Metamorphism, Metamorphic Rocks & Hydrothermal Rocks

Geology 105
Chapter #7
Metamorphism -

- Means -
- Changes are due to:
  - 1)
  - 2)
  - 3)
Metamorphic Rock

- Transformations occur in the solid form
- Changes may include-
  - New textures
  - New mineral arrangement
- Or both
- Parent Rock-
Factors controlling characteristics of metamorphic rock

1)

2)

3)

4)
1) Composition of parent rock before metamorphism

- Mineral content is controlled by the chemical composition of the ___________
2) Temperature and pressure during metamorphism

- Heat needed for metamorphic reactions comes from ________________
- A mineral is considered ________ if it does not react with another substance or convert to a new mineral
- ________________ pressure applied equally on all surfaces as a result of burial
3) Effects of tectonic forces

- Stress-
- forces on the object are stronger or weaker in different directions.
- - causes parts of a body to move or slide relative to one another across a plane
- - force pushing together on a body
Foliation-

- Foliated rock has a ________________
- When identifying metamorphic rock this is the 1st thing to decide is-
Slaty cleavage

Slaty Cleavage is a type of foliation expressed by the tendency of a rock to split along parallel planes.

Slaty cleavage results from ________
______________________________.
Phyllite - slaty texture but -
Schistose

The platy mica crystals are aligned ____________ to each other and the rock tends to break easily along this direction.

Visible minerals that are ________________________________.
Gneissic texture

If the rock became very ductile and new minerals separated into distinct Light (feldspar & quartz) and dark (biotite, amphibole or diorite) layers or lenses
Nonfoliated-

Formed around _______________ where the temperatures are high but the pressures are relatively low and equal in all directions (confining pressure)

How does density change?.

[Diagram of pressure and density changes]
Marble

Forms when _________________ is recrystallized during metamorphism
Quartzite

Difficult to break along grain boundaries
Hornfels-

Dense, dark mass of grains too fine to identify with the naked eye
Types of Metamorphism

- Regional Metamorphism
- Dynamic Metamorphism
- Contact Metamorphism

Factors:
- Pressure
- Heat
- Faulting
Contact metamorphism

- Occurs when ____________________________
  ______________________________________

- Rock are usually non-foliated
- Marble-
- Quartzite-
- Hornfels-
Regional metamorphism:

- Deep underground
- Foliated
- Majority of metamorphic rocks
  - Prograde metamorphism-
Prograde metamorphism of slate
Migmatite-

Temperature high enough for partially melting of rock, the magma collects in layers
Plate tectonics explains

1)

2)

3)

4)
Plate Tectonics & Metamorphism

Shearing takes place-

Regional metamorphism takes place throughout & foliation is parallel to the -
Hydrothermal Rock-

- Rocks that have precipitated from hot water or have been altered by hot water are difficult to classify.
- Waters is important because it
- 1
- 2
Hydrothermal activity at Divergent Plate Boundaries
Ore deposits at divergent plate boundaries

- A *hydrothermal vent* is a ____________. It continuously spews super-hot, mineral-rich water that helps support a diverse community of organisms.

- [http://www.ceoe.udel.edu/deepsea/level-1/geology/smoker.mov](http://www.ceoe.udel.edu/deepsea/level-1/geology/smoker.mov)

- Economically important because
Metasomatism -

Ions are brought in by ________ from outside and are incorporated into the newly crystallizing minerals.

Commercially mined deposits of metals are produced when metasomatism is associated with _________________.

[Diagram showing geological features such as pockets of kaolinite, aureole, schorl rock, quartz, tourmaline, dunite or peridotite, greisen quartz, muscovite, topaz, and serpentinite.]
Prophyry copper deposits

Secondary concentration of minerals after erosion
Brigham Canyon copper mine