7th Grade Unit 3: Earth’s History

*lesson 1: How do we learn about Earth’s history?*

*vocab: uniformitarianism, fossil, trace fossil, climate, ice core*

The principle/law of uniformitarianism

* says that geological processes that are happening today

happened in the past at the same rate and in the same way

* ex. of geological processes weathering, minerals forming rock,

rock cycle, deposition

* catastrophism (think catastrophe)- says that there are some events that effect

the geologic record that happen suddenly or randomly

* scientist use that rate/speed that rock processes happen to estimate the age of

the Earth

* the Earth is 4.6 billion years old

Sedementary rock is the only type of rock that holds evidence of living things

Preserving once living things

fossil- trace evidence or the remains of once living things preserved in sedimentary rock

* trapped in amber- a living thing gets stuck in tree sap; it hardens and

is preserved in sediment (usually bugs or small lizards)

* trapped in asphalt- a living thing gets stuck in tar; it hardens and

is preserved in sediment (no older than 40,000 years, think mammoths)

* buried in rock- a living thing gets buried quickly after death by sediment;

it hardens and is preserved (only preserves the hard portions of the body)

* become petrified- over time minerals sink into the once living things remains

and turn the remains to stone

* become frozen- once living thing freezes and stays frozen; found where there is

permafrost (permanently frozen ground) (ex. Otzi the Iceman)

Trace fossils- a fossilized structure that formed in sedimentary rock by animal activity

* formed in very soft sediments
* ex. tracks and foot prints, burrows, and animal dung
* tracks can tell you if the animal was social, the paths it moved in, size and speed
* coprolite is fossilized animal poo
* trace fossils tell you about an animal's behavior

Fossil tell us:

* clues to the past called the fossil record
* only shows part of the past b/c fossilization is rare
* don’t have record of every organism
* show environmental changes over time; ex. fish fossils in a desert
* show changes in life forms over time; compare living things to fossilized things

Sedimentary rock shows Earth’s history

* sedimentary rock gets made from sediment (broken down rock) that cements together

by minerals in water or pressure

* the layers build up oldest to youngest
* composition (make-up) of the rock tells what kind of sediment created the layer; it shows

us the source of the sediment or what was the environment like in the past

* texture or the rock tells us how it got laid down; wind, water, and the direction it was moving
	+ ripple marks-record the motion of the wind or water
	+ mud-cracks- show where water evaporated and left behind mud to turn to rock

Earth’s surface can tell us about the past

* continents move
	+ were together; called Pangea
	+ looks like puzzles pieces, there are fossils of the same species on different

continents, same kinds of rock on diff. continents, Mt. ranges line up

across continents

* landforms change over time
	+ as continents move they push together creating Mt. ranges
	+ as they pull apart and slide past each other they create volcanoes
	+ forces on Earth build up and break down landforms
	+ rough becomes smooth over time
	+ small fast rivers become big and slow

Other materials that tell us about Earth’s history:

* Ice caps near the poles form as snow compacts and turns to ice as it builds up
	+ ice core-a long cylinder of ice drilled by scientists from a place like a glacier
	+ show the layers that the ice was laid down in; thick layer = more precipitation

or a wetter rainier/snowier year

* + ice traps gases from the atmosphere and soot and dust showing evidence of

pollution levels

* trees grow a layer of new wood each year creating rings
	+ tell the age of the tree (some over 2000 years)
	+ thick rings mean lots of growth that year shows environment was

good for plant growth

* + thin rings show poor conditions (temp., amount of rain etc.)
* sea-floor sediment forms as material sinks to the bottom of the ocean
	+ gets drilled out like an ice core
	+ contains fossils of microscopic organisms that show environmental conditions
	+ some microorganisms like warm environ. and will be present it the ocean was warm

at the time that layer was laid down

* + the chemical composition of the sediment can give clues to what the water was like

(ex. how salty?) and the atmosphere (ex. lots of oxygen in water lots of oxygen in air)

*lesson 2:How are the relative ages of rock measured?*

*vocab: relative dating, superposition, unconformity, fossil, geological column*

relative dating- giving a comparative date to an object or layer based on its position in the layers

* gives a date as older or younger than something else
* gives an estimated age based on the ages of the things around the object

Relative dating works using the law of superposition

* sedimentary rock gets laid down in horizontal layers
* as new sediment gets laid down the old sediment is buried under it
* superposition- says that rock layers go from oldest at the bottom to the youngest at the top
* superposition work for undisturbed rock (has stayed in the same place over time)

Disturbances in rock layers

* tilting- rock moves up/down unevenly; causes slanted layers
* folding- bending of rock as it gets pushed together; causes a zig-zag in layers
* fault- a break or crack in the rock; allows igneous rock to fill in the gap
* intrusion- an area where igneous rock has filled in a fault
* unconformity- a break in the geologic record where the rock layer has been

 eroded or where sediment wasn’t deposited for a long time (missing layer)

Fossils (traces or remains of a once living thing preserved in sedimentary rock) show changes over

time. They get grouped and classified by the relative ages of the rock they are found in. Rock with

organisms similar to modern organisms is typically younger than rock with more primitive organisms.

* geological column- an ordered arrangement of rock layers that is based on the relative age

 of the rocks within it with the oldest layers on the bottom and youngest on the top

* can be made from different locations and makes an ideal image of what

 the rocks layers would look like (fitting rock layers like a puzzle)

* scientist use matching types of rock to compare and help give relative dates to fossils

*lesson 3: How is the age of rock measured?*

*vocab: absolute dating, half-life, radioactive decay, radiometric dating*

absolute dating- determining the actual age of an event or object

* several methods used
	+ radioactive decay- breakdown of a radioactive element into a stable one
		- usually happens when extra neutrons are turned into protons which

 releases an electron

* the radioactive element is called the parent isotope the stable element

 that is created is called the daughter isotope

* the decay happens at a set rate that depends on the type of parent isotope
* half-life- the time needed for half of a sample to decay into daughter isotopes
* radiometric dating- finding the absolute age of an object or event by finding the relative

 percentages of parent and daughter isotopes

* ex. Given a sample that has a half-life of 10 million years

 You test and find that 50% has decayed into daughter isotopes

 How many half-lives have passed? How old is your sample?

 50/50= 1 half life; 75/25=2 half-lives; 87.5/12.5=3 half lives

Types of radiometric dating

* need to know age range bc some isotopes half-lives are too big or small
* also depends on the material itself; not all things have all the types of isotopes
* radiocarbon dating:
	+ can only date organic remains (bones, shells, teeth)
	+ parent isotope is called Carbon-14; daughter is called Nitrogen-14
	+ during life CO₂ gets absorbed into the body; takes in equal amounts of C-14 and C-12
	+ when they die they no longer absorbs C-14 and it turns into Nitrogen-14
	+ the clock starts the day it dies; the date you get is how long the organism has been dead
	+ carbon’s half life is 5,730 years
	+ can be used for things younger than 45,000 years
* potassium-argon dating:
	+ radioactive parent isotope is called potassium-40
	+ stable daughter is called argon
	+ potassium’s half life is 1.25 billion years
	+ used to date igneous rock between 100,000 and billions of years
	+ the date marks the moment the rock cooled from magma/lava
* uranium-lead dating
	+ radioactive parent isotope is called uranium-238
	+ stable daughter isotope is called lead-206
	+ for testing igneous rock between 100 million and billions of years
	+ half life is 4.5 billion years

We can use radiometric dating to date rocks on Earth. But some have been eroded or

weathered or melted back into magma. But we can date rocks from outside of Earth to give

us clues to Earth’s age too! A meteorite found in Antarctica was dated at 4.5 billion years old.

Index fossils determine the date of sedimentary rock

* can use igneous rock above and below the sedimentary rock layer
* can give an absolute age to the rock with the types of fossils that are in it
* an index species is an organism that lived during a short period of time and

 was very common over a large area

* index species may have special traits that make them easy to identify
* index fossil is used to date the rock layer it was found in
* used as markers of time in the geological column
* ex. *Tropites* an ancient squid lived 230-208 mya; if in a rock layer than the

 layer would be 230-208 million years old

 ex. trilobite that lived 405-360 mya found in a layer in AZ and found in a layer in PA

 would make both the rock layers about the same age

*lesson 4:What is the geologic time scale?*

*vocab: geology, geologic timescale*

geology- the scientific study of the origin, history, and structure of Earth and the processes

that shape it

Geologist describe/study Earth by the rate of changes

uniformitarianism is change occurring gradually

catastrophism is change that happens suddenly

geologic time scale- a division of Earth’s history into intervals of time defined by major

events or changes on Earth; a way to organize Earth’s history

4 Eons: Hadean,Archean, Proterozoic, Phanerozoic

First 3 are part of the super eon called the Precambrian (90% of Earth’s history)

Phanerozoic eon is divided into 3 eras : Paleozoic, Mesozoic, Cenozoic

Eras are divided into periods that are divided into epochs

many periods in geologic time end w/ an extinction event

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