

12.109 Petrology  
Ternary systems

- closer to the real thing (rocks!)
- read Hess chapter 2

These are represented in 2-D using triangular diagrams called liquidus diagrams.

Primary phase volume – part of composition space where a phase  $\phi$  is on the liquidus.

Boundary curve – meeting of two primary phase vols. Arrows indicate direction of falling temperature. An example of a boundary curve is...

Cotectic – 2 solids and liquid stable

Ternary eutectic – liquid + 2 solids coexist.  $F = c + 2 - \phi = 5 - 4 = 1$

Liquidus diagrams are projections – they are polythermal and show the liquid composition coexisting with solids over a range of temperatures – analogous to topographical map. Information about the composition(s) of solids that coexist with liquids is sacrificed in these diagrams, and must be reconstructed!

You can use the lever rule to determine phase proportions.

Alkemade line – straight line that connects two phases that share a common boundary curve. If the Alkemade line intersects with the boundary curve, the boundary curve is a cotectic. If not, the boundary curve is a reaction boundary.

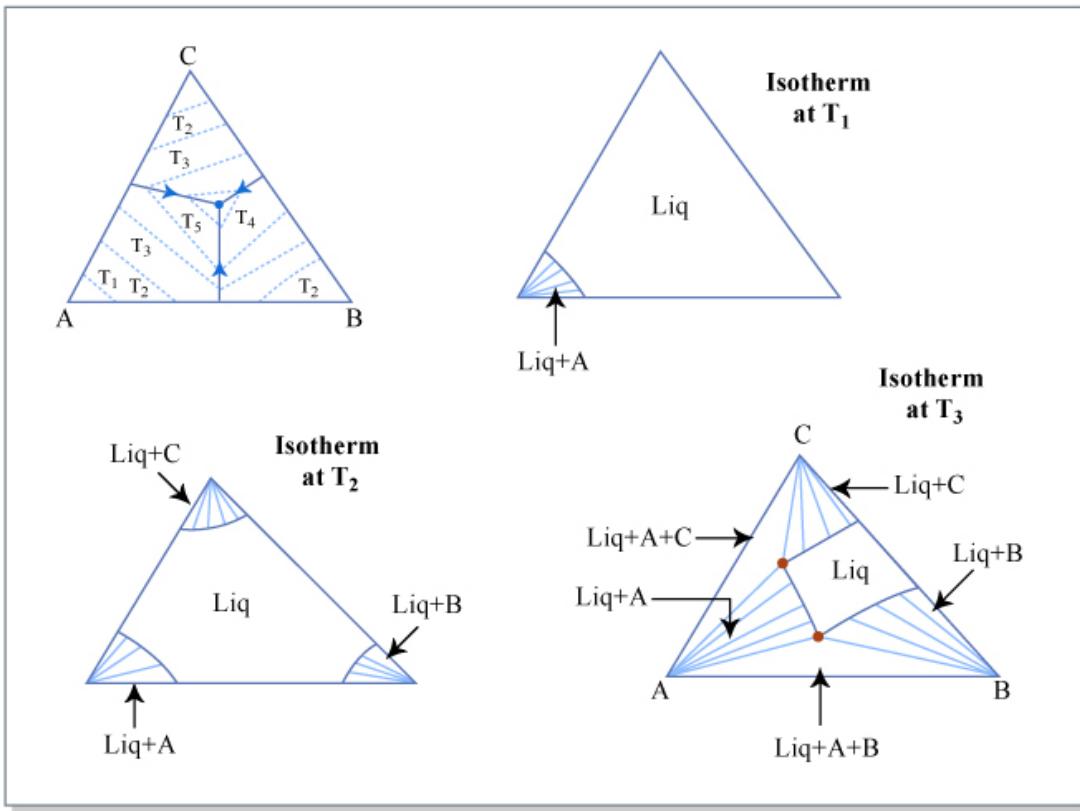
We will use ternary diagrams to discuss crystallization and melting paths. They are closer analogies to natural igneous systems.

Reaction boundaries – along these boundaries, one phase and liquid react to form a second phase – their binary analog was a peritectic reaction

Reaction points – can be identified by using Alkemade's theorem. When liquid that coexists with 3 solids lies outside of the Alkemade triangle, the 4 phase point is a reaction point

Eutectic point – liquid coexisting with 3 phases lies inside the Alkemade triangle defined by the 3 phases

Example – ternary system – 3 pure solids A, B, C, eutectic behavior:



\