In 1837, Louis Agassiz developed a radical new hypothesis ...

"theory of the ice ages"

Glaciers are made of compressed, recrystallized snow, usually carrying a large load of sediments.

Where Glaciers Form

- Glaciers form at high elevations and high latitudes.
- Glaciers range in length and width from several hundred to thousands of kilometers.
- Glaciers form at very high elevations at latitudes of about 65-75 degrees.

Glaciers range in size from small patches of snowpack to large ice sheets.

Glaciers form in regions where winter snow does not completely melt in the summer — above the snow line.

- Requirements:
  - Cold temperatures
  - Polar latitudes
  - High elevations
  - Sufficient snow

Sufficient snow is critical. In cold, arid climates like the southwestern United States, growth of glaciers is limited by the lack of snow and cold temperatures.

- Alpine glaciers typically form on the wet side of the mountains.
- Flat areas where snow can accumulate (snowfields).

Where do Glaciers Form?

- Sea level
- C2: Ellesmere Island
- D2: Tierra del Fuego
- E2: South Pole

Glaciers form at high elevations and high latitudes.

Vestiges of the Last Ice Age

- Glaciers are present on every continent except Australia.
- ~160,000 glaciers are found today.
- ~46 of the world's countries have glaciers.
- >94% of Earth's ice is in Greenland and Antarctica.

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Glaciers form on land, undergo internal deformation, and create glacial landforms. As ice moves, it erodes the underlying crust. PLUCKING and ABRASION. 

Ice moves through the interior of a glacier as if on a one-way conveyor belt. Glacier Mass Balance (relative rate of accumulation and wastage).
Identify the Glacial Landforms

Erosional Features

Depositional Features

Glacial Till
Terminal, Lateral, and Medial Moraines

U-shaped Glacial Valley

Esker...
Earth's Recent History Has Been Characterized by Cycles of Ice Ages and Interglacials.

- **Ice Age Temperature Changes**
  - Graph showing temperature changes over thousands of years.

- **Greenland, during MIS 5e**
  - Map showing ice sheet morphology.

**Foraminifera - CaCO₃**
- O₁₆ easy to evaporate and easy to precipitate
- O₁₈ difficult to evaporate and difficult to precipitate

**Deep Sea Drilling**
- Images of drilling equipment and samples from the sea floor.

- Near the poles, atmospheric water vapor is displaced into O₁₈.
Layer by layer sampling of oceanic sediments reveals oxygen isotope record. The ratio of oxygen isotopes in glacial ice and deep-sea sediments is a proxy for global climate history.

Glacial–Interglacial cycles are controlled by the amount of solar radiation reaching Earth.

During the last interglacial, climate was warmer and sea level higher than at present.