

Chapter 18: Amazing Ice: Glaciers and Ice Age

- ❖ Glaciation and Global Warming
 - How are these related?
 - What is weather?: day to day variation in the atmospheric conditions
 - What is climate?: long term average of all weather events including the variability
- ❖ Continental Glaciation: The Last Ice Age
 - Areas of erosion and deposition.
 - US = mainly depositional
 - Max ice thickness = 3-4 km
 - During the last ice age, the sea level drops. Pulls water from ocean and locks it up as ice in glaciers.
 - Land surface expanded 18,000 years ago during the last ice age because sea level dropped 85 meters.
- ❖ Climate Change and Ice Ages
 - Long-Term Causes (Cause of Ice Age)
 - Large landmasses at or near poles
 - Land surfaces of relatively high elevation
 - Nearby oceans to provide moisture as snow
 - = PLATE TECTONICS
 - Polar continents allow buildup of land ice
 - When there are fewr continental bodies on the poles, the ice cannot build up
 - Short-Term Fluctuations (Glacial and Interglacial Periods within ice ages)
 - Eccentricity of orbit - earth's path around the sun changes from a circular to elliptical orbit (100,000 year cycle)
 - low eccentricity: more circular
 - high eccentricity: more elliptical
 - Tilt of the Earth's axis of rotation varies from 21.5 to 24.5 degrees (41,000 year cycle)
 - Reason for seasons
 - More tilted = extended dark times
 - Precession: Earth's axis wobbles like a top (23,000 year cycle)
 - More precession = extended dark times
 - "Milankovitch Cycles"
 - Moderate term fluctuation glaciation every 100,000 years
 - Shorter ones every 20,000 years
 - Shorter-Term Fluctuations
 - Volcanism

- Sun spot activity
- Reflectivity of Earth's surface
- Disruption of thermohaline currents due to decreasing evaporation & increasing salinity

❖ Climate Change and Ice Ages

- Other global effects include the circulation of water in the oceans.
- Information about glacial periods can be derived from fossils in sediment from the ocean floor.
- Isotopic Record of the Ice Volume
 - The global ice volume increases during glaciations
 - Ice on the continents is enriched in Oxygen-16
 - Water in the oceans is depleted in Oxygen-16
 - Calcareous ooze from the ocean floor contains a record of these isotopic variations (Calcite in calcareous; calcite is oxygen, calcium, and nitrogen(?).)
- Dendrochronology - looking at trees' rings, fossils, species, etc.
 - Climate data back to about 8K-10K years ago
 - 1 ring = 1 year
 - Certain trees are only found in certain areas
- Ice Core Basics
 - Incorporation of Air in Polar Ice
 - Records of CO₂, CH₄, and N₂O

❖ The Earth's Glacial History

- Precambrian (~2.2 billion years ago)
 - Evidence - layer of tillite
- Permian (~245-286 Ma ago)
 - Striations on bedrock + tillites found on Australia, S. America, India and Africa
 - Evidence of Pangea
- Quaternary (~1.8 Ma ago, cooling began about 50 Ma ago; now suggest glaciation began 3 Ma ago)
 - N. American Ice Sheet stripped soil, sediment, and bedrock. Glacial max ~20K years ago
 - Ice Sheet began retreating about 12K years ago (interglacial period)

❖ Additional Effects of Glaciation

- Changes in Sea Level
 - Sea level falls during glacial periods
 - Sea level rises during interglacial periods
- Changes in Landscape
 - The Great Lakes

- The Channeled Scablands
- ❖ What is the greenhouse effect?
 - What gas(es) help increase this effect?
 - CO₂, methane (& H₂O vapor)
 - Does this have an effect on Earth's temperature?
 - Yes
 - How much?
 - 33 degrees Celsius
- ❖ Is humanity contributing to the warming of the Earth? In other words are we causing global warming?
 - Probably - the basic definition of global warming is that Earth's temperature is rising. It does not differentiate between natural and man-included effects
- ❖ Is the climate change that is recorded really significant?
 - This is a highly debated topic.
The last time there has been this high of concentration of CO₂ in the atmosphere was about 40-50 million years ago. In the geologic past there have been times that greatly exceeded this concentration, but it is the rate that the CO₂ is increasing which is troubling.

Chapter 8: Earthquakes

- ❖ Why should you be concerned with earthquakes?
 - They can kill us...
- ❖ Earthquakes and Plate Tectonics
 - 95% of energy from earthquakes affect narrow zones along the boundaries
- ❖ What causes earthquakes?
 - Earthquakes: vibrations of the ground created by the sudden release of strain energy accumulating in deformed rocks.
 - Where does the strain come from?
 - Strain: the accumulation of stress energy
 - Types: elastic, brittle, plastic
 - Earthquakes can be on all fault types
- ❖ What is an earthquake?
 - Fault: crack in Earth where slip occurs
 - Earthquake: vibrations produced during slippage along a fault
 - Earthquake focus: fault slip location
 - Earthquake epicenter: point on the surface directly above the focus
 - May not even feel anything (like eye of a storm)