Name _____

Relative Dating: Which Rock Layer Formed First

Before the theory of evolution was proposed by Charles Darwin in 1859, geologists had already noticed that fossil assemblages changed from one stratum to the next (i.e. through time). This concept is termed faunal succession. For example, geologists noticed that the abundance of mammal fossils occurred higher stratigraphically (i.e. later in time) than the abundance of reptile fossils. Geologists were able to use the faunal succession of fossil assemblages to correlate distant rock beds to each other. These correlations led to the construction of the geologic time scale, a global record of rocks and their relative ages.

However, before geologists can correlate the ages of rocks from different areas, they must first figure out the ages of rocks at a single location. Within a single locality, geologists are able to determine which rock units are the oldest and which are youngest. This type of analysis is called relative age dating. The principles of relative age relationships are listed below:
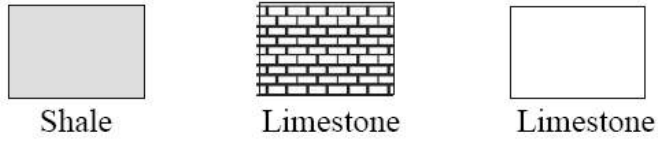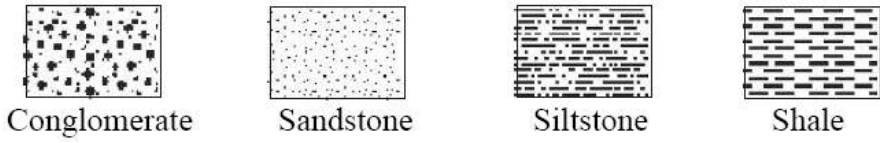
1. Principle of superposition: In a sequence of undeformed sedimentary rock layers, the rocks get older from top to bottom (i.e. the bottom layer is the oldest layer and the top layer is the youngest).

2. Principle of original horizontality: When sedimentary rock layers are being deposited, gravity forces them to be deposited as flat, horizontal layers. Once the sediment has solidified and become rock, they can be tilted or folded.

3. Principle of faunal succession: Groups, or assemblages, of plant and animal fossils appear in the geologic record in a specific order. These assemblages can be used to identify certain periods of geologic time.

4. Principle of crosscutting relations: An igneous rock unit or fault that cuts across another rock unit must be younger than the unit it cuts across. In other words, the other rock unit must have already been there for the igneous rock or fault to cut across it.

5. Principle of inclusion: A rock unit that contains inclusions of preexisting rocks must be younger than the rock unit from which the inclusions came.

6. Metamorphic rocks: A metamorphic rock is always older than the non-metamorphosed rocks around it. The metamorphic rock must have formed before the surrounding rocks, otherwise they would be metamorphosed as well.

To apply the principles we just illustrated, geologists first make detailed sketches of rock outcrops similar to the one you just drew. Look at the following drawings and the symbol key, then use the relative age principles to determine the age relationships. Typically, geologists will list the age order of rocks from top to bottom, with the oldest rocks at the bottom and youngest at the top (like the principle of superposition).
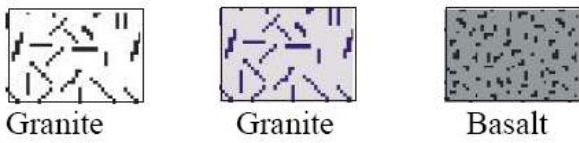
Note: You will notice that the top boundary of some of the rock layers is jagged. This boundary, an unconformity, is where the rock layer's surface was exposed to wind and water erosion for a significant amount of time before the next sediments covered it.
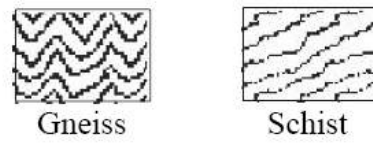
Name _____

Key to Rock Symbols
Sedimentary Rocks

Conglomerate   Sandstone   Siltstone   Shale

Shale   Limestone   Limestone

Igneous Rocks

Granite   Granite   Basalt

Metamorphic Rocks

Gneiss   Schist

Special Features:
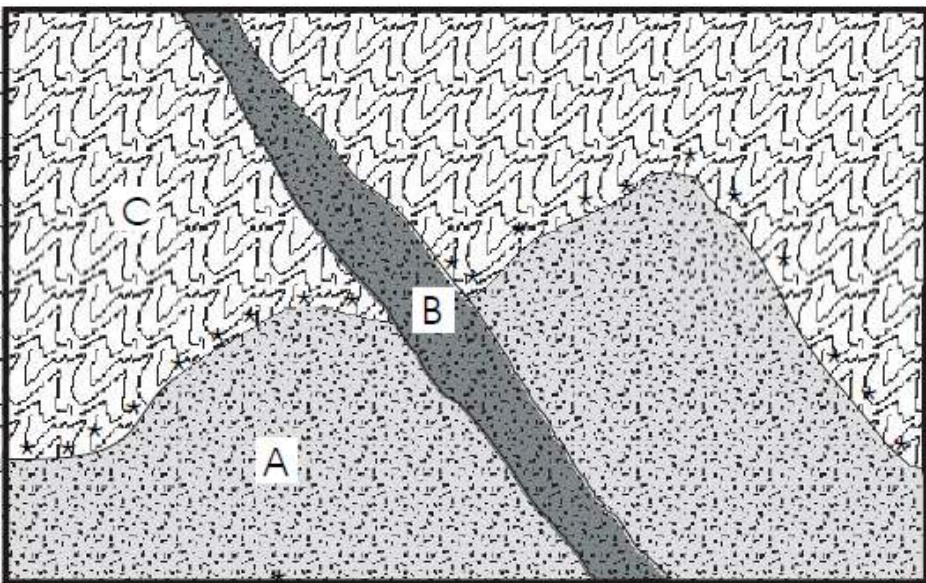
~~~~~~~~~ Contact that is an unconformity (layers on either side of it are of differing ages)

_____ Fault

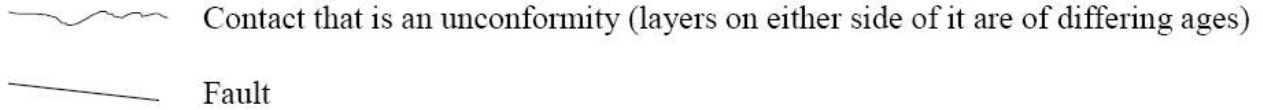Figure 1:

Youngest _____

_____

_____

_____

Oldest _____

List the principles you used to determine the age relationships: _____

_____

Name _____

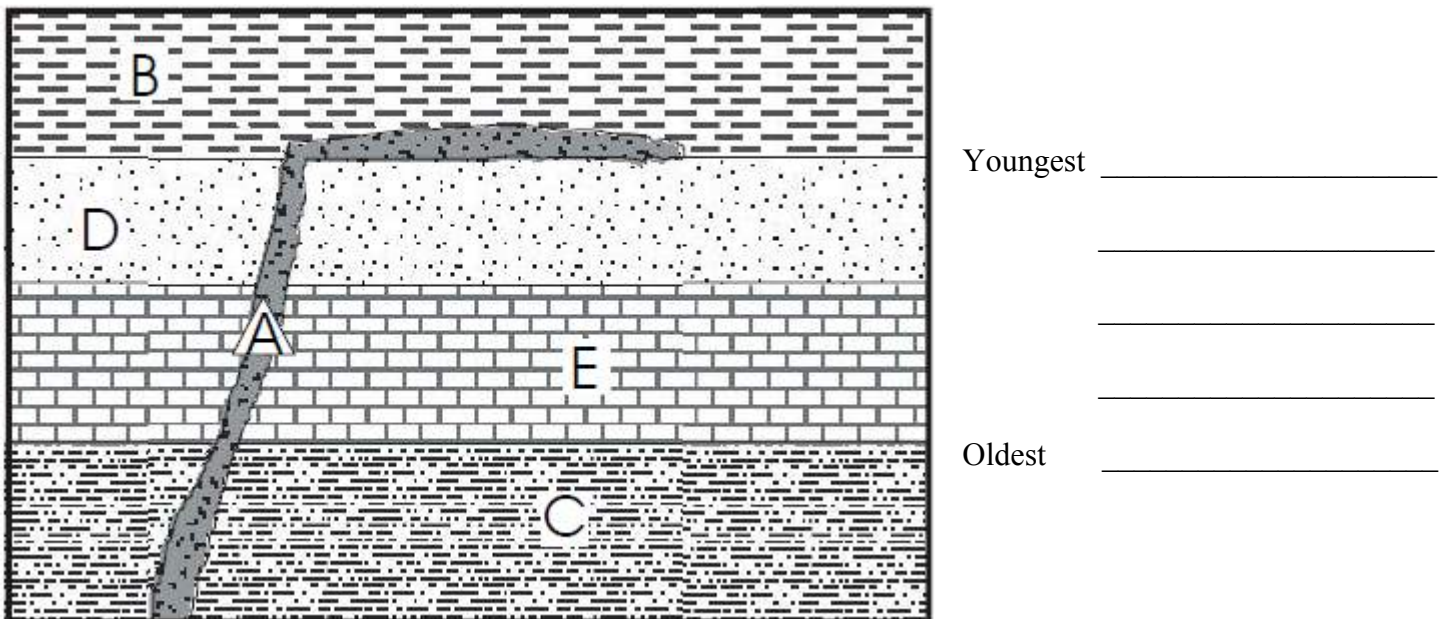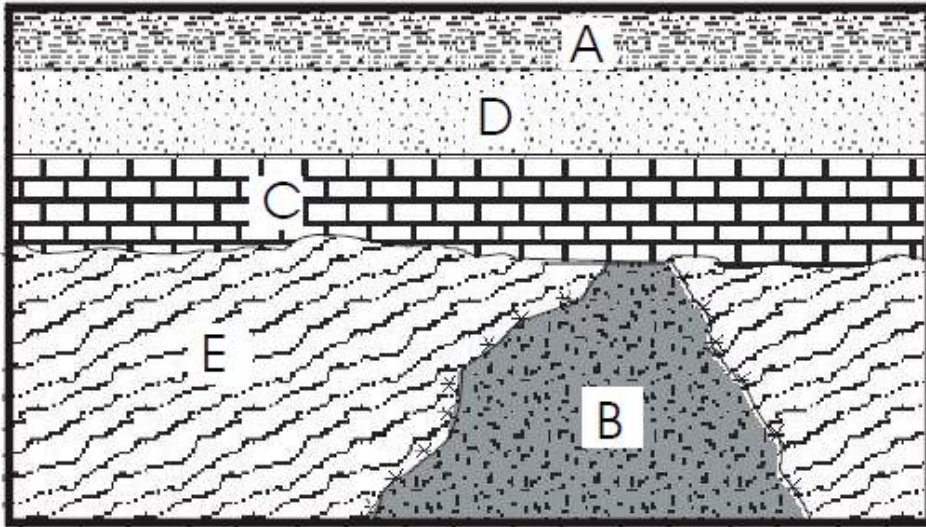Figure 2:

Youngest _____

_____

_____

_____

Oldest _____

List the principles you used to determine the age relationships: _____

_____

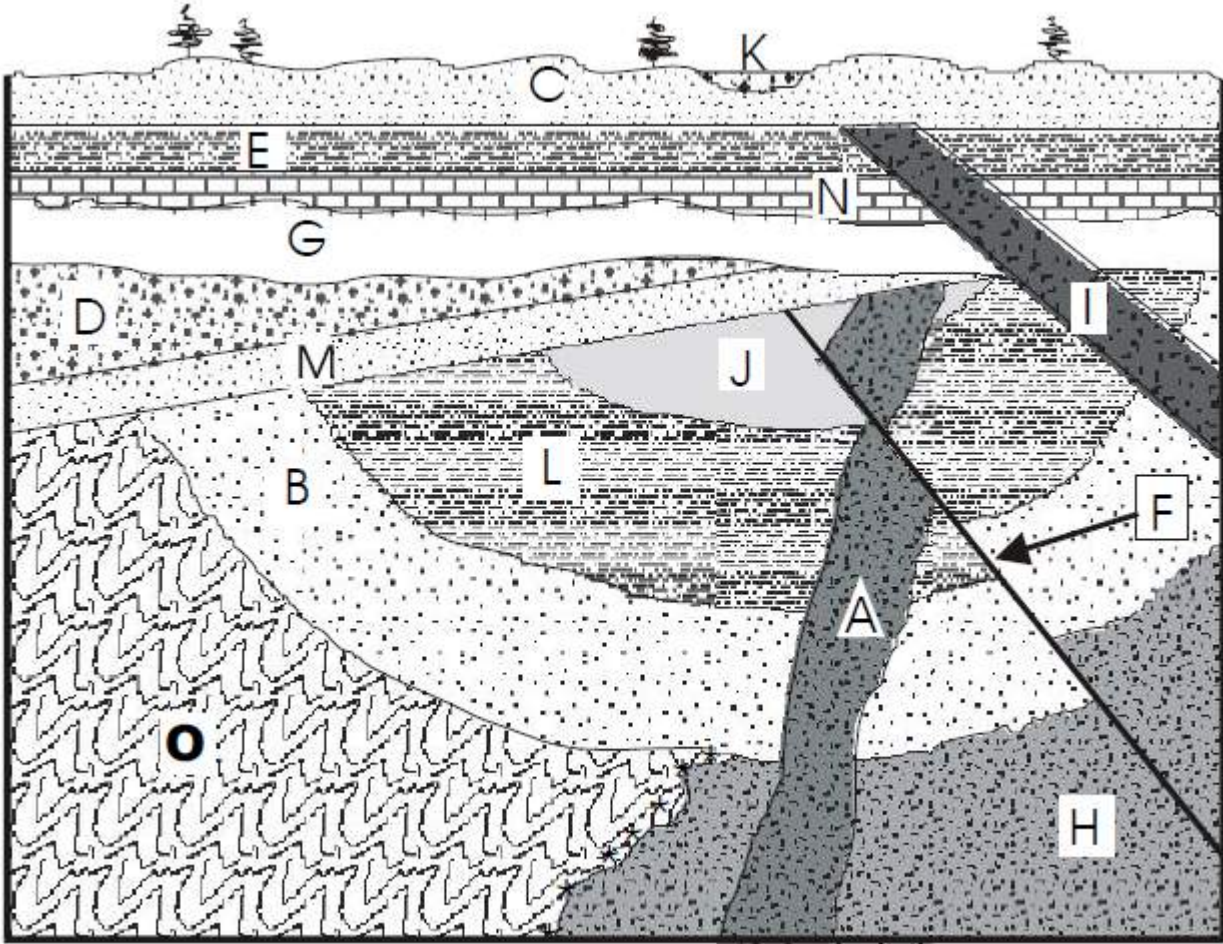Figure 3:

Youngest _____

_____

Oldest _____

List the principles you used to determine the age relationships: _____

_____

Name _____

Figure 4:

Youngest: _____

              _____

              _____

              _____

              _____

              _____

              _____

Oldest   _____

What type of unconformity is pictured above? : _____

_____

Name _____

Figure 5:

Youngest: _____

              _____

              _____

              _____

              _____

              _____

              _____

              _____

Oldest   _____

The folding event occurred between the deposition of which two rock layers?

_____

_____

What are the two types of unconformities pictured above? : _____

_____

Name _____

Figure 6

Youngest:_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

Oldest _____

How many folding events occurred, and between which rock layers? _____

_____

_____

What are the three types of unconformities pictured above? : _____

_____