The Rock Record

- Geologists have divided the history of Earth into time units based upon the fossils contained within the rocks.
- The geologic time scale is a record of Earth's history from its origin 4.6 billion years ago to the present.











The Rock Record

Homo sapiens evolves; most recent ice ages occur; Grand Canyon forms.

Phanerozoic Eon

Cenozoic Era

Quaternary Period 1.6 M.Y.B.P.

Recent Holocene Epoch 0.01 M.Y.B.P. Pleistocene Epoch 1.6 M.Y.B.P.

Neogene Period 23 M.Y.B.P.

Pliocene Epoch 5 M.Y.B.P. Miocene Epoch 23 M.Y.B.P.

Paleogene Period 66 M.Y.B.P.

Oligocene Epoch 35 M.Y.B.P. Eocene Epoch 56 M.Y.B.P. Paleocene Epoch 66 M.Y.B.P.

Dinosaurs become extinct.

Dinosaurs are dominant; first birds appear; mountain building continues in western North America.

Mesozoic Era

Cretaceous Period 146 M.Y.B.P.

Jurassic Period 208 M.Y.B.P.

Triassic Period 245 M.Y.B.P.

Mammals are abundant; angiosperms are dominant; Alps and the Himalayas begin to rise.

Angiosperms appear; Rocky Mountains begin to form.

First mammals, and cycads appear; Atlantic Ocean begins to form, Pangaea breaks up. Many marine invertebrates become extinct; building of Appalachians ends; glaciers retreat.

Amphibians are dominant; glacial advances occur.

Corals and other invertebrates are dominant; warm, shallow seas cover much of North America.

Trilobites, brachiopods, other marine invertebrates are abundant; thick sediments deposited in inland seas.

*Millions of years before present

Paleozoic Era

Permian Period 290 M.Y.B.P.

Pennsylvanian Period 323 M.Y.B.P.

Mississippian Period
362 M.Y.B.P.

Devonian Period 408 M.Y.B.P.

Silurian Period 439 M.Y.B.P.

Ordovician Period 510 M.Y.B.P.

Cambrian Period 540 M.Y.B.P.

Precambrian
Time
Proterozoic Eon

2500 M.Y.B.P.

Archean Eon

4600 M.Y.B.P.

Reptiles evolve; coal swamps form; shallow seas begin to withdraw.

Fish are dominant; first amphibians; Appalachians continue to form in North America and Europe.

First land plants form, first insects.

First fish appear; Appalachians begin to form.

Ediacara organisms develop.

Bacteria-like organisms form; several episodes of mountain building occur.













Geologic Time

The time scale is divided into units:

- An eon, measured in billions of years, is the longest time unit of the geologic time scale.
- An era, defined by the differences in life-forms found in rock and measured in hundreds of millions to billions of years
- Periods, measured in tens of millions of years to hundreds of millions of years, are defined by the life-forms that were abundant or became extinct during the time.
- Epochs the smallest unit & are usually measured in millions of years to tens of millions of years.











Section Assessment

1.Match the following terms with their definitions.

____ **©**on

____ period

___ era

___ epoch

- A.time periods defined by the life forms that were present; usually measured in terms of tens of millions to hundreds of millions of years
- B.smaller divisions of time; usually measured in millions to tens of millions of years
- C.the longest period of time; measured in billions of years
- D.second longest period of time; measured in hundreds of millions to billions of years













Relative-Age Dating of Rocks

he principle of uniformitarianism states that the forces that continually change the surface features of Earth today have been occurring since Earth formed.













Principles for Determining Relative Age

 The concept of relative-age dating places the ages of rocks and the events that formed them in order, but without exact dates.

This is done by comparing one event or rock layer to another.











Principles for Determining Relative Age

Geologic Principles



The principle of original horizontality states that sedimentary rocks are deposited in horizontal or nearly horizontal layers.

The principle of superposition states that in an undisturbed rock sequence, the oldest rocks are at the bottom and each successive layer is younger than the layer beneath.









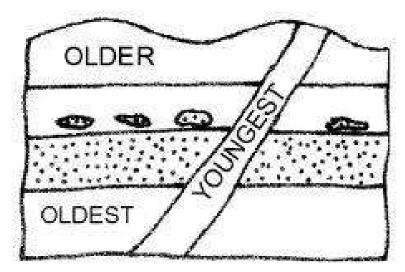




Principles for Determining Relative Age

Geologic Principles

The principle of cross-cutting relationships states that an intrusion or a fault is younger "an the rock it cuts across.















Other Means of Determining Relative Age

Correlation of Rock Strata



- Correlation is the matching of outcrops of one geographic region to another.
- Geologists examine rocks for distinctive fossils and unique rock or mineral features to help correlate the rock layers.
- Correlation allows geologists to accurately locate that same rock layer in another location.











Section Assessment

1. Match the following terms with their definitions.

____ riginal horizontality

___superposition

____ Rnconformity

correlation

- A.principle which states that sedimentary rocks are deposited in horizontal layers
- B.a gap in the rock record
- C.principle which states that oldest rocks are at the bottom and that each successive layer is younger
- D.matching of outcrops from one geographic region

to another







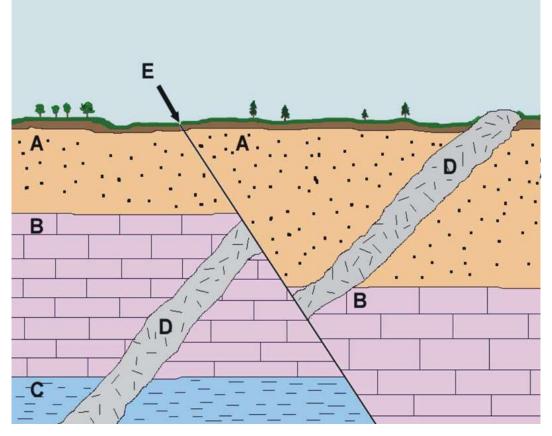






Section Assessment

2. What rock layers are the oldest? The Youngest?













We will Take A Break From Notes

- We will work on the Relative Dating Activity from the Worksheet Ms G is handing out.
- 30 minues













Absolute-Age Dating of Rocks

 Absolute-age dating enables scientists to determine the actual age of a rock, fossil, or other object using the decay rate of radioactive isotopes.





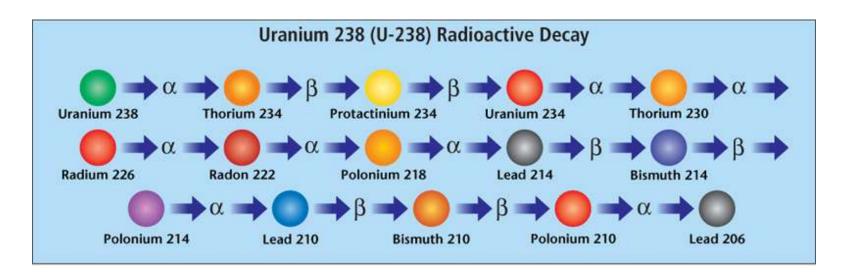






Absolute-Age Dating of Rocks

Radioactive decay is the emission of radioactive particles and the resulting change into other elements over time.













Use of Radioactive Isotopes

An a process called radiometric dating, scientists attempt to determine the ratio of parent nuclei to daughter nuclei within a given sample of a rock or fossil to determine its absolute age.

Because it often takes a long time for the entire amount of an isotope to decay, geologists use the half-life of an isotope.











Use of Radioactive Isotopes

Palf-life is the length of time it takes for one-half of the original amount of an isotope to decay.

Table 21-1 Half-Lives of Selected Radioactive Isotopes				
Radioactive Isotope	Approximate Half-Life	Decay Product		
Rubidium-87	48.6 billion years	Strontium-87		
Thorium-232	14.0 billion years	Lead-208		
Potassium-40	1.3 billion years	Argon-40		
Uranium-238	4.5 billion years	Lead-206		
Uranium-235	0.7 billion years	Lead-207		
Carbon-14	5730 years	Nitrogen-14		











Use of Radioactive Isotopes

Carbon-14

- Carbon-14 (C-14) is a radioactive isotope that is commonly used to determine the absolute age of an object, especially one that is of organic origin.
- C-14 is accurate for dating objects up to 75 000 years old.

	Percent Parent Element	Percent Daughter Element	Elapsed Years	Number of Half-Lives
Time 1	100	0	0	0

Table 21-2 Radioactive Decay of Carbon-14 to Nitrogen-14

Time 2 50 50 5730 1
Time 3 25 75 11 460 2
Time 4 12 5 87 5 17 190 3













Remains of Organisms in the Rock Record

once-living plants or animals.

The fossil record provides evidence of

👝 evolution.

Evolution is an adaptive change in the DNA of populations as a result of mutation and/or

Fossils preserved in the rock record also provide information about past environmental conditions and can be used to correlate rock layers from one area to another.













Possils with original preservation are the soft and hard parts of plant and animal remains that have not undergone any kind of change since the organisms' deaths.

Such fossils are uncommon because their preservation requires extraordinary circumstances such as freezing, drying out, or oxygen-free environments.











Altered Hard Parts























Molds and Casts























Indirect Evidence of Past Life

- Trace fossils are indirect evidence of plant and animal life.
- Trace fossils can provide information about how an organism lived, how it moved, or how it obtained food.











