Metamorphic Rocks

Metamorphism

- *Meta* = change, Greek
- *Morph* = form, Greek
- Metamorphic rocks form from other rocks (protolith) by essentially solid-state changes in mineralogy and/or texture as a result of a change in chemical and/or physical environment.

Metamorphism is characterized by:

- **phase changes** growth of new physically discrete, separable components (minerals), either with or without (isochemical) addition of new material; and/or
- **textural changes** recrystallization, alignment and/or grain size, usually as a result of unequal application of stress

Agents of Metamorphism

- Have been recrystallized as the result of
 - Temperature
 - Pressure
 - Confining pressure (compressive stress)
 - Directed pressure (differential stress), including shearing
 - Chemical Activity
 - the composition of pore fluids

Pore Fluids

- A fluid that occupies the empty spaces between particles
- May come from
 - Partial melting of the rock
 - Groundwater

Metamorphic Processes

- Recrystallization
- New Minerals-Index Minerals
 - Neomorphism: transformation of one mineral into a new one, depending upon its new environment.
 - Metasomatism: metamorphism coupled with the introduction of ions from an external source. (Ex: Water)
- Mineral Orientation
- Mineral Segregation

Metamorphic Processes-How it is Done

- Temperature changes
 - − Below 200° not much happens
 - Metastability can occur
 - Migmatite can form from igneous rocks
 - Half igneous, half metamorphic

Pressure Changes

• Makes minerals pack themselves closer (mineral segregation)

Chemically Active Fluids

- Volatiles (H₂O, CO₂) play an important role
 - Source is self contained
- Metasomatism (open system)
 - Usually from an igneous intrusion
 - Hot water
 - Hydrothermal alteration
 - Plays a part in the formation of ores

Effects of Metamorphism

- Foliation
 - Slaty
 - Phyllitic
 - Schistose
 - Gneissic

Classification of Metamorphic Rocks

Foliated Rocks

- **♦**Slate
- **♦**Phyllite
- **♦**Schist
- **♦**Gneiss

Non-Foliated Rocks

- **♦**Marble
- **♦**Quartzite
- **♦**Hornfels
- ♦Anthracite Coal

Types of Metamorphism

- Contact or Thermal Metamorphism
- Regional or Dynamothermal Metamorphism

Metamorphic Facies

- Facies =set of characteristics that distinguish a rock
 - Hornfels
 - Zeolite
 - Blueschist
 - Greenschist
 - Amphibolite
 - Granulite
 - Eclogite
 - Migmatite
 - (Magma)

Insert your beautiful diagram here: