Relative Dating: What Happened First, Then Next?

(This homework assignment will be done in class.)

Name: _____

Before the theory of evolution was proposed by Charles Darwin in 1859, geologists had already noticed that the fossils found in the earth changed from one layer of sediment 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, younger rock layers are above older rock layers (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 formed, gravity forces them to be deposited as flat, horizontal layers. Once the sediment has solidified and become rock, they may become 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 first for the igneous rock or fault to cut across it.

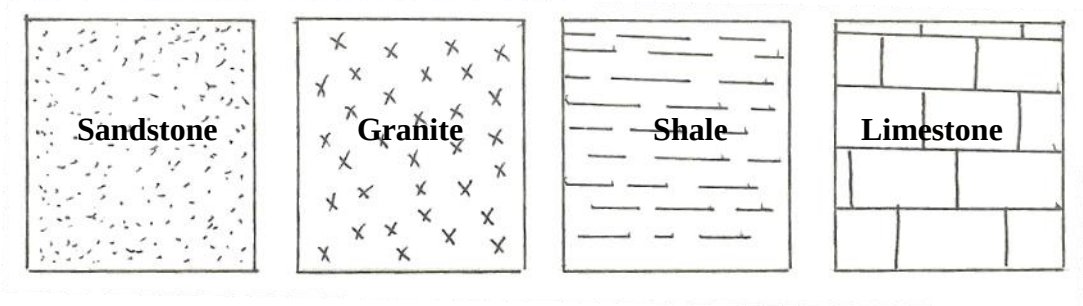
5. **Principle of inclusion:** A rock unit that contains inclusions of preexisting rocks must be younger than the rock unit from which the inclusions came.

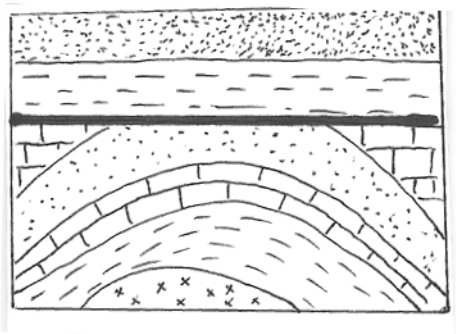
6. **Metamorphic rocks:** A metamorphic rock is always older than the non-metamorphosed rocks around it. The metamorphic rock must have formed before the surrounding rocks, otherwise they would be metamorphosed as well.

To apply these principles, geologists first make detailed sketches of rock outcrops. Look at the following drawings and the symbol key, then use the relative age principles to determine the age relationships.

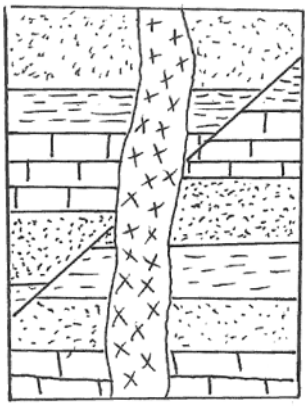
Note: You will notice that the top boundary of some of the rock layers is jagged. This boundary, an unconformity, is where the rock layer's surface was exposed to wind and water erosion for a significant amount of time before the next sediments covered it.

Typical Symbols for Types of Rock



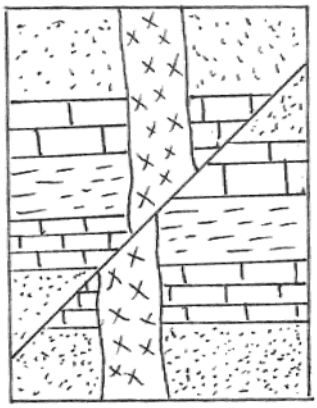


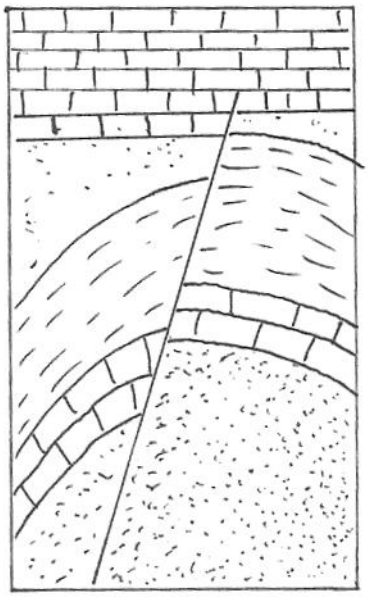
This is an **angular unconformity**. This is also an example of a syncline or a dome. It is difficult to know which it is with only one cross section.



Which happened first: the fault or the igneous intrusion?

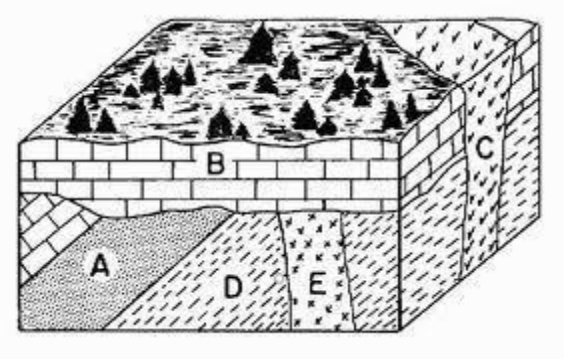
What kind of igneous intrusion appears in these diagrams?





Which happened first: the fault or the fold?

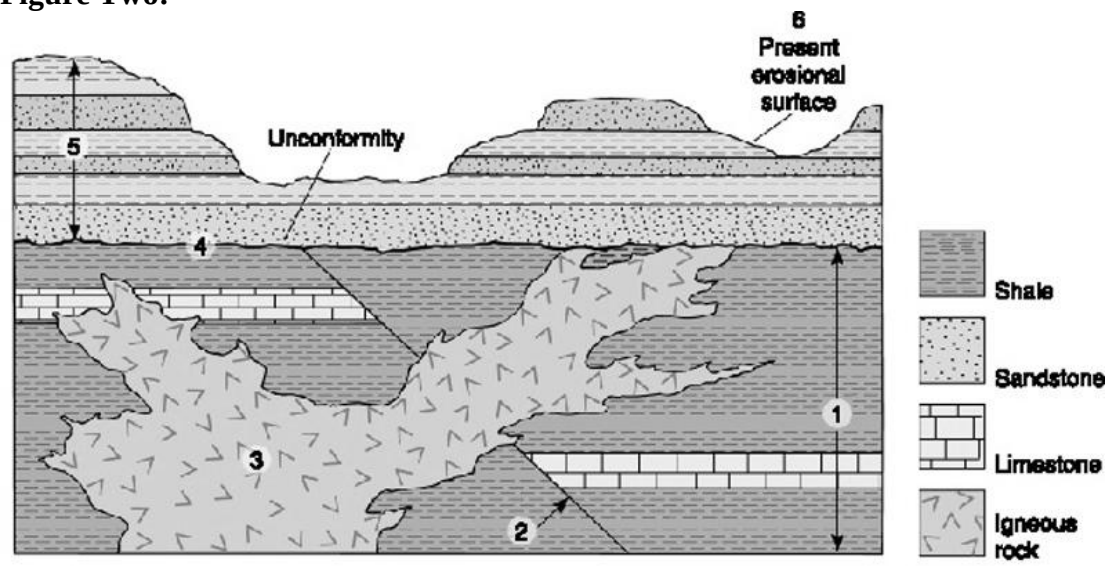
Figure One:



1. Which intrusion is older, C or E?

2. Which layer is older, D or A?

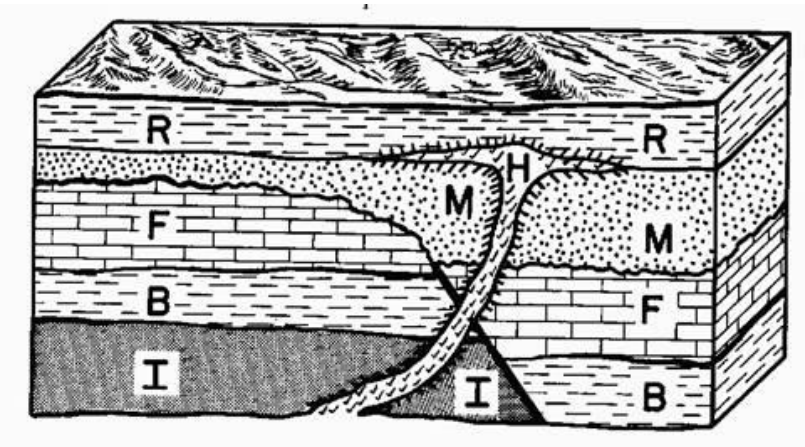
Figure Two:



3. Which is older; the fault (2) or the intrusion (3)?

4. Is this a normal or a reverse fault?

Figure Three:



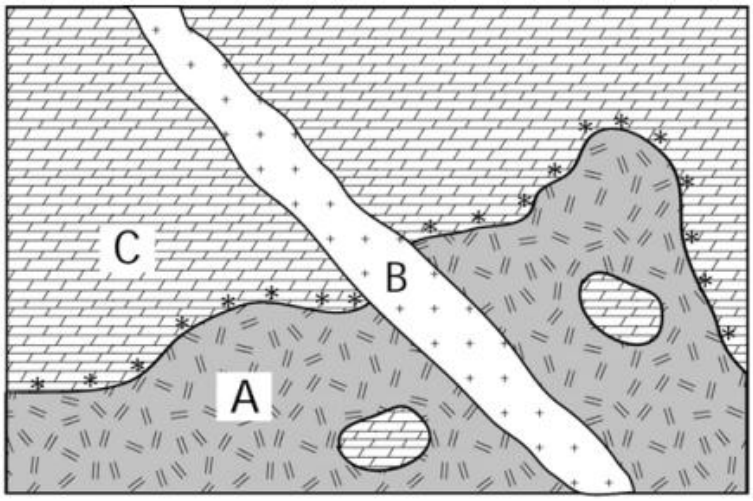
5. What is feature H?

6. Which came first, the fault or H?

7. Is this a normal or reverse fault?

8. Which is older, F or B?

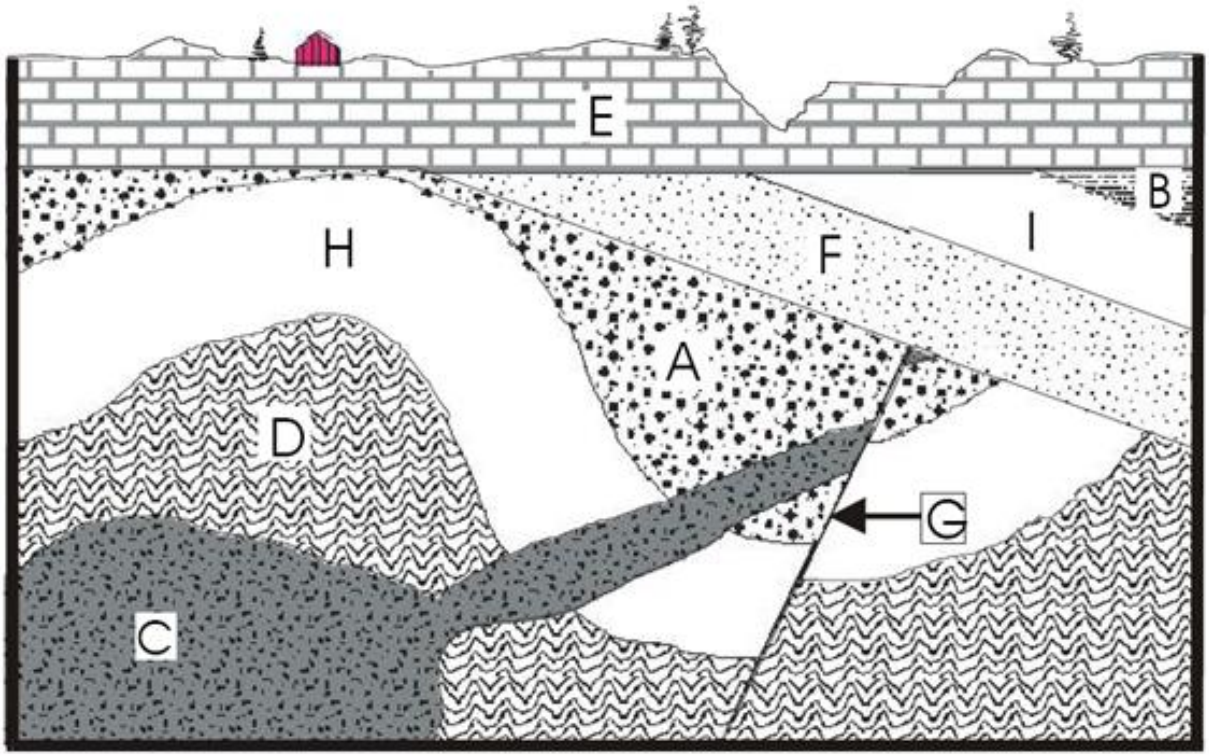
Figure Four:



9. Which is older, A or C?

10. What do the little * mean?

Figure Five:

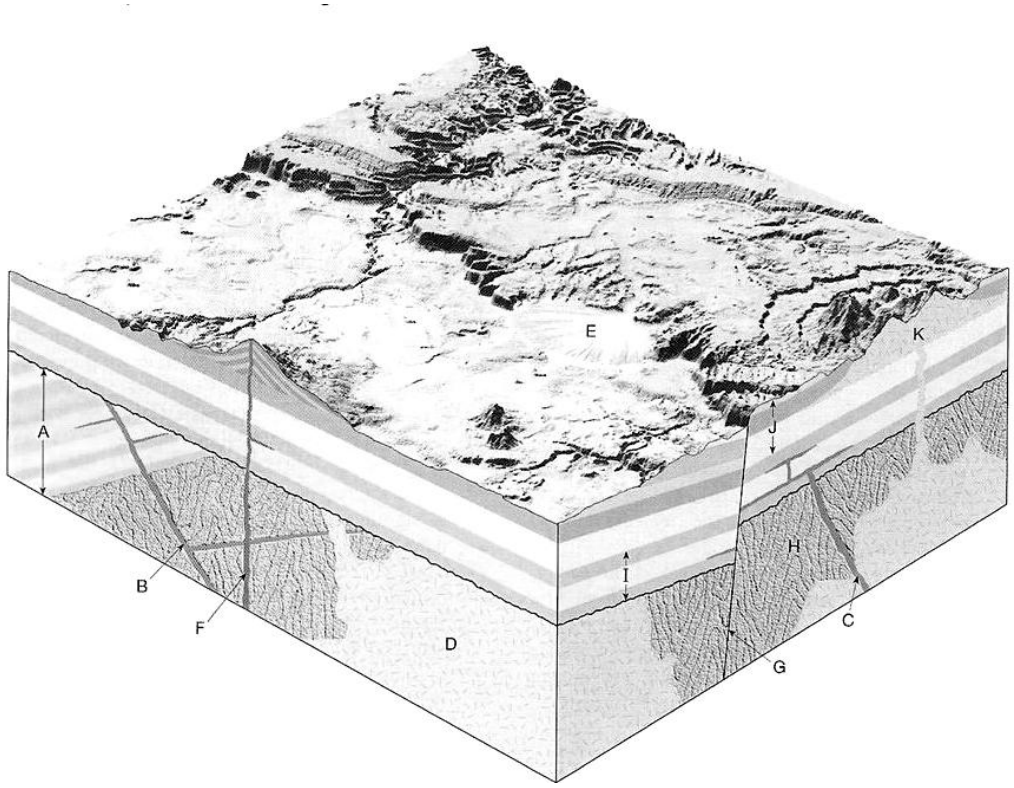


12. Put all of the labeled features in order from oldest to youngest.

13. Which happened first - the folding or the fault?

14. Which happened first - the fault or the intrusion C?

Figure Six:



15. Which occurred first, fault G or intrusion C?

16. Which occurred first, the tilting of section A or intrusion B?

17. Circle the sills in this picture.

18. What type of fault, normal or reverse, is fault G?

19. Which happened first, D or B?

Figure Seven:

20. Find the igneous intrusion in this photograph and circle it. What is it?