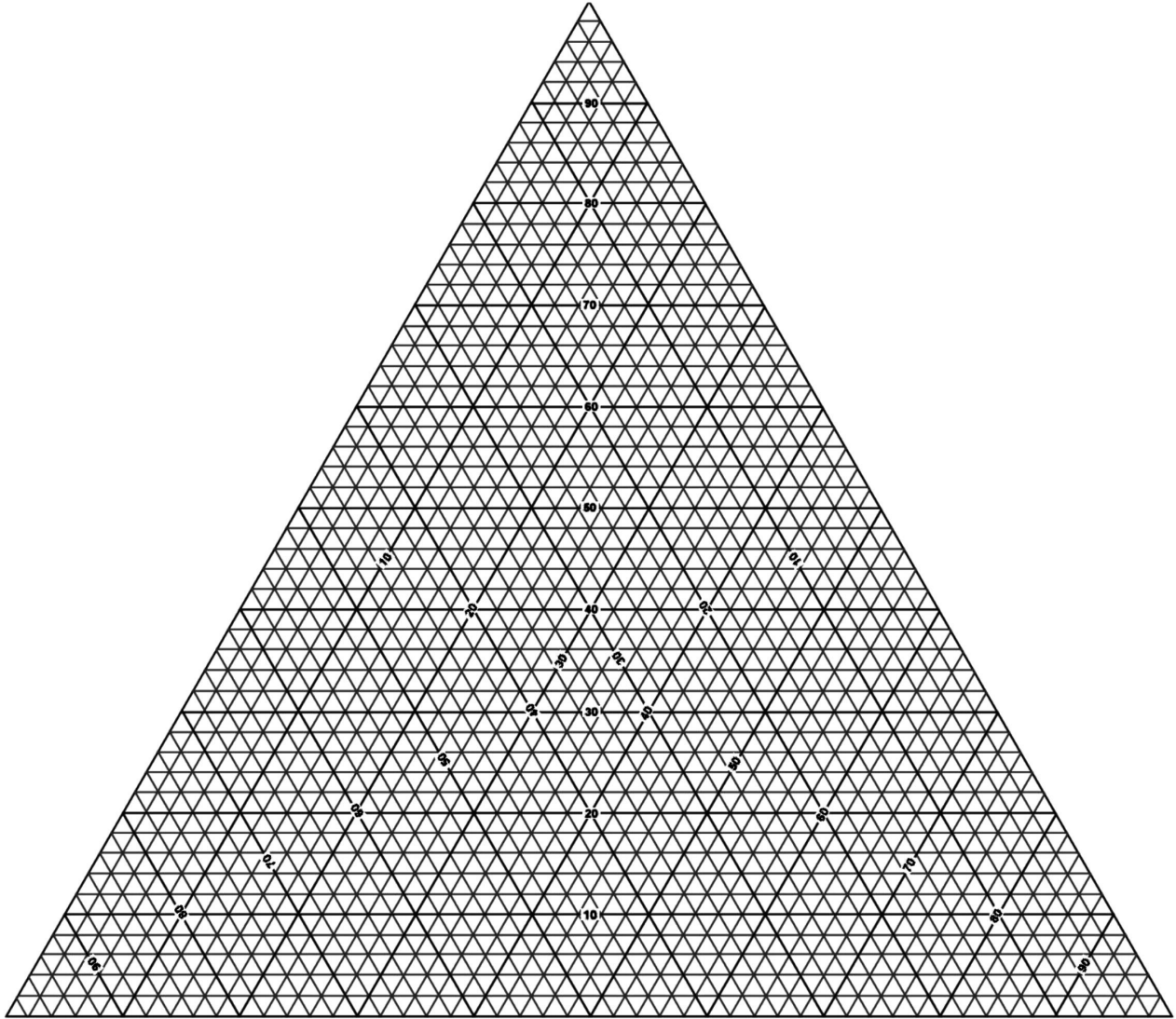


Triangular Diagrams

Al

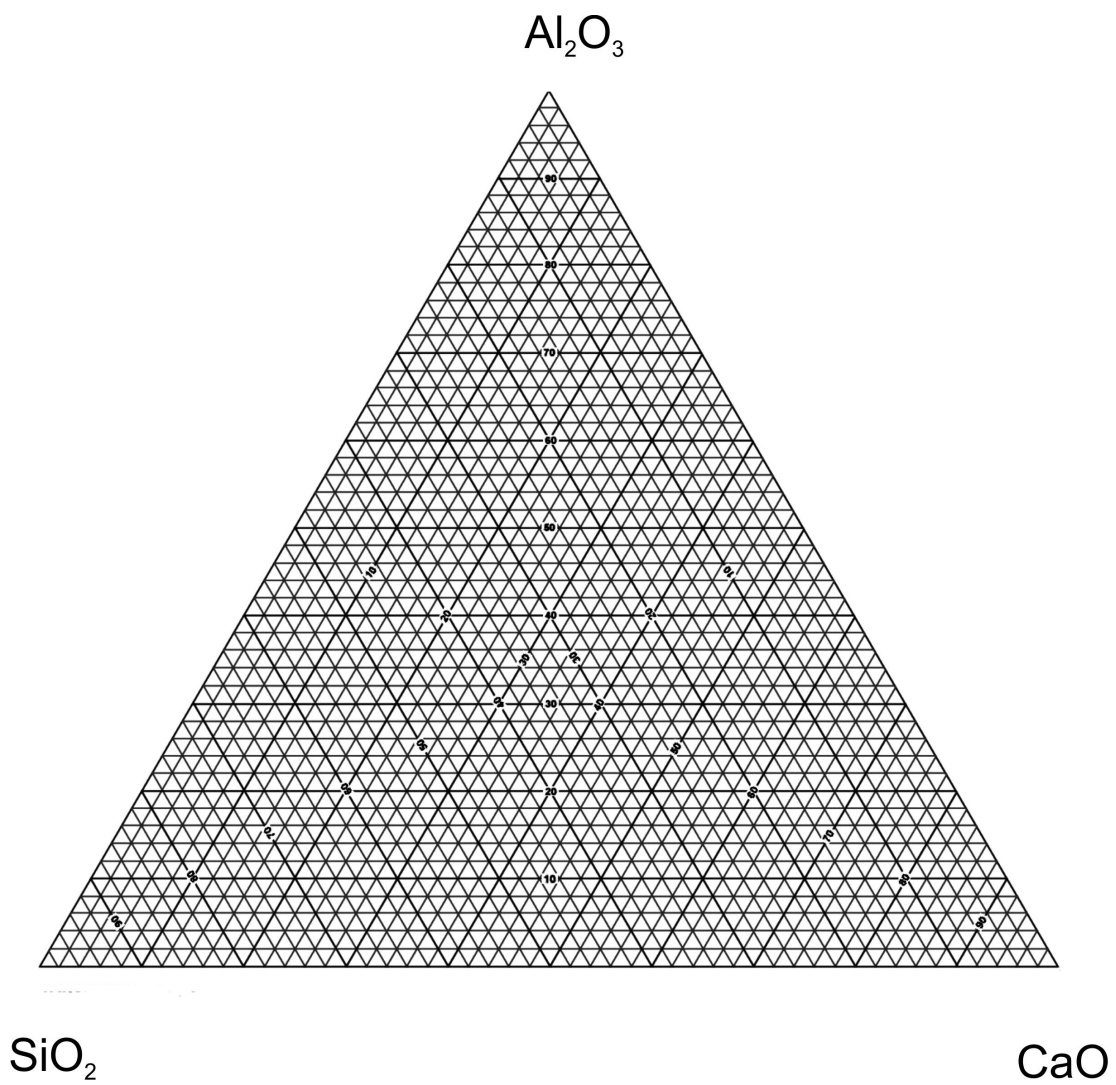


Si

O

Note: For this exercise, everything is plotted using mole%. Sometimes it is done with wt% but that just adds unnecessary complications.

1. On the diagram above, plot the following (mostly mineral) compositions:
 - silicon
 - quartz
 - corundum
 - kyanite



2. On the diagram above, plot the following (mostly mineral) compositions:

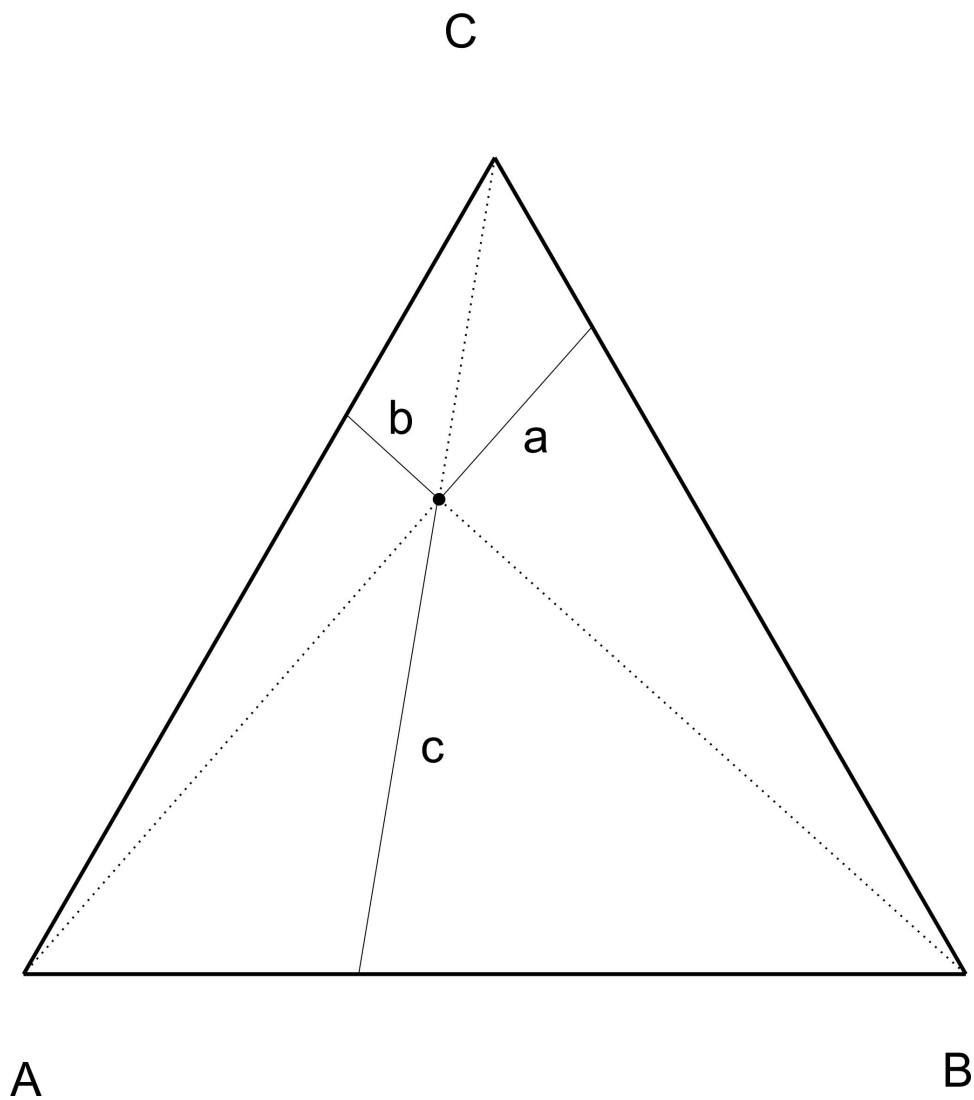
- silicon
- quartz
- corundum
- kyanite
- grossular, $\text{Ca}_3\text{Al}_2\text{Si}_3\text{O}_{12}$
- CaTs, $\text{CaAl}_2\text{SiO}_6$

(Beware of a possible trick question.)

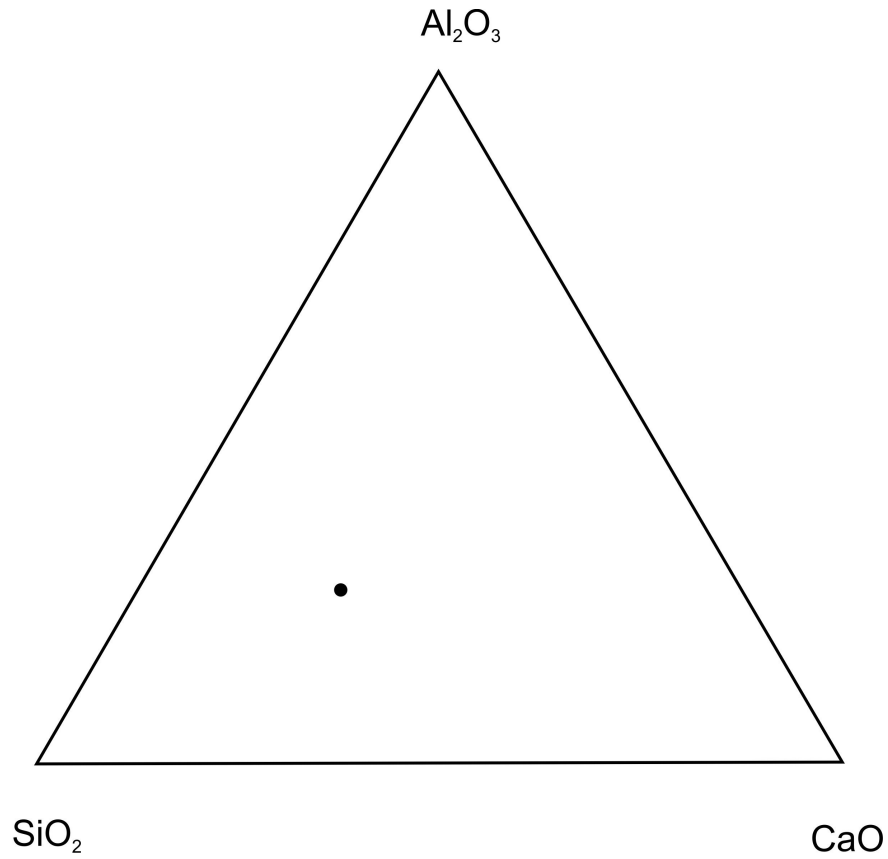
The Lever Rule

Sometimes you won't have all those % lines on your diagram. You can draw them in, or use the lever rule.

3. Where on the diagram do compositions plot that contain 0% A? 0%B? 0%C?
4. Where on the diagram do compositions plot that contain 50% A? 50%B? 50%C?
5. What %A, %B, and %C are represented by the black dot? (Figure out real number values.)

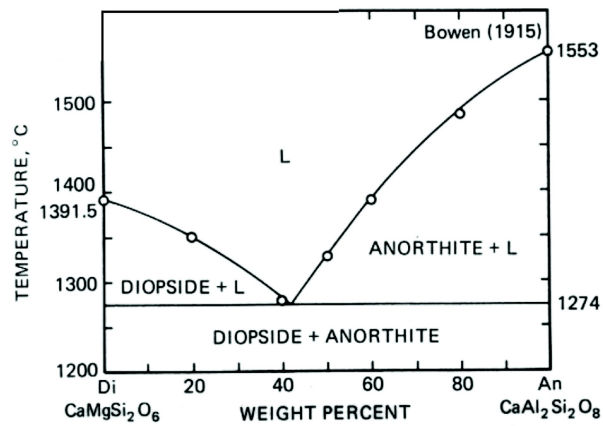


4. What mineral (name it!) is plotted on this diagram? (You may wish to use a ruler.)



5. What is a eutectic?

On this binary diagram (below), where is the binary Di-An eutectic?



Standard petrologic triangular diagrams are ternary compositional diagrams with a different component at each of the three corners. Liquidus temperatures (the temperatures at which crystallization begins upon cooling of a magma) are contoured much like a topographic map. The diagrams often contain eutectics and cotectics, and may contain peritectics. Numbers in the diagram below are temperatures in centigrade.

86 Ternary systems – I

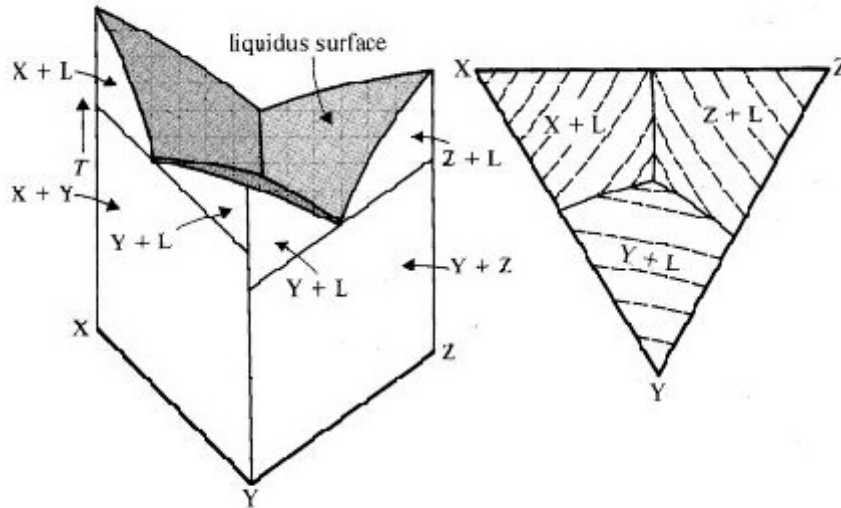
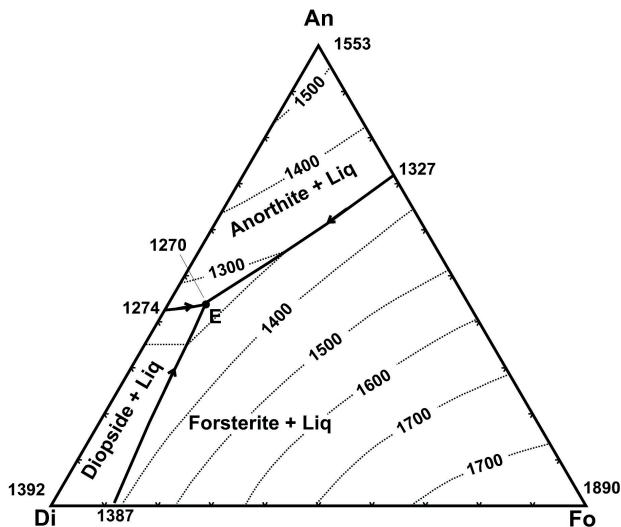


Figure 4.3 Perspective view of ternary T-X prism (left) and liquidus projection with thermal contours (right).



6. On the ternary diagram above where is the binary Di-An eutectic?
7. On the ternary diagram above, where is the ternary Di-An-Fo eutectic?

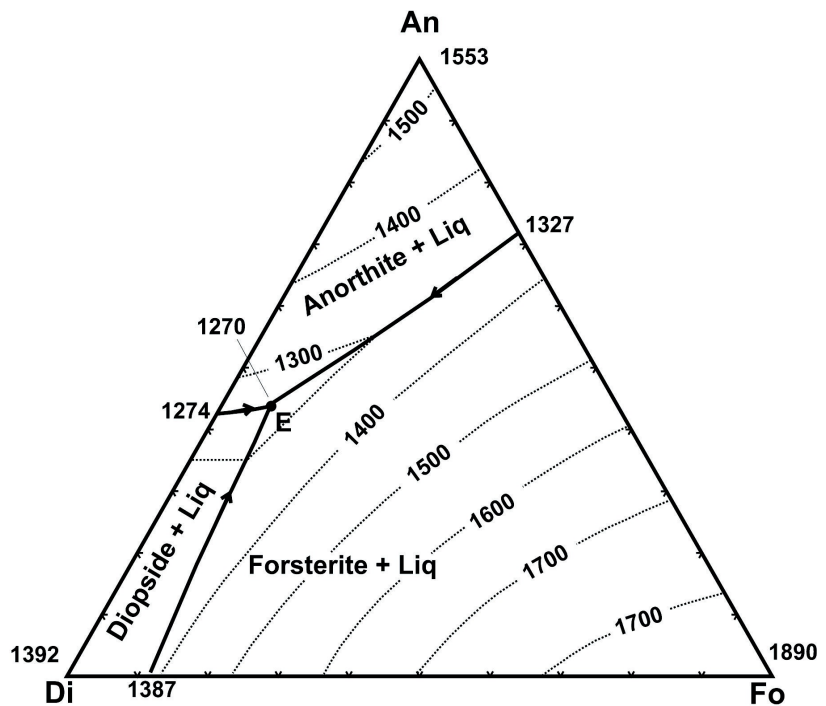
8. Using the ternary diagram on the previous page as a reference, sketch the Di-An binary phase diagram as best you can to scale with temperatures of end members and any eutectic (if present) labeled).

9. Consider the diagram shown.

If a magma (of any composition) cools, what is the lowest temperature it can reach before it is all solidified?

If a rock composed of a mix of Di, An, and Fo is heated, at what temperature will it begin to melt?

If a rock contains some amounts of Di, An, and Fo, what is the highest temperature it can reach without being completely melted?



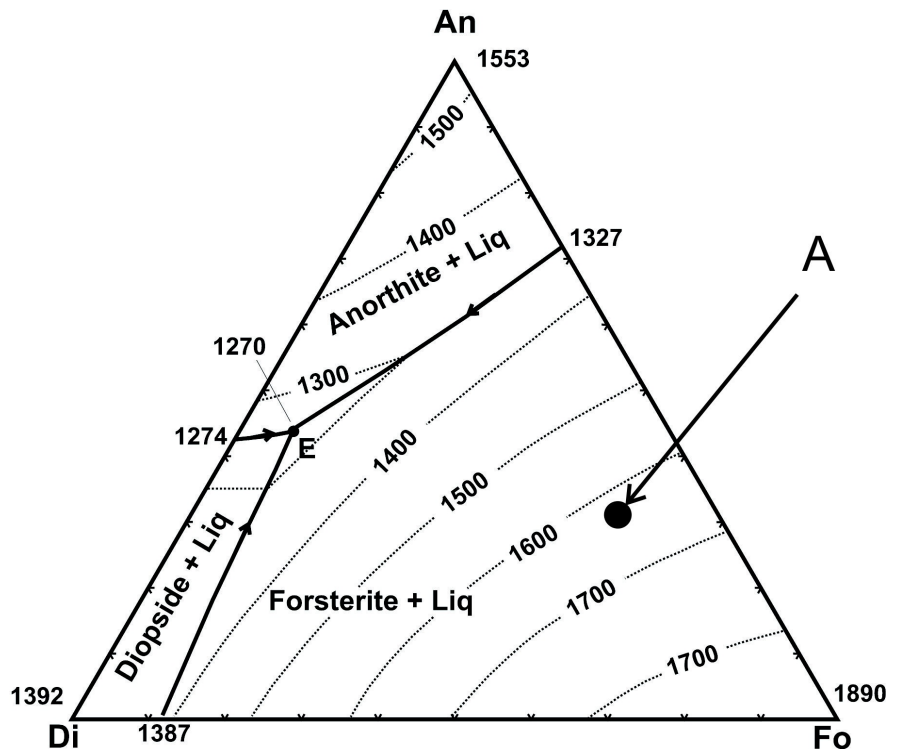
10. Triangular diagrams describe melting/crystallization in model chemical systems that approximate real rocks. What kind of rocks (name some; e.g., diorite) does the diagram on the previous page best describe? You may wish to look at the IUGS classification scheme - be sure to look at the correct diagram.

11. Consider a rock containing Di, An, and Fo that has overall composition A, shown below. What %s Di, An, and Fo does this rock contain?

12. Consider a plutonic rock with composition A. What name would an igneous petrologist give to such a rock? (Consult the IUGS classification scheme.)

13. If a magma of composition A cools to 1640°, it will begin to crystallize forsterite. What happens after that? Describe what happens and at what temperatures.

14. If magma A crystallizes completely, what will be present after it is all solid?



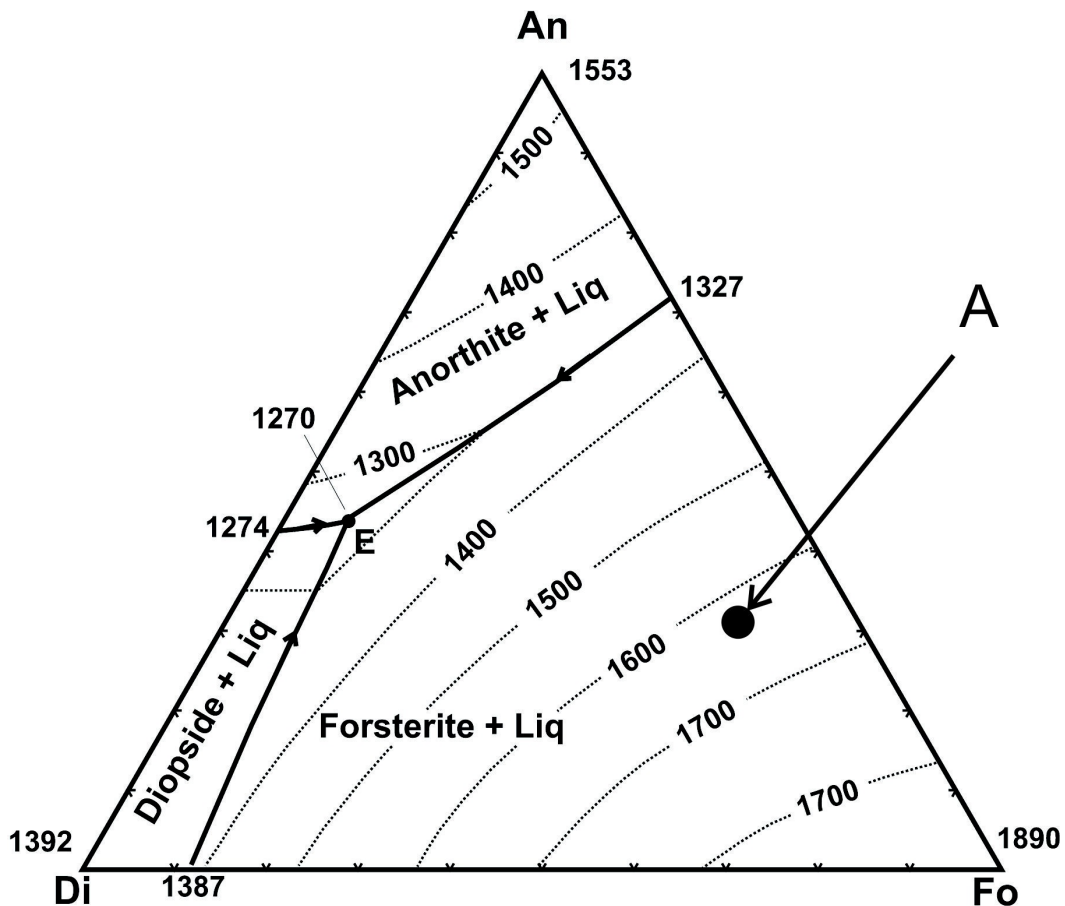
15. A rock of composition A is heated. At what temperature will melting begin? Which mineral will melt first?

What will be the composition of the first drop of melt?

If melting continues, at what temperature will the rock be entirely melted?

Will all minerals in this rock melt at the same time? Or will they melt in sequence? Explain.

16. Describe in general terms how melting proceeds until the rock is entirely molten. Use arrows on the diagram to show how the magma composition changes during melting.



Use the lever rule again!

17. Suppose melt A cools and crystallizes. At what temperature will it be approximately 50% solidified?

18. The melt will change composition until it reaches the eutectic. What % melt will be present just when the composition reaches the eutectic?

What minerals will be present just before melt composition reaches the eutectic?

Just after the melt composition reaches the eutectic, what minerals will be present?

19. Suppose the melt reaches the eutectic and then the remaining melt squirts off (is separated from the crystals). What rock (name it) will that melt produce when IT crystallizes?

And, what kind of rock is left behind?

