

Name: \_\_\_\_\_ Unit 3: Weather, Climate & The Atmosphere

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### FOCUS: Climate Change

**ESSENTIAL QUESTION:** Can you describe the factors that contribute to climate change? Can you describe what we know about climate change from ancient ecosystems and how that affects our study of climate today?

#### What do we already know?

- Climate is the average year after year condition of <sup>s</sup>  
temp., precipitation, wind, and  
clouds in an area.

- The climate in a particular location is influenced by that location's  
(elevation) altitude, latitude, proximity to  
large bodies of water, and  
mountains, currents.

- Changes in these and other factors can result in a permanent climate change.

#### Studying Climate Change

- We can better understand climate change today by studying climate change in ancient ecosystems using three methods:

- tree rings
- ice cores
- pollen



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• Tree rings: annual rings of xylem and phloem that form around a tree's trunk

1) Counted to determine a

tree's age

2) Thickness

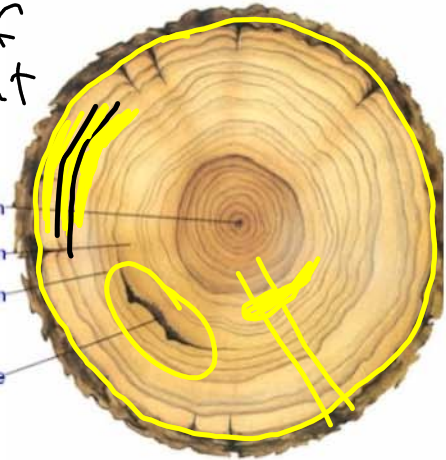
gives clues about ancient

climates:

▪ Thickest rings = \_\_\_\_\_ year

▪ Thinnest rings = cold, dry year

first year growth  
rainy season  
dry season  
scar from forest fire



• Ice cores:  
Cylinders of ice drilled & removed from glaciers & polar ice sheets.

3) Glaciers form when snow

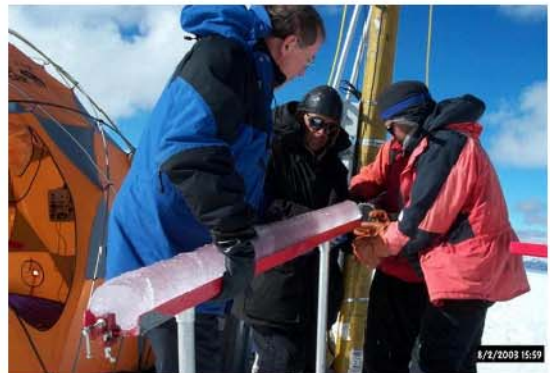
builds up year after year and does not melt during the summer.

Over time, its own weight causes it to compress into ice.

4) The ice forms layers indicating the yearly seasons, similar to rings on a tree.

5) Layers can be analyzed for:

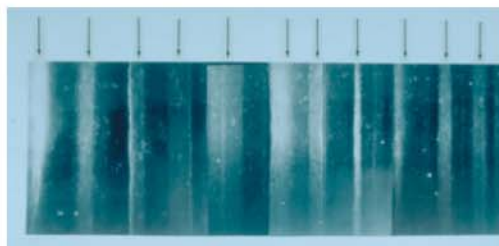
▪ Levels of dust, ash, and sulfur to determine when and where ancient volcanoes erupted.



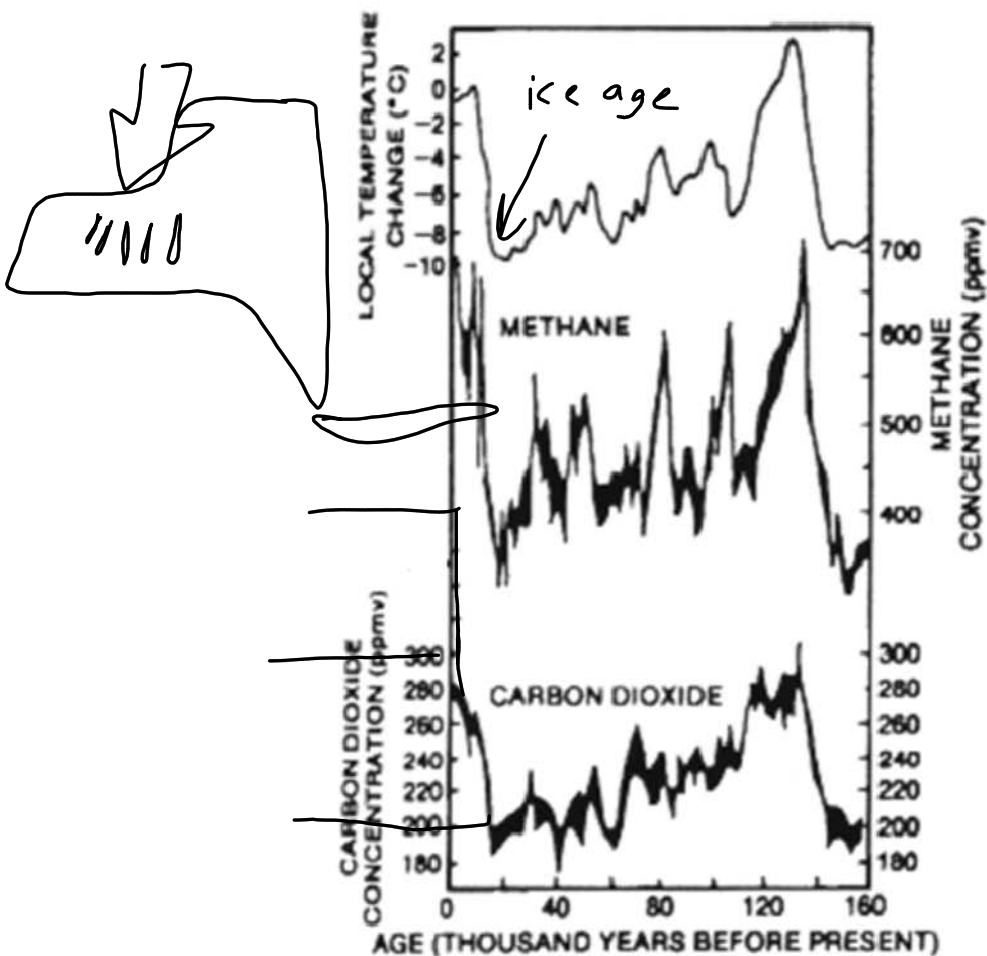
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- Levels of Carbon dioxide and Oxygen to determine relative global temperatures at the time the snow fell.



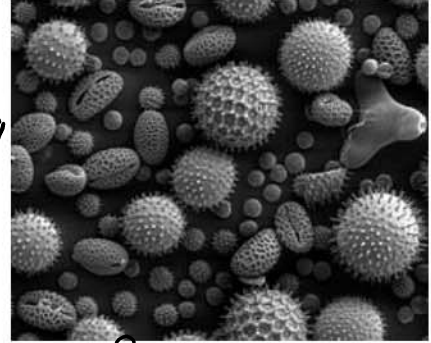
- Levels of methane to determine if wetlands were abundant (an indication of a warmer planet)



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• Pollen: the male reproductive cell of plants released into the air during pollination



- 1) The unique DNA of each plant species can be found within each pollen grain.
- 2) Pollen grains are very hardy and can be found fossilized in layers of sedimentary rock, frozen in ice cores, or in layers of sediment at the bottoms of lakes and ponds.
- 3) The study of ancient pollen by *palynologists*, *paleoecologists*, and *paleoclimatologists*, can tell us about the types of plants that existed in ancient climates and, therefore, the types of climates those plants grew in.
- 4) Ex: Pollen from a tropical plant found in core samples in a polar location indicates that the climate there was once much warmer.

#### Historical Examples of Climate Change

- 1) Ancestral Pueblo Indians:



▪ Flourished around the year 1000, evident by the building of their intricate cliff dwellings in the Southwest United States.



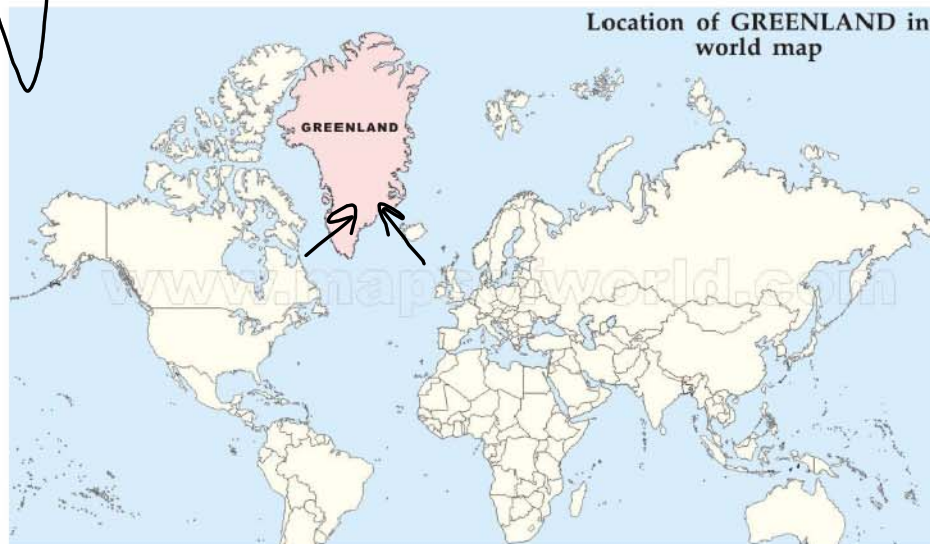
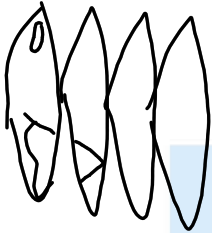
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- They had to deal with several periods of intense drought in the 1200s, causing them to abandon their pueblo cities.
- Evidence of this climate change is found in several years of narrow tree rings.

2) Greenland:

- Today, Greenland is covered with thick glaciers, but 80 million years ago, Greenland had a warm moist climate.
- How do we know?
  - Fossils of magnolia and palm trees found in rock layers.
  - ~~High  $CO_2$  levels found in~~



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### Natural Causes of Climate Change

- Major climate changes in geologic history can be connected to four causes:

1. Earth's Position:

- As it revolves

around the sun, the time of year when

Earth is closest to the

sun shifts from January to July and back again over a period of 23,000 years.

- The angle of Earth's axis and the shape of Earth's orbit change slightly over long periods of time.

- Expected to be the main causes of Earth's ice ages.

2. Solar Energy:

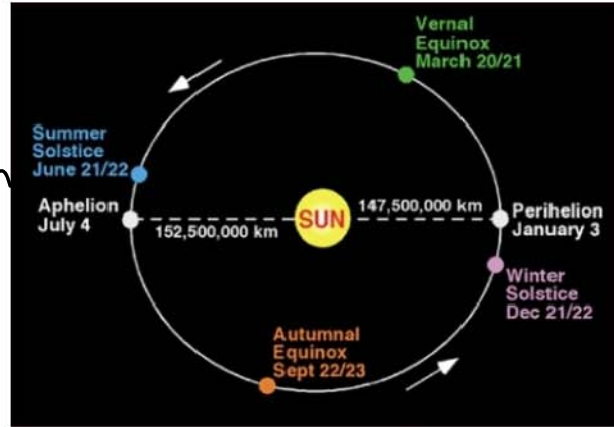
- Sunspots increase

and decrease in a periodic

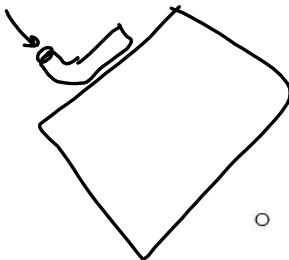
11-year cycle that can be linked to short-term climate changes.

- More sunspots =  
More energy produced by the  
Sun = warmer

temperatures on Earth



$23\frac{1}{2}^\circ$   
 $22^\circ - 24^\circ$   
ice ages  
41,000 years



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### 3. Volcanic Activity:

- Major volcanic eruptions release large amounts of gas and ash into the atmosphere.
- Materials in the upper atmosphere can filter out solar radiation, leading to cooler temperatures on Earth.

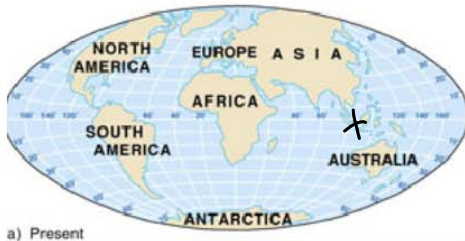


### 4. Movement of continents:

- According to the Theory of Plate Tectonics

Earth's continents were once joined together in a single

supercontinent called Pangaea (~225 million years ago).



- As the continents broke apart, lands that were once very close to the Equator are now found in Polar climates (Ex: Greenland).

Movement of continents changes global wind and ocean current patterns, both of which greatly affect climate.

- As the continents continue to move, climate will continue to change.

