# Mole %, Wt. %, Compositions and Projections

**C:\Courses\320\fall2007\in class\020-Projections.wpd; August 23, 2007 (3:31pm)**

Consider the minerals/fluids listed in Table 1, at the end of this handout.

1. Calculate the mole % of each element in each phase and fill in the table.

2. Calculate the weight % of each element in each phase and fill in the table.

(If I were doing this, I would use Excel or Quattro or some other spreadsheet. If you set up the spreadsheet it will save you a lot of button pushing on your calculator. And you will not make errors. But, hey, it's a fee country – do it as you wish.)

3. *Answer question 4 before doing this:* For those phases that do not contain water: Plot their compositions on the two triangular diagrams provided later on in this handout, and label the points with the phase abbreviations. One plot uses mole % values, the other uses Wt %.

4. BUT WAIT! BEFORE YOU DO THE PLOTTING, ANSWER THIS QUESTION: Make a prediction -- What do you think the differences will be between the two plots. Will they be the same? If so, why? If not, will they be completely different? Or, only a little different? Why? Explain.

5. For plotting mineral compositions and thinking about how they compare and mineral reactions, etc., which kind of plot do you think would be most valuable: mole% plots or weight% plots? Why?

6. Under what circumstance would the other kind of plot be useful?

7. Now redo the mole% diagram you just plotted but add the phases that include $H_2O$ as well. The problem is that we now have four components. Must come up with a plan. What to do? Hmmm.

BEFORE YOU START PLOTTING AGAIN, PREDICT WHAT YOU WILL FIND. YOU ARE GOING TO MAKE FOUR PLOTS (READ BELOW): WILL THE FOUR PLOTS COME OUT TO BE SIMILAR, DIFFERENT, OR SOMEWHERE BETWEEN?

Try plotting the compositions (use mole%) ignoring $H_2O$. Just add up the other three and *normalize* (multiply by a fudge factor) so they total 100%. Then plot. (The ones you plotted before will not move because they already total 100% – they contain no $H_2O$.) By ignoring a component, you are creating a *projection*. The idea is that if $H_2O$ (or something else) is unimportant, we can just ignore it for plotting purposes.

Try plotting the compositions, projecting from (ignoring) CaO.

Try plotting the compositions, projecting from (ignoring) $Al_2O_3$.

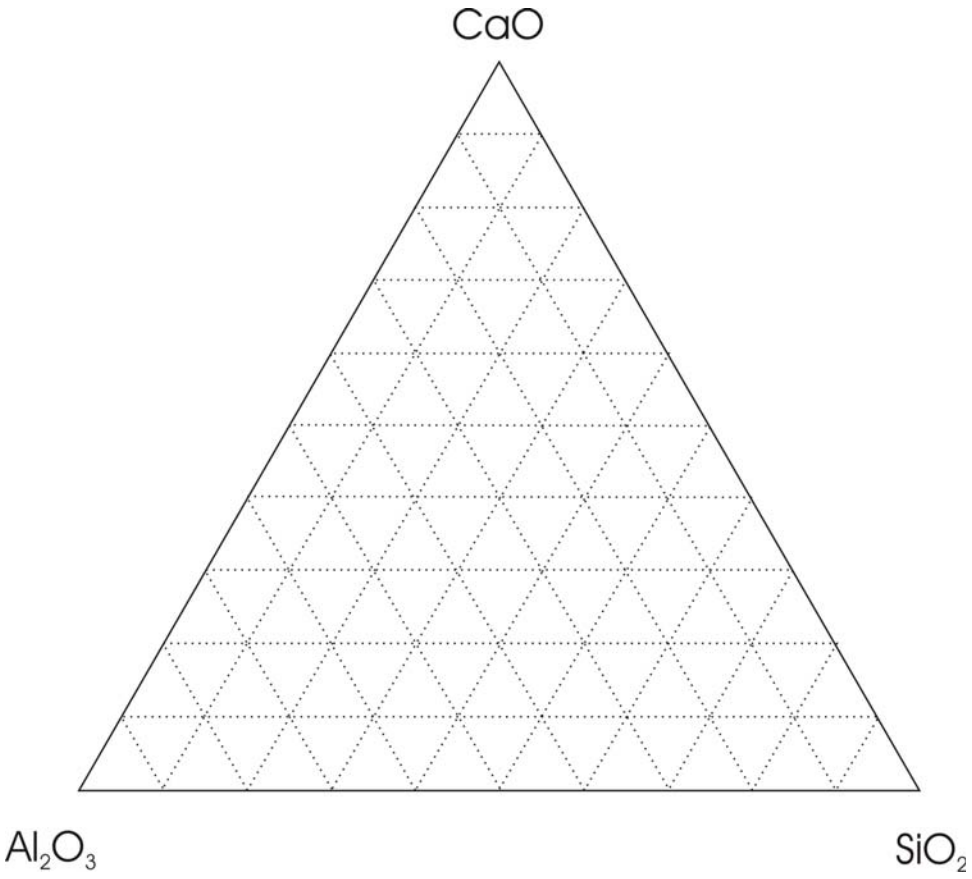
Try plotting the compositions, projecting from (ignoring) $SiO_2$.

8. How do the four plots you just made compare? Very similar, different, close . . . ? Which do you think would be most valuable when considering mineral compositions, reactions, etc.?

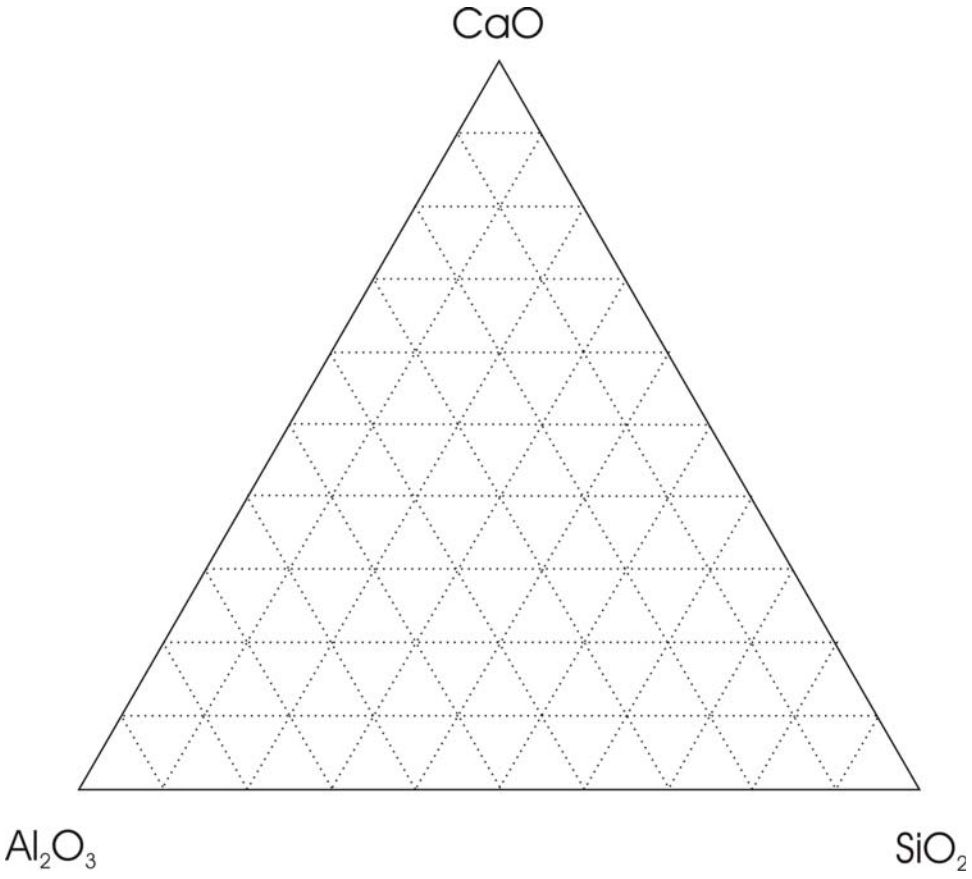
9. What do you think about using projections to plot 3-D compositions on a 2-D piece of paper? Is this useful, misleading, hairy, fun, etc.? Discuss, briefly.

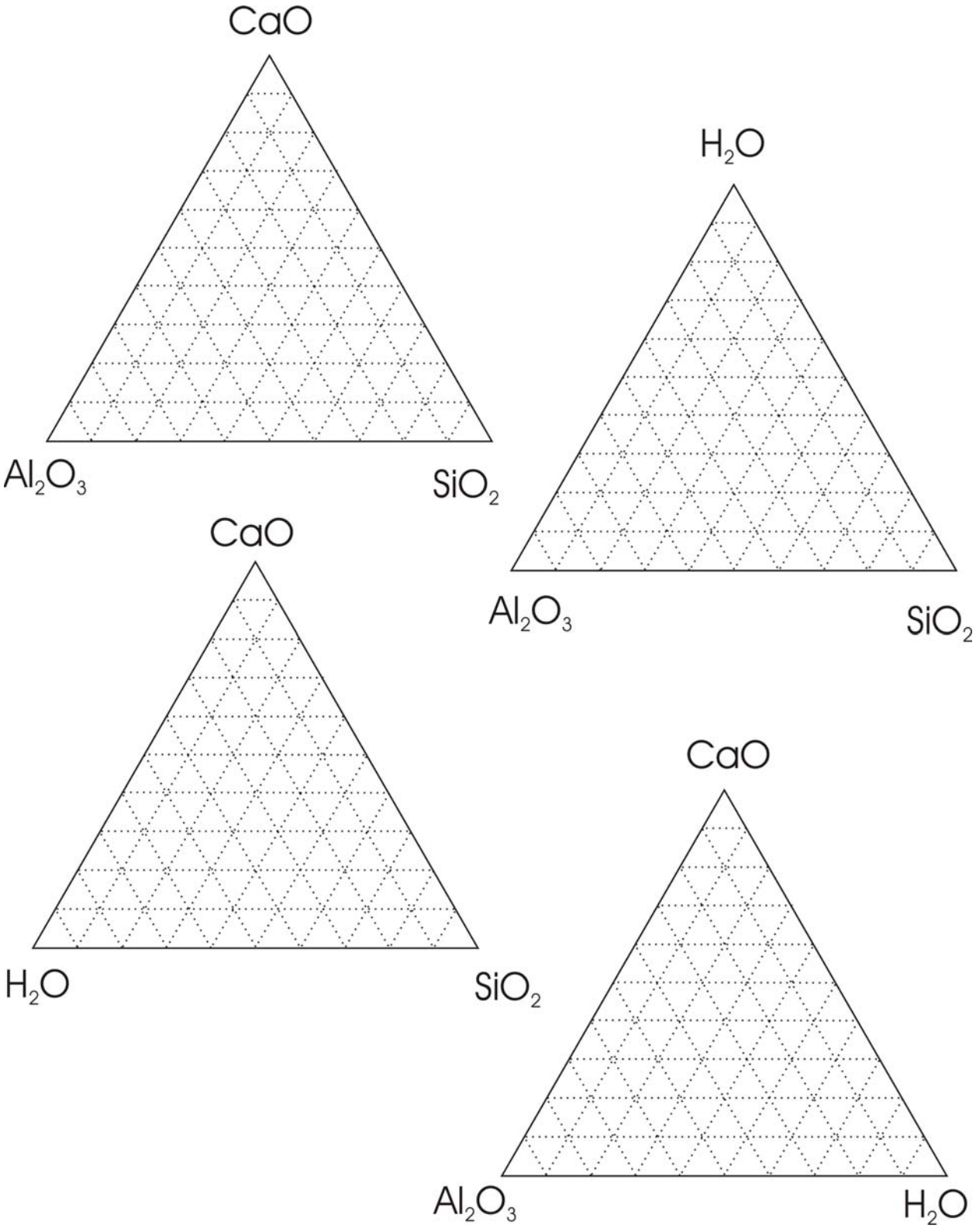
3. Plotting the minerals that do not contain $H_2O$.

Mole % ==>




Wt % ==>




CaO
Al2O3
SiO2
H2O
Al2O3
SiO2
CaO
H2O
SiO2
CaO
Al2O3
H2O

| | | | mole % values | | | | weight % values | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| phase | abbrev. | formula | CaO | $Al_2O_3$ | $SiO_2$ | $H_2O$ | CaO | $Al_2O_3$ | $SiO_2$ | $H_2O$ |
| quartz | Qz | $SiO_2$ | | | | | | | | |
| corundum | Co | $Al_2O_3$ | | | | | | | | |
| lime | Li | CaO | | | | | | | | |
| water vapor | $H_2O$ | $H_2O$ | | | | | | | | |
| kyanite | Ky | $Al_2SiO_5$ | | | | | | | | |
| sillimanite | Sil | $Al_2SiO_5$ | | | | | | | | |
| andalusite | And | $Al_2SiO_5$ | | | | | | | | |
| diaspore | Dsp | AlO(OH) | | | | | | | | |
| wollastonite | Wo | $CaSiO_3$ | | | | | | | | |
| grossular | Gr | $Ca_3Al_2Si_3O_{12}$ | | | | | | | | |
| anorthite | An | $CaAl_2Si_2O_8$ | | | | | | | | |
| gehlenite | Ge | $Ca_2Al_2SiO_7$ | | | | | | | | |
| margarite | Mg | $CaAl_4Si_2O_{10}(OH)_2$ | | | | | | | | |
| zoisite | Zo | $Ca_2Al_3Si_3O_{12}(OH)$ | | | | | | | | |
| lawsonite | Lw | $CaAl_2Si_2O_7(OH)_2 \cdot H_2O$ | | | | | | | | |
| prehnite | Pr | $Ca_2Al(AlSi_3O_{10})(OH)_2$ | | | | | | | | |