

Name:

Date:

Period:

Relative Dating

The study of geology as a science is quite young as compared to other sciences like physics, astronomy, and biology. When thinking about geologic history and processes, people believed these events happened on human like timescales. It was difficult for anyone to fathom that the Earth could be drastically older. It was not until the late 1700's that scientists started accepting and studying the age of Earth and how the world around them was shaped geologically.

Who is James Hutton and why is he important to the study of geology?

James Hutton was an uniformitarian. Explain how uniformitarianism supports an old Earth?

Uniformitarianism helped scientist make observations and describe how geologic events occurred during the past, by relating it to what scientists observe today. This concept also enabled scientist to observe and claim the ages of different rock strata (layers). This is done through relative dating.

What is relative dating?

In order to determine the relative age of rocks, geologist need to use different principles to govern their observations.

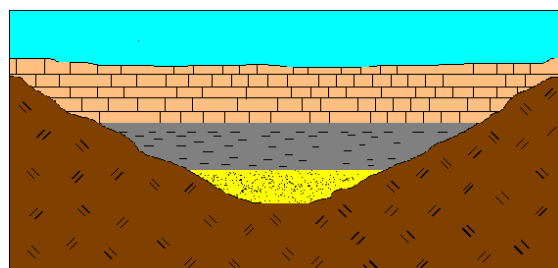
Principles of Determining Relative Age:

What is the principle of original horizontality?

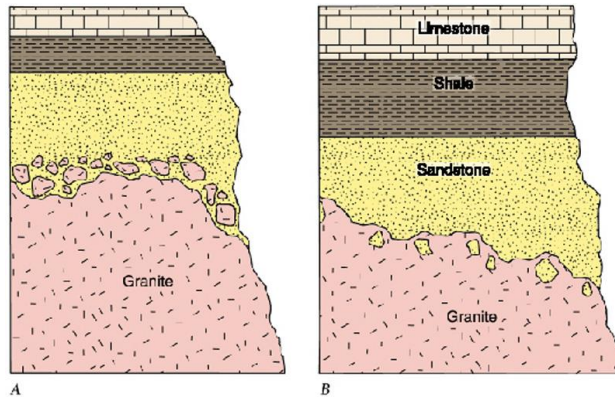


The sedimentary rocks in the Paleozoic part of the Grand Canyon were formed horizontally. Sometimes these horizontal layers experience outside forces and this causes them to tilt or bend

What is the principle of superposition? Number which rocks are the oldest and which are the youngest.
1 = oldest and 4 = youngest



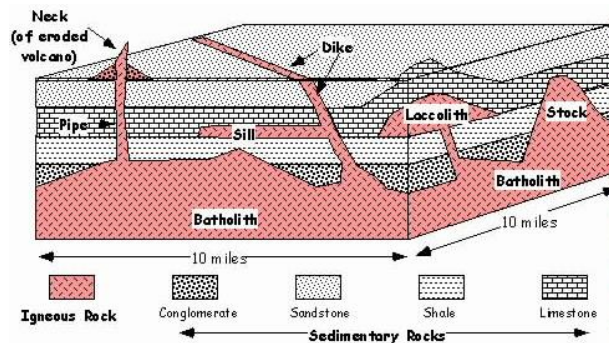
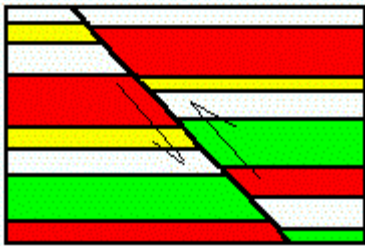
What is the principle of inclusions?



In picture A, is the sandstone or the granite older? Is the same in picture B? Why?

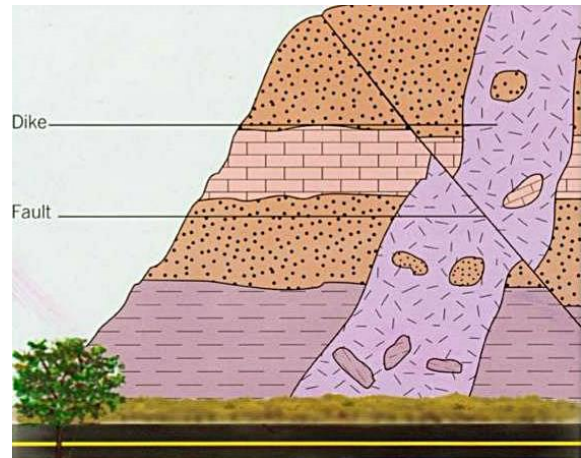
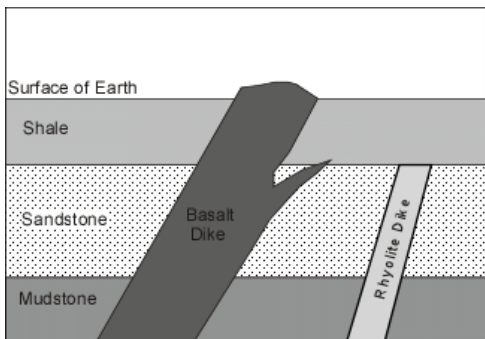
What is the principle of cross-cutting relationships?

These apply to the following two pictured items. They are what?



Practice using Cross Cutting Relationships:

Number which rocks are the oldest and which are the youngest where 1 is the oldest.



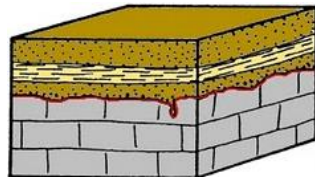
Relative Dating Part II

Yesterday, we discussed about four main principles to relatively date a cross section of rock strata. The principles or laws of original horizontality, superposition, cross-cutting relationships, and inclusions are all necessary in determine how to compare the ages of different rock layers. There are still different principles needed to be used to describe difference in times of rocks and looking for the similarities of the rock strata in a vast geographic area.

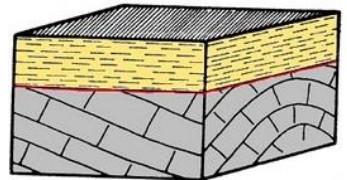
What is an unconformity and how do they occur in the observed rock strata?

There are three types of unconformities that exist to show relations of time gaps in the formation of different rock layers. The three types of unconformities are as follows: disconformity, nonconformity, and angular unconformity.

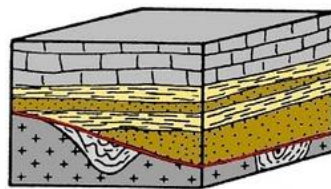
What is a disconformity?



What is an angular unconformity?

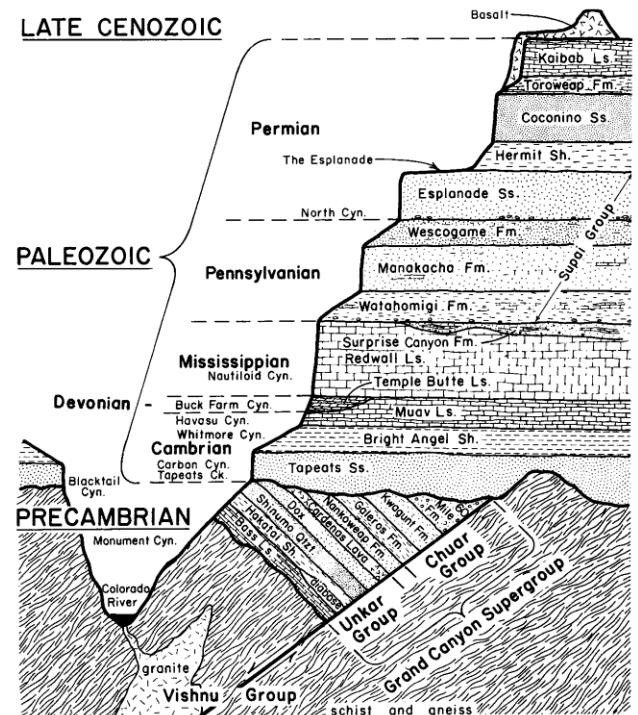


What is a nonconformity?



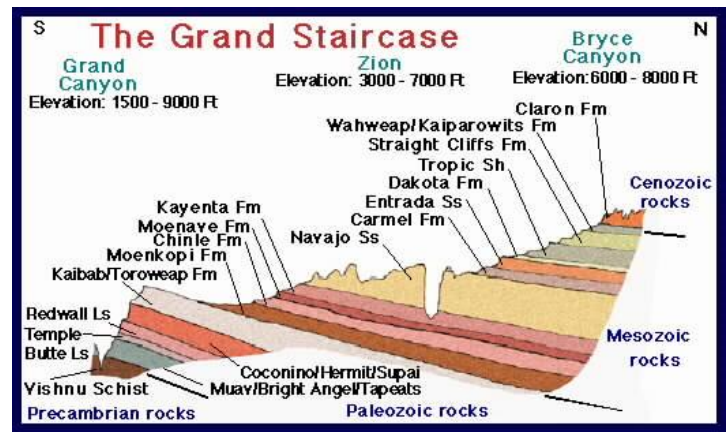
The Grand Canyon is a feature that is fortunate to display all three types of unconformities. Using three different colored pencils mark where the unconformities exist in the Grand Canyon. Make a key to show what colored boundary represents which type of unconformity.

Sometimes a rock layers or a species of a fossilized extinct (dead) organism can cover a large geographic area. These sources of data show how rocks are similar to one another and create correlation patterns.

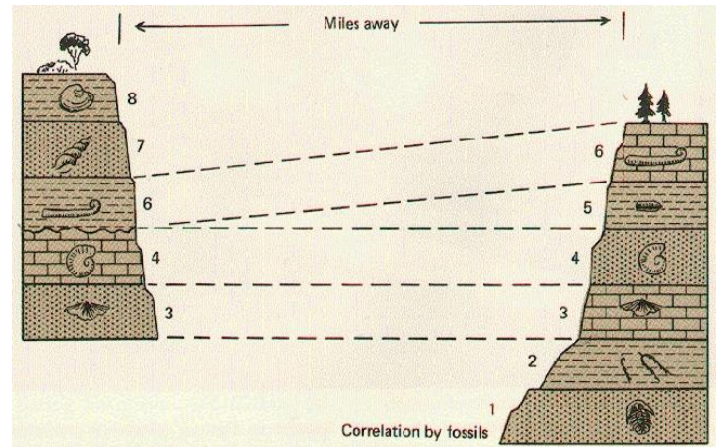


What is correlation?

What is key bed correlation?



What is fossil correlation?



Rules for Relatively Dating Rock Strata:

1.
2.
3.
4.
5.
6.

Absolute Dating

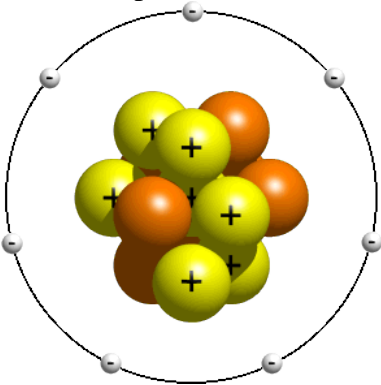
In the past couple of lessons, we learned how early geologists determined the Earth was much older than previously believed. We also discussed how geologists used certain principles to relatively date rock strata. Relatively dating uses the principles based on observation to determine how certain rocks are older than others. Today, we are going to discuss how we determine the actual age of rocks and fossils.

What is absolute dating?

How do we determine the age of rocks?

What is radioactivity?

Label the parts of an atom. What is an isotope and how does it pertain to radioactivity?



Purpose: To model the decay of a typical isotope with respect to half-life

Materials:

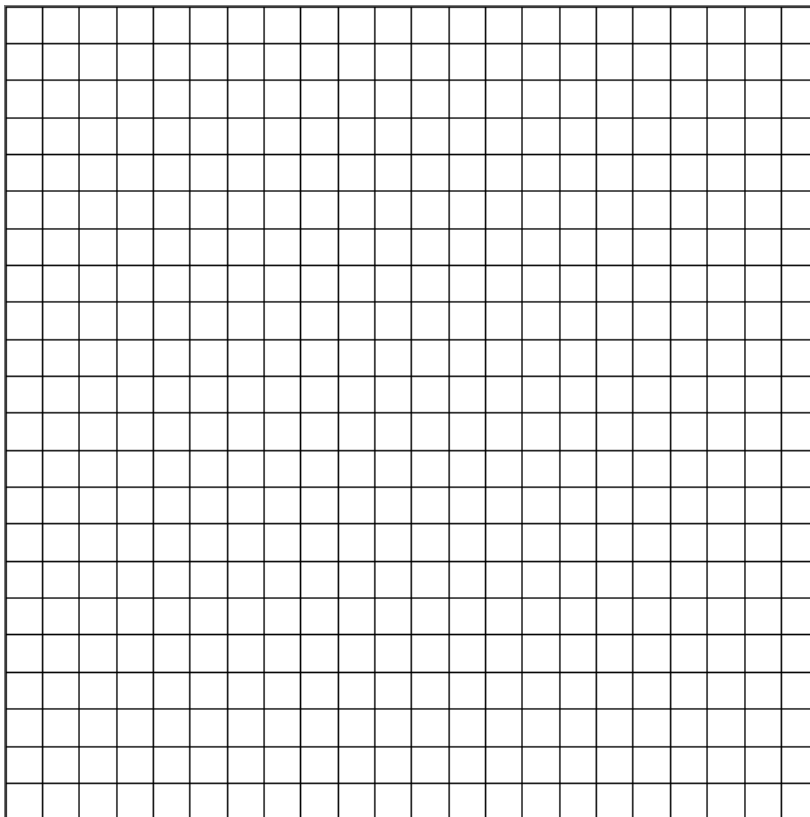
Cup of M&M's and a paper plate

Procedure:

1. With a partner, count the number of M&Mium isotopes in your study and record this number in the data table under *nondecayed isotopes* (radioactive).
2. Place the isotopes in the container and mix. Pour out on a clean surface. Remove the "m" up isotopes. Count the remaining candies and record in your data table as the number of undecayed atoms.
3. Return the "m" down isotopes (undecayed) to the cup. Mix up and repeat step 2.
4. Continue the process until all isotopes have decayed.
5. You may then eat your candies when both trials are completed.

Using the graph paper provided, construct a graph by plotting the number of half-lives as the independent variable (x axis) and the number of undecayed atoms as the dependent variable (y-axis). *Remember to label your x-axis, y-axis, and indicate a title for your graph.*

Trial	Undecayed (Radioactive)	Decayed Isotope
0		
1		
2		
3		
4		
5		
6		
7		
8		



***Graph both data points. Make a key for the two data points being graphed**

Interpret your graph. What does your data show you? How does this relate to absolute dating?

How radiometric dating is used to measure the age of geologic objects?

Explain what a half-life is.

What are parent and daughter isotopes? How are they used in radiometric dating?

What are some examples of radioactive elements that we use for radiometric dating?

Nature's ways of absolute dating

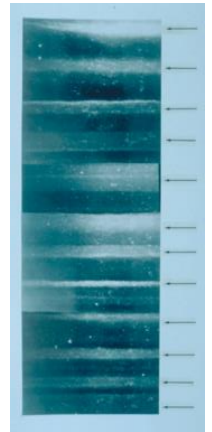
Tree Rings:

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-
-
- Thick = wet year and thin = dry year
- Used to compare the climates of different areas during correlating years; to show difference between environments



Ice Cores:

- Similar to tree rings but for colder/polar climates
-
-
- Thick = lots of precipitation and thin = little precipitation
- Records past climate situations in geologic history



Varves:

- Alternating light and dark colored sediments deposited from glaciers in lakes
- Carried by melt-water from glaciers
- Dark bands = winters and light bands = summers
- Summers are usually thick but winter band thickness depends on climate of the area



Fossils

What is a fossil?

What are the three ways fossils are formed?

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Ways fossils are formed:

Original Preservation:

-
- Examples: tar pits, ice, and amber (tree sap)

Mineral Replacement:

-
- Often calcite replaces original organic material

Recrystallization:

-
- Petrified wood: organic material gets replaced with hard minerals, but shape and look remain the same

Types of fossils:

Casts are:

Molds are:



What are index fossils?

- Fossils that are used to date rocks
- Can be microscopic or large; some of the best index fossils for dating rocks are microscopic. They can either be fossilized pollen grains or types of algae, plankton, and/or diatoms
- Criteria for being a good index fossil

- 1.
- 2.
- 3.
- 4.

