The Granite System

Best, Ch. 8, p. 280-295

Important Mineral Systems

- Ab-An
- Or-Ab
- Or-Ab-An
- Ks-Q

Important Influences

- Role of water
- Oxygen partial pressure
- Oxygen isotopes
- Bowen’s Thermal Valley

Effect of Water Pressure

- Increased \( P_{H2O} \) lowers the solidus and liquidus of the Or-Ab system
**Hypersolvus-Subsolvus**

- Hypersolvus granites form at low water pressure
  - They crystallize a single alkali feldspar that later may exsolve to form a perthite
- Subsolidus granites form at high water pressures
  - They crystallize two alkali feldspars, albite and K-spar, simultaneously

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**The granite minimum**

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**Granite system with feldspathoids**

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**Strontium Isotopes**

- $^{87}$Rubidium decays to $^{87}$Sr
- The half life is very long (50 Gy)
- $^{86}$Sr is stable and not formed by radioactive decay
- The ratio $^{87}$Sr/$^{86}$Sr is a good petrologic index
**Significance of Sr ratio**

- Rb follows K in fractionation
- Sr follows Ca in fractionation
- MORB and the mantle have low Sr ratios ~0.703
- A lava with a ratio < 0.706 suggests mantle origin
- A higher ratio suggests melting of a continental source with high Rb/Sr or contamination of a mantle-derived magma by such material
- Old continental crust may have a very high ratio >0.710

**Oxygen Isotopes**

- Common isotopes are $^{18}$O and $^{16}$O
- Standard ratio of $^{18}$O/$^{16}$O is mean ocean water (SMOW)
- $\delta$ is parts per mil (thousand) of sample compared to SMOW
- Fractionation of oxygen isotopes is temperature dependant

**Some Oxygen Isotope Values**

- Meteoric waters are enriched in $^{16}$O
  - They have negative $\delta$ values
- Rocks are enriched in $^{18}$O
  - They have $+$ $\delta$ values

**Si Activity**

- $\alpha_{SiO_2}$
- Based on set of reactions
- Limits three main magma series