

Lecture 2: History of Ice on Earth

GES-441

Long-Term Ice Ages

Ice ages in PreCambrian (prior to 570 my ago), Ordovician-Silurian (~440 my), Permo-Carboniferous (270-300 my), and Cenozoic (0-~50 my)

Much warmer in Mesozoic, 6-12 degrees C globally, much more at poles.

Causes of Long-Term Ice Ages

- 1) Variations in solar radiation due the passage of the solar system through hydrogen-rich clouds
- 2) Changing atmospheric CO₂ due to tectonics
volcanoes produce CO₂ - cause warmer temperatures
weathering of silicate rocks removes CO₂ - causes colder temperatures
- 3) Changes in land distribution and elevation
higher elevation = cooler, more snowfall, higher albedo
continents over the poles favor ice-sheet development
well-connected seaways that can transport heat to the poles favor warm temperatures
- 4) Extraterrestrial causes - comet or meteorite impacts

Cenozoic Ice Age

Structure of Cenozoic climate - climate deterioration since 50 my ago, with jumps at ~23 my, 14 my, and 2.5 my ago
characterized by the development of large, temperate ice sheets

Structure of the last 125,000 years