

# Unit 5: Age of the Earth

Objective:

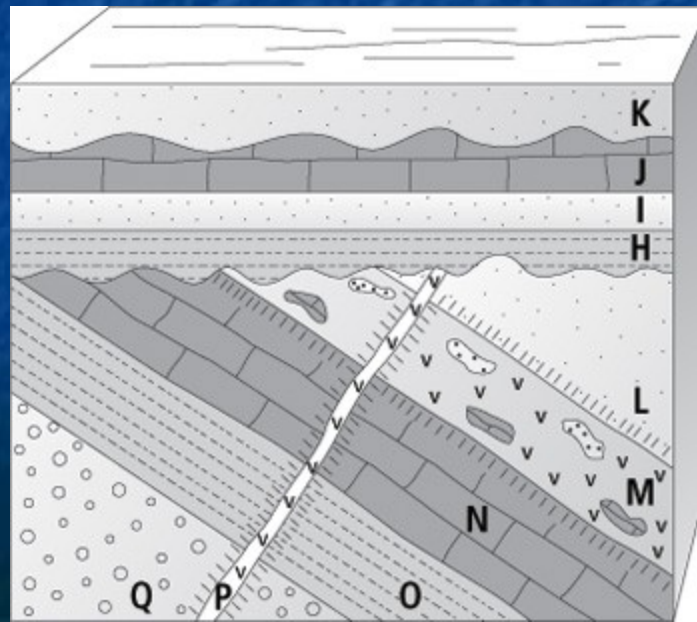
E5.3D Describe how index fossils can be used to determine time sequence.

E5.3g Identify a sequence of geologic events using relative-age dating principles.

# Relative Dating

In the same way that a history book shows an order of events, layers of rock (called strata) show the sequence of events that took place in the past. Using a few basic principles, scientists can determine the order in which rock layers formed. Once they can know the order, a relative age can be determined for each rock layer.

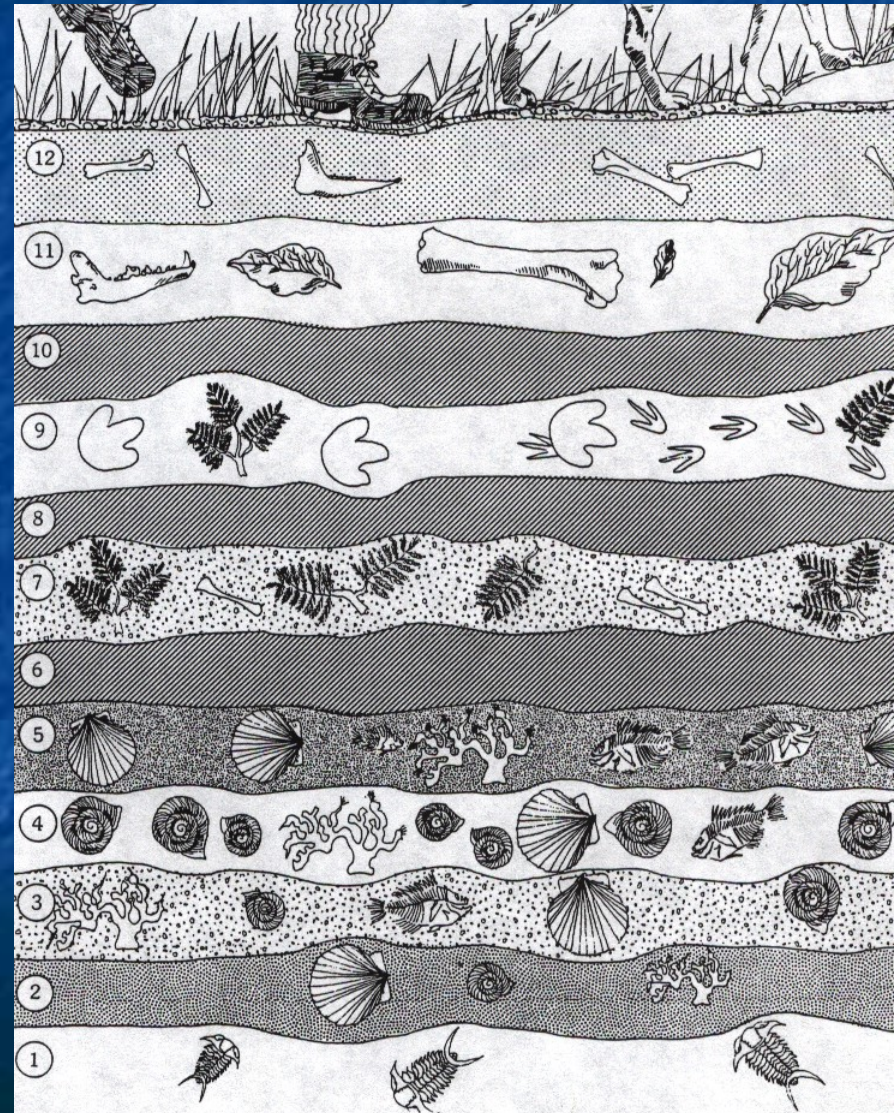
**\*Relative age** indicates that one layer is older or younger than another layer, but does not indicate the rock's age in years (absolute age).



# Law of Superposition

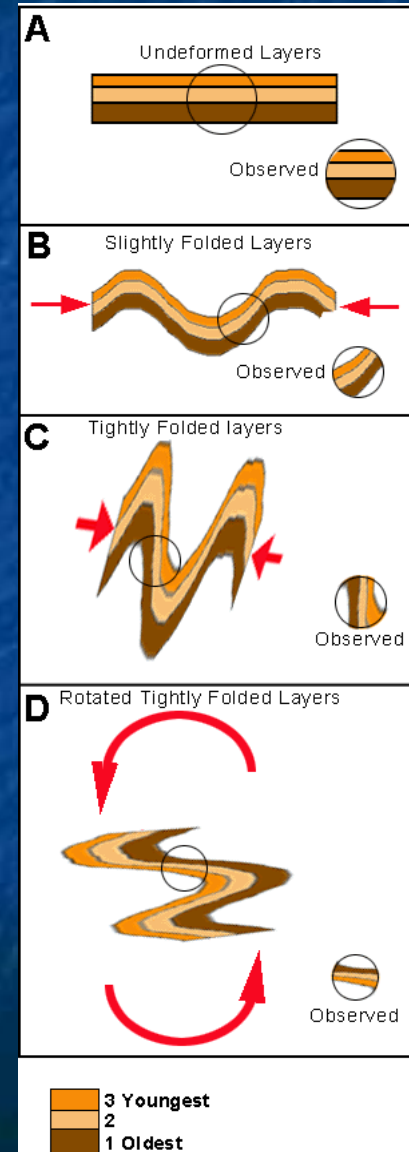
Sedimentary rocks form when new sediments are deposited on top of old layers of sediment. As the sediments accumulate, they are compressed and harden into sedimentary rock layers.

Scientists use a basic principle called the **Law of Superposition** to determine the relative age of a layer of sedimentary rock. \*The **Law of Superposition** is that an undeformed sedimentary rock layer is older than the layers about it and younger than the layers below it. According to the Law of Superposition, layer 1 was the first layer deposited, and thus the oldest layer. The last layer deposited was layer 12, and thus it is the youngest layer.



# \*Principle of Original Horizontality

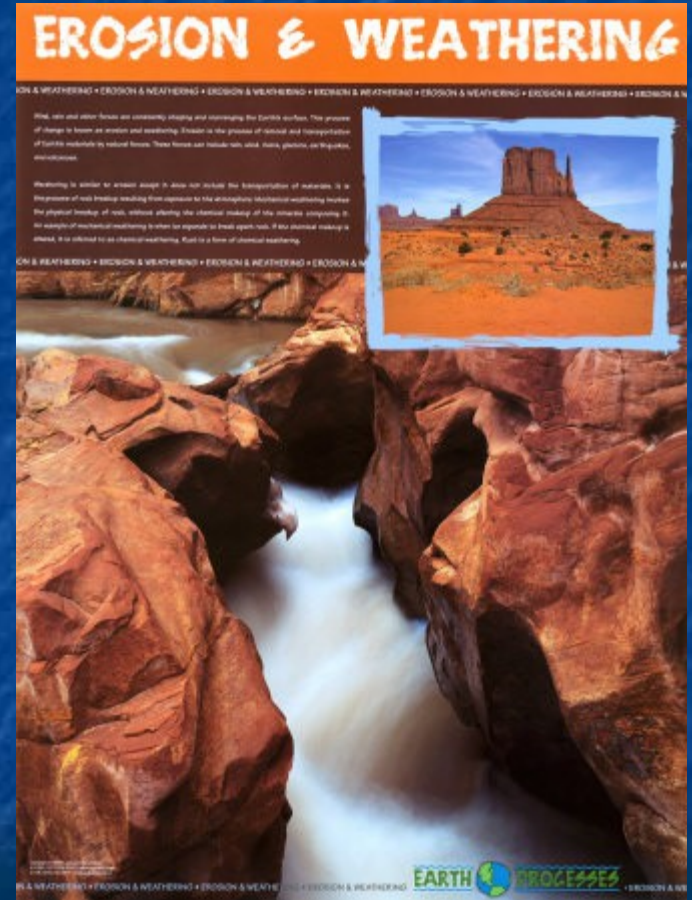
Scientists also know that sedimentary rock generally forms in horizontal layers. The **Principle of Original Horizontality** is that sedimentary rocks left undisturbed will remain in horizontal layers. Therefore, scientists can assume that sedimentary rock layers that are not horizontal have been tilted or deformed by crustal movements that happened after the layers formed.



# Unconformities

Movements of Earth's crust can lift up rock layers that were buried and expose them to erosion. Then, if sediments are deposited, new rock layers form in place of the eroded layers. The missing rock layers create a break in the geologic record in the same way that pages missing from a book create a break in a story.

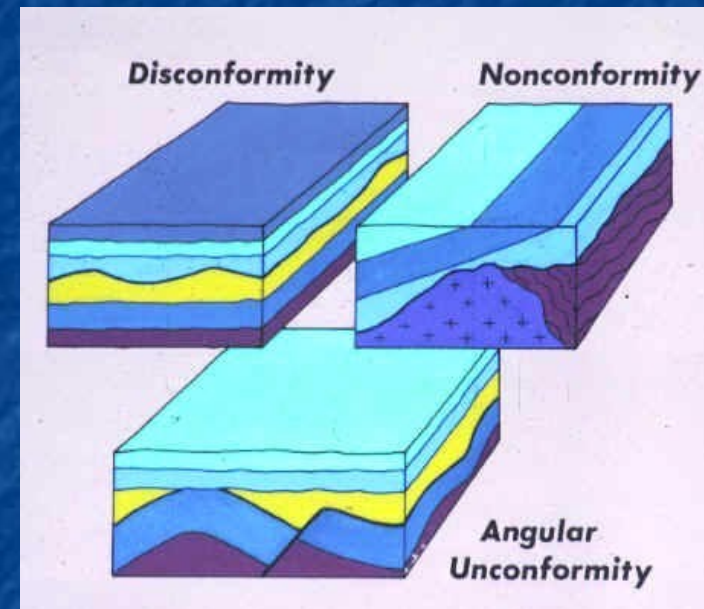
\*A break in the geologic record is called an **unconformity**. An unconformity shows that deposition stopped for a period of time, and rock may have been removed by erosion before deposition resumed.



# \*Unconformities

There are three types of unconformities.

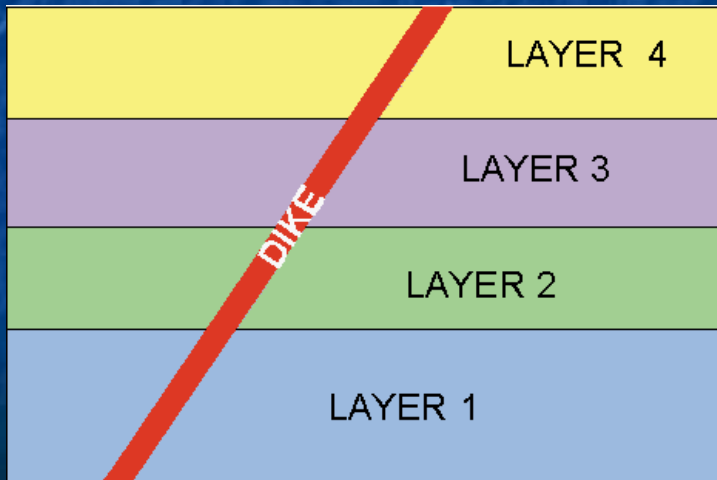
1. An unconformity in which stratified (layers) of rock rests upon unstratified rock is called a **nonconformity**.
2. The boundary between a set of tilted layers and a set of horizontal layers is called an **angular unconformity**.
3. The boundary between horizontal layers of old sedimentary rock and younger, overlying layers that are deposited on an eroded surface is called a **disconformity**.



According to the Law of Superposition, all rocks beneath an unconformity are older than the rocks above the unconformity.

# Crosscutting Relationships

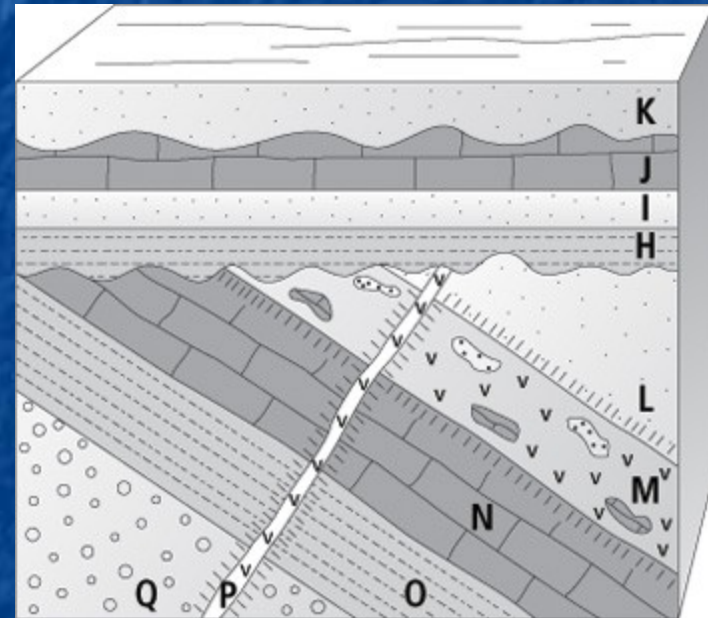
When rock layers have been disturbed by faults (a break or crack in Earth's crust) or intrusions (a mass of igneous rock that forms when magma is injected into rock and then cools and solidifies), determining relative age may be difficult. In such cases, scientists may apply the **Law of Crosscutting Relationships**. \*The **Law of Crosscutting Relationships** is that a fault or intrusion is always younger than all the rocks it cuts through above and below the unconformity.



# Relative Age

Based on what you now know about the Law of Superposition, the Principle of Original Horizontality, unconformities, and the Law of Crosscutting Relationships can you place the layers indicated in the diagram in the correct order, starting from the oldest layer?

The oldest layer is Q, followed by O, then N, then M, then L. P cuts across layers L-Q, so it is the next layer since it does not cut into layer H. Above the unconformity we then have layer H, followed by I, then J, with K being the youngest layer.





# \*Index Fossils

Paleontologists can use fossils to determine the relative ages of the rock layers in which the fossils are located. Fossils that occur only in rock layers of a particular geologic age are called **index fossils**.

To be an index fossil, a fossil must meet certain requirements:

1. It must be present in rocks scattered over a large region.
2. It must have features that clearly distinguish it from other fossils.
3. Organisms from which the fossil formed must have lived during a short span of geologic time.
4. The fossil must occur in fairly large numbers within the rock layers.

