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GEOLOGY 285:
INTRO. PETROLOGY
Eskola Recognized the need to show the effect of Rock Composition on Mineral Assemblage at a given Pressure and Temperature
Rock and Mineral Compositions are conveniently shown on Triangular Diagrams

- To use a triangle, we need to reduce important chemical components to three.
- Eskola invented the **ACF diagram** to show minerals in Metamorphosed Mafic Rocks.
- He eliminated uninformative minerals: albite, quartz, K-feldspar, magnetite, ilmenite, apatite.
- He grouped elements that substitute for one another (FeO, MgO, and MnO).
ACF Diagram

- **A** = “Al$_2$O$_3$”
- **A** = Al$_2$O$_3$ + Fe$_2$O$_3$ - (Na$_2$O+K$_2$O)
  
  [- amt. Al$_2$O$_3$ in Na,K feldspars]
- **C** = “CaO”
- **C** = CaO - 3.3 P$_2$O$_5$
  
  [- amt. CaO in apatite]
- **F** = “FeO”
- **F** = FeO + MgO + MnO
Some minerals plot on top of each other, some have a range of composition, not all are stable at same P, T conditions.
Rock Compositions on the ACF Diagram

ACF is especially good for Mafic Rocks, because they plot near the center.
There are one or more different ACF diagrams for each met. facies

We’ll look at ACFs for Greenschist, Epidote Amphibolite, and Amphibolite Facies
Different minerals at different P and T, e.g., in the Greenschist facies

- Calcite
- Actinolite
- Talc
- Epidote
- Chlorite
- Quartz
- Albite
- Magnetite
at higher T - Epidote Amphibolite Facies

The only significant change is that amphibole gets more Al-rich and becomes black Hornblende.
still higher T - Amphibolite Facies

Hornblende gets even more Al-rich, Calcic plagioclase replaces epidote, garnet replaces chlorite

+ quartz
+ magnetite
We’ve seen ACFs for 3 Facies in Medium P Facies Series
Amphibolite Facies (+EpAm) represents range of conditions very important in regional metam.

• In this range there are few changes in mafic rocks
• Many changes in metapelites (metamorphosed shales)
  – Staurolite
  – Kyanite and
  – Sillimanite zones of Barrow’s area
• There are good pressure indicators in pelites, esp. Andalusite, Kyanite and Sillimanite (not in mafic rocks)
• More later