

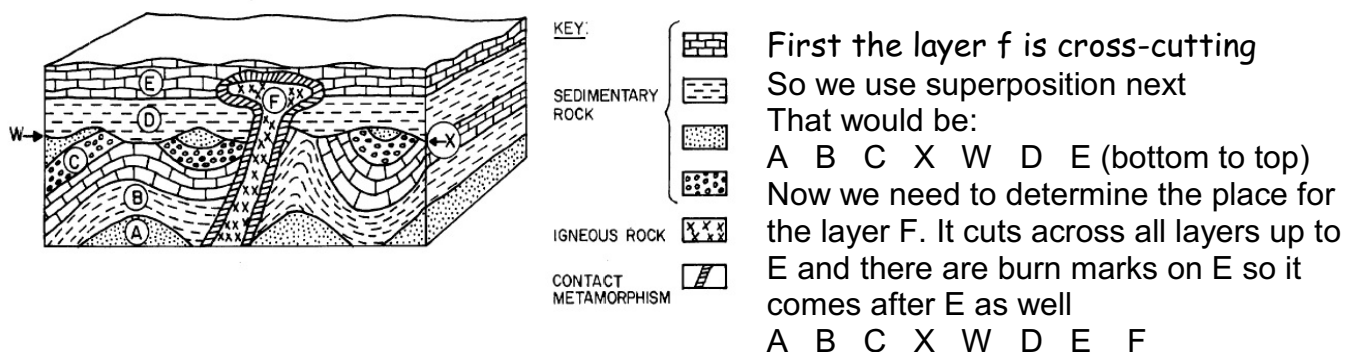
Principles of Relative Dating

When trying to determine the relative ages of the rock layers, geologists use a variety

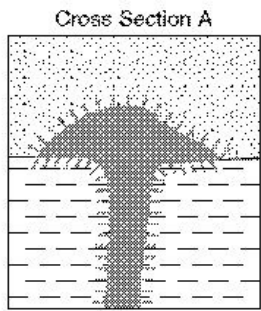
- A. **Principle of original horizontality:** sediments are deposited in layers parallel to the Earth's surface.
 - 1. Significance of non-horizontal beds
- B. **Principle of superposition:** in a layered sequence of rock, each layer is younger than the one below it and older than the one above it.
- C. **Principle of cross-cutting relationships:** a fault or intrusive igneous body is younger than the rocks it crosses.
- D. **Principle of inclusion:** rock fragments included in a sedimentary deposit are older than the rock they are contained in.
- E. Recognition of **unconformities**, which are surfaces of erosion between rock units
 - Types of unconformities
 - a. **Disconformity:** younger strata above the unconformity have the same attitude as those below, but the unconformity itself may be an irregular (erosional) surface.
 - b. **Nonconformity:** younger strata rest on older metamorphic or intrusive igneous rocks.
 - c. **Angular unconformity:** younger strata rest on top of tilted or folded older strata.
- F. **Correlation:** the process of demonstrating that rock bodies are of the same age, over short and long distances
 - 1. Worldwide correlation most typically uses **fossils**.
 - 2. Fossils are useful because the groups or assemblages of fossils follow one another in an orderly fashion (**principle of faunal succession**).
 - 3. The most useful fossils (**index fossils**) are those with a narrow age range and wide distribution.

Advice for Relative Dating

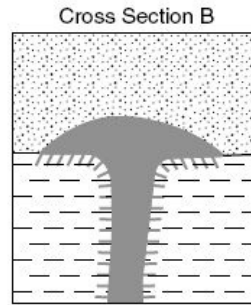
When trying to find the order that rocks were laid down in, the first thing that needs to be done is to identify any layers that cut across other layers. Once that is done, then use superposition to date all of the other letters first. Then when this is done, find out where each of the cross cutting layers go. This should ordinarily give you your answer. Lets look at an example and see this method in action.



Burn Marks (contact metamorphism) Sometimes it is difficult to determine if an intrusion is younger than the last it touches. Look at the two examples shown here.



Here the top layer has burn marks so the layer was there before the intrusion. It is called an intrusion flow.



Here the top layer is not burned so it was added after the intrusion. This is called a buried lava flow.

These marks help determine what was there first.

UNCONFORMITIES

An unconformity can be defined as a buried surface of erosion that represents a break in the rock record. It is important to recognize unconformities in the rock record, because they tell you that rocks of certain ages may be missing at that location (they were eroded away). Unconformities represent "time gaps" that may be years to hundreds of millions of years in duration.

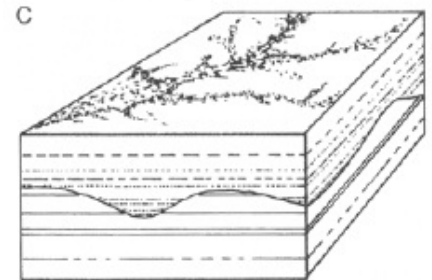
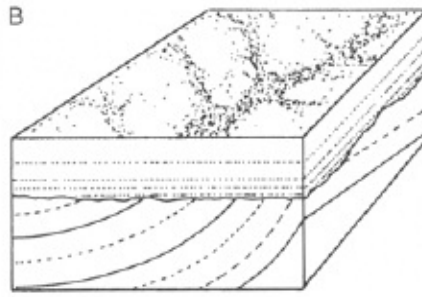
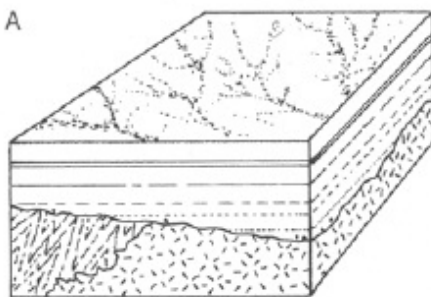
Unconformities are shown using a bold wavy line between beds.

Types of unconformities include:

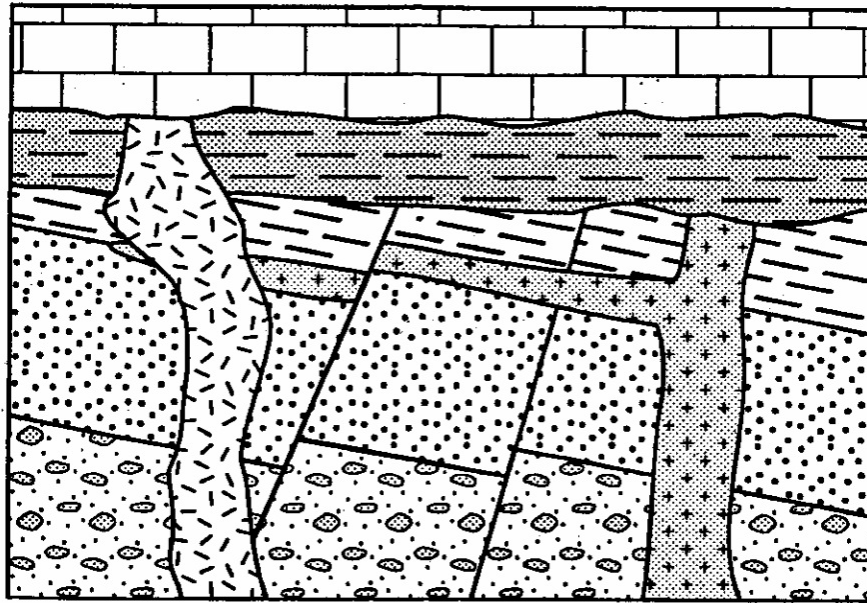
Nonconformity - An unconformity between sedimentary rocks above and igneous or metamorphic rocks below

Angular Unconformity - An unconformity between horizontal sedimentary rocks above and tilted (deformed) sedimentary rocks below.

Disconformity - An unconformity between horizontal sedimentary rocks above and below .

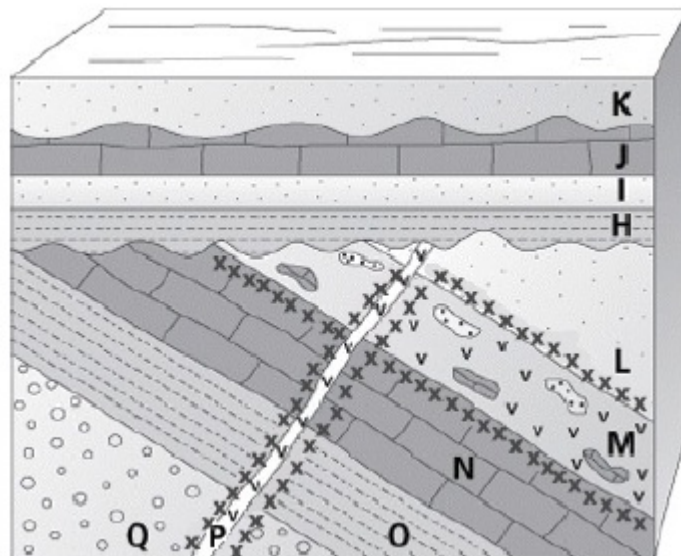


Now its time for you to try some of them.



- Number all the sedimentary layers from oldest to youngest.
- Label any intrusions with capital letters from oldest to youngest. Place burn marks along the edges of them
- Label any faults with lower case letters from oldest to youngest.
- Label all unconformities.
- Finally, list all events identified above in the order in which they occurred.

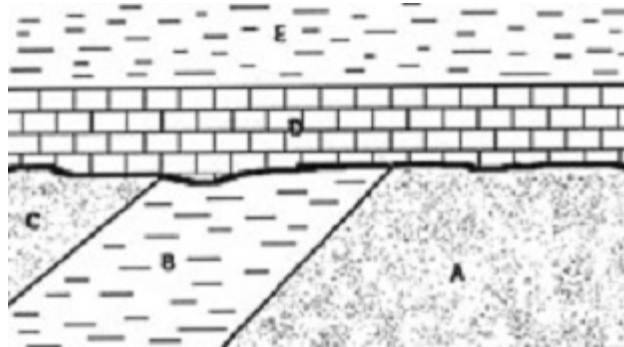
Try this one from a former public exam. List the order for each of the letters shown here.



oldest —————> youngest

We should also be able to work the other way as well and using a description of the layers of rocks we can draw them. For example if I was told I had the following layers I would get the diagram below.

Three layers of sedimentary rocks are laid down and then they were tilted by forces of tectonics. Then a period of erosion took place after which two new periods of deposition took place.



Now you take a turn at drawing a cross-section of your own using these descriptions. Try it on a piece of scrap paper first and then copy it in the box below.

Two layers of sedimentary rock were laid down flat and then tilted counterclockwise. The new rocks were eroded so they were flat along the surface. Then there were two new layers of sedimentary rock that were laid on top of this unconformity. Next igneous rock intruded through the center of your diagram upward until it reached the surface and covered the top. It burned everything it touched. Finally another layer of sedimentary rock was deposited on top of the lava flow. See if you can use what we learned to draw this cross-section? Be sure to use burn marks and proper lines to indicate unconformities.

