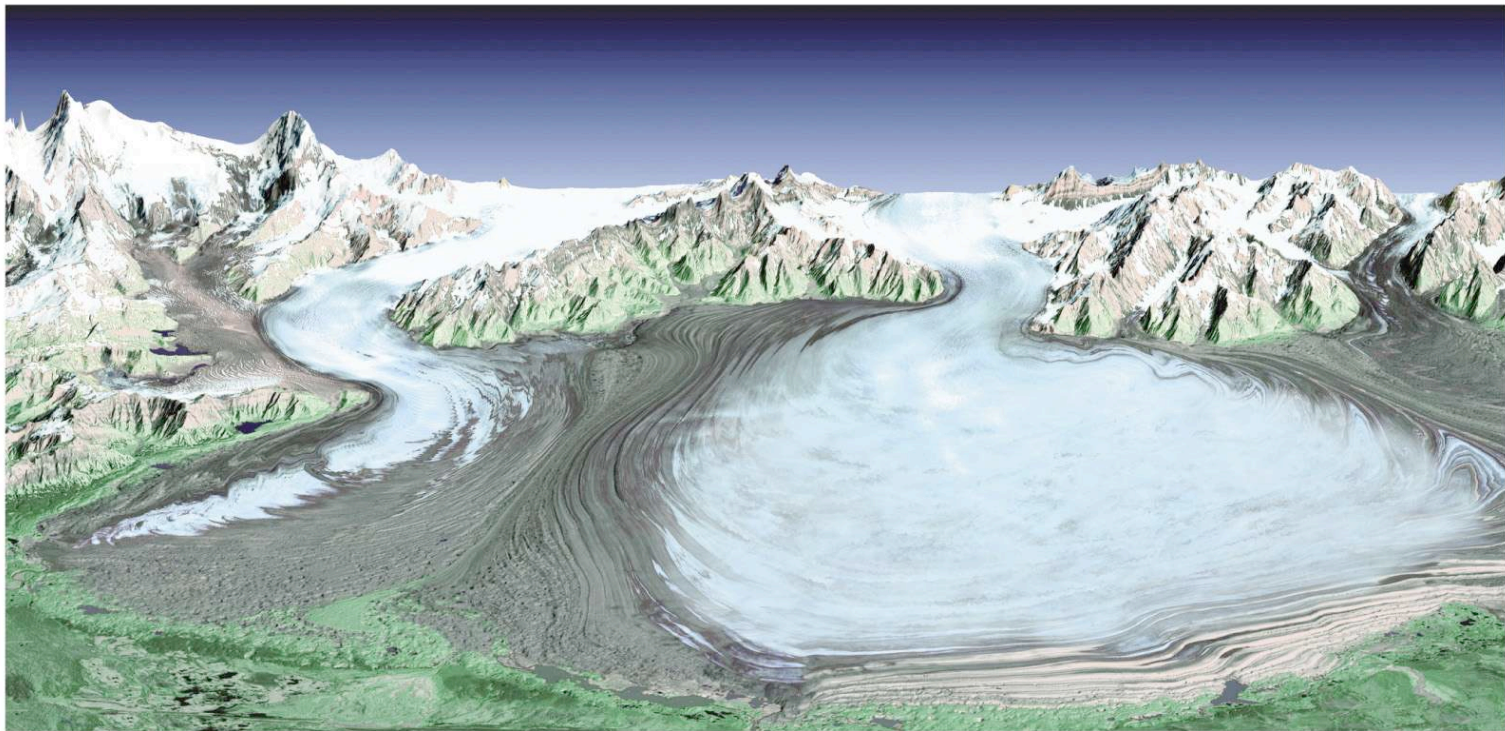


Chapter 18

Glaciers and Glaciation



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Glaciers

■ **Types of glaciers**

- **Valley (alpine) glaciers**

- **Exist in mountainous areas**
- **Flow down a valley from an accumulation center at its head**

- **Ice sheets**

- **Exist on a larger scale than valley glaciers**
- **Two major ice sheets on Earth are over Greenland and Antarctica**

Glaciers

- **What if the ice on Earth melted?**
 - **Slightly more than 2 percent of the world's water is tied up in glaciers**
 - **Antarctic ice sheet**
 - **Eighty percent of the world's ice**
 - **Nearly two-thirds of Earth's fresh water**
 - **Covers almost one and one-half times the area of the United States**
 - **If melted, sea level would rise 60 to 70 meters**

The transformation of snow to glacial ice

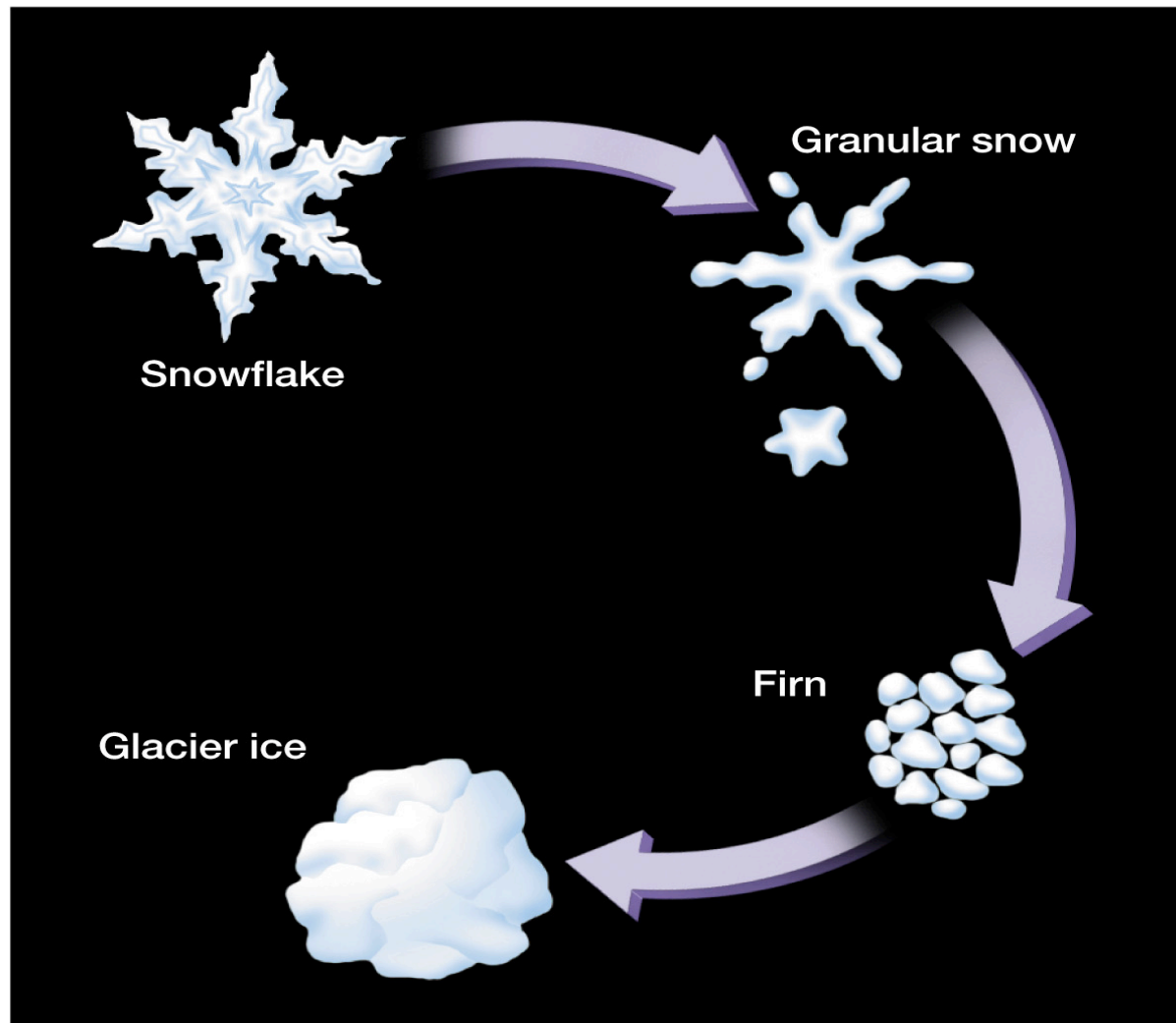
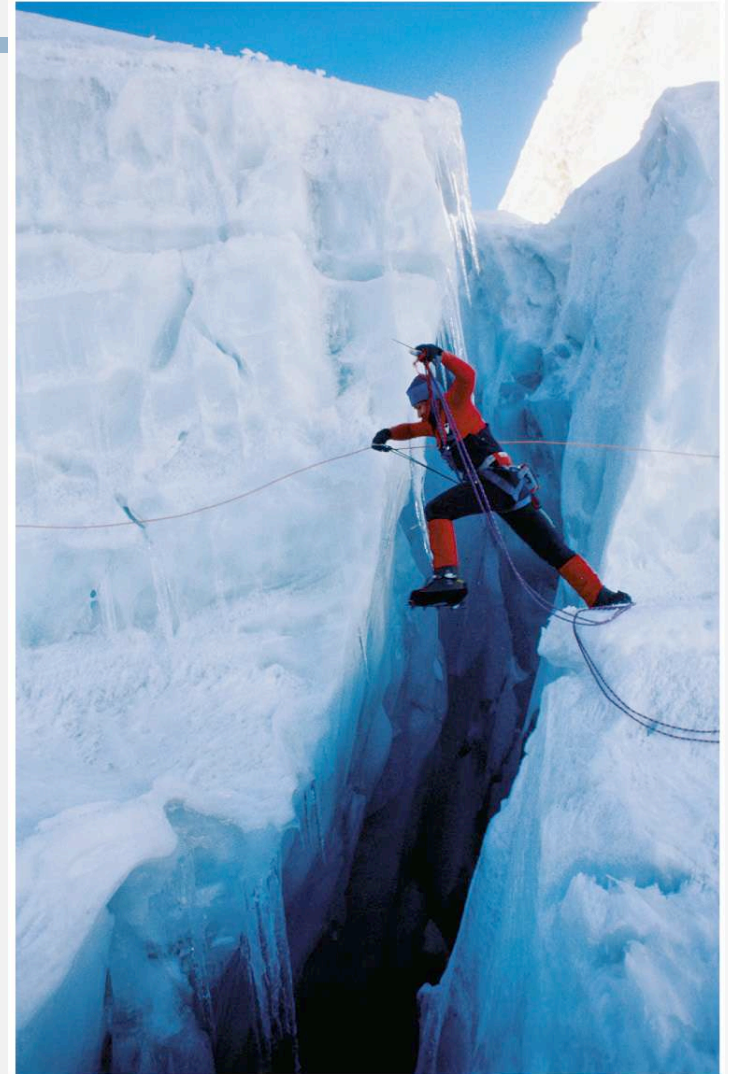
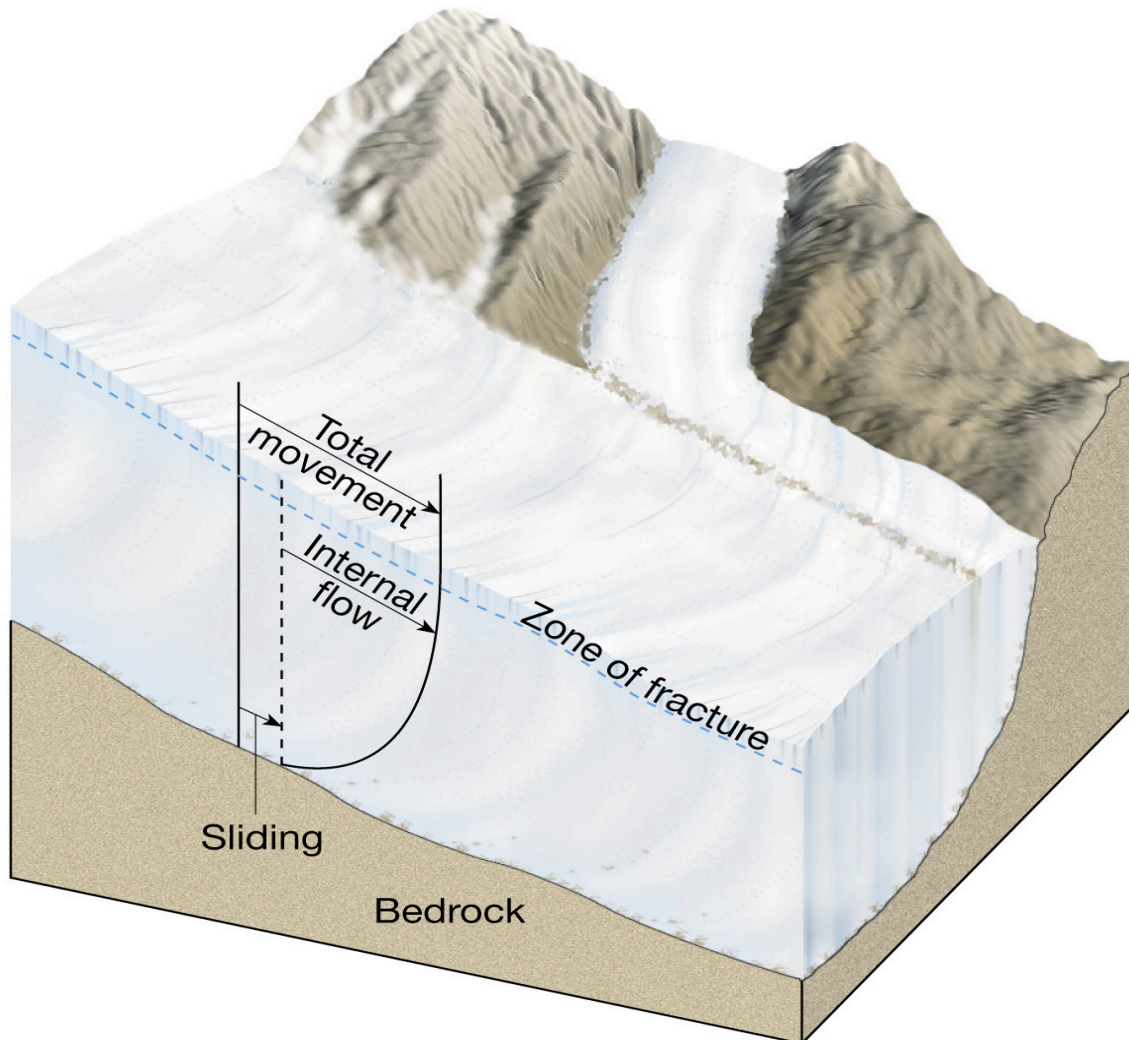
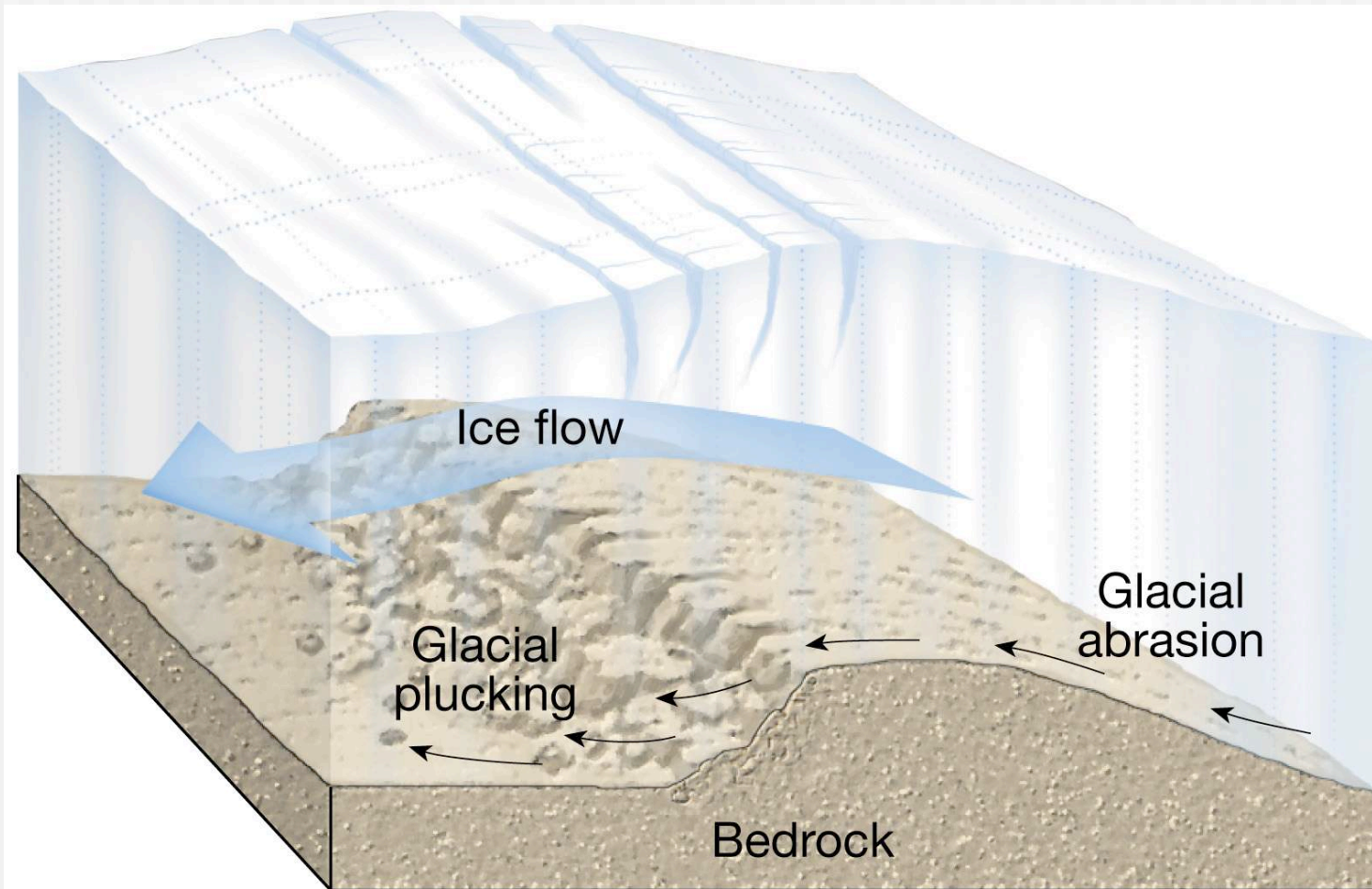


Figure 18.7

Glaciers move by basal sliding and internal flow



Movement of glacial ice

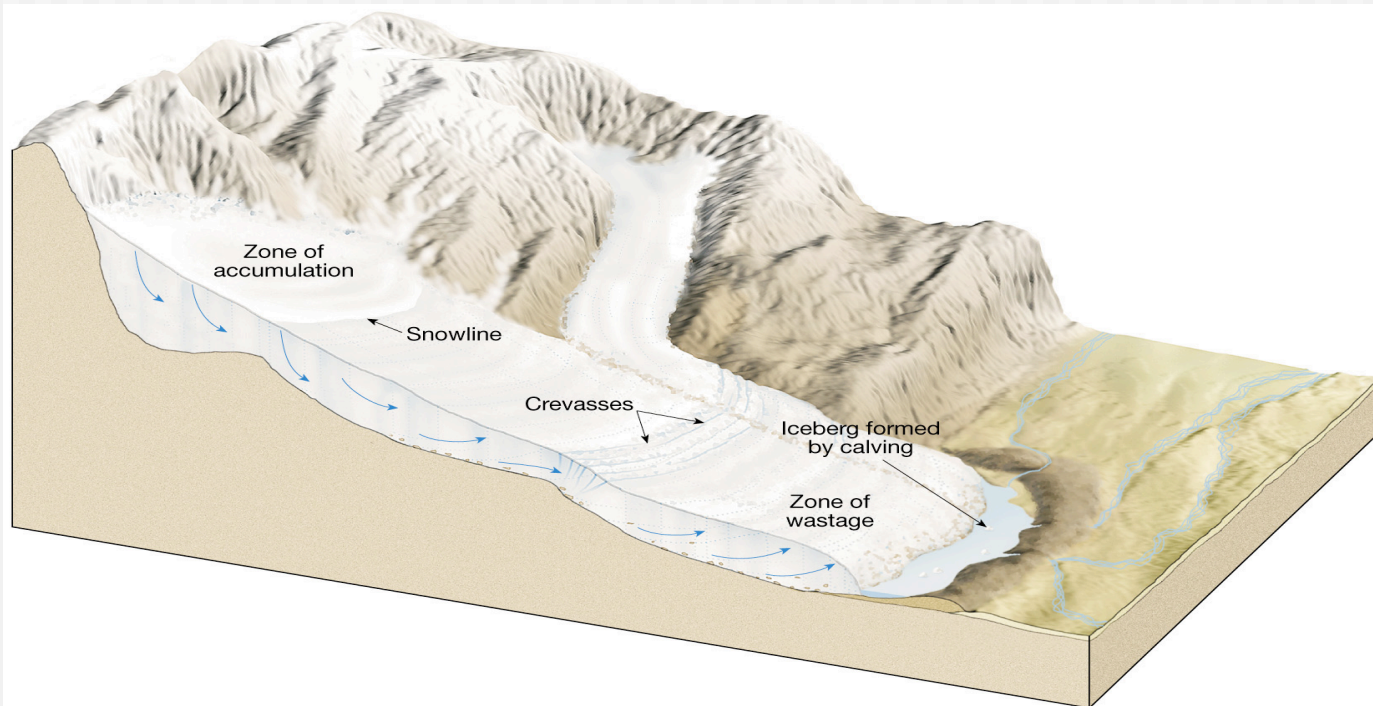


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Movement of glacial ice

■ **Budget of a glacier**

- **Accumulation > Melting = ??**
- **Accumulation < Melting = ??**
- **Accumulation = Melting = ??**



Glaciers & Geology

- Processes:
 - Erode
 - Transport
 - Deposit



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Glacial erosion

- **Glaciers are capable of great erosion and sediment transport**
- **Glaciers erode the land primarily in two ways**
 - **Plucking** – lifting of rocks
 - **Abrasion**
 - **Rocks within the ice acting like sandpaper to smooth and polish the surface below**

Glacial erosion



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- **Glacial erosion**
 - **Glacial striations**
- **Landforms**
 - **Erosional features**
 - **Glacial trough**
 - **Truncated spurs**
 - **Hanging valleys**
 - **Aretes**
 - **Horns**
 - **Cirques**

Glaciated topography

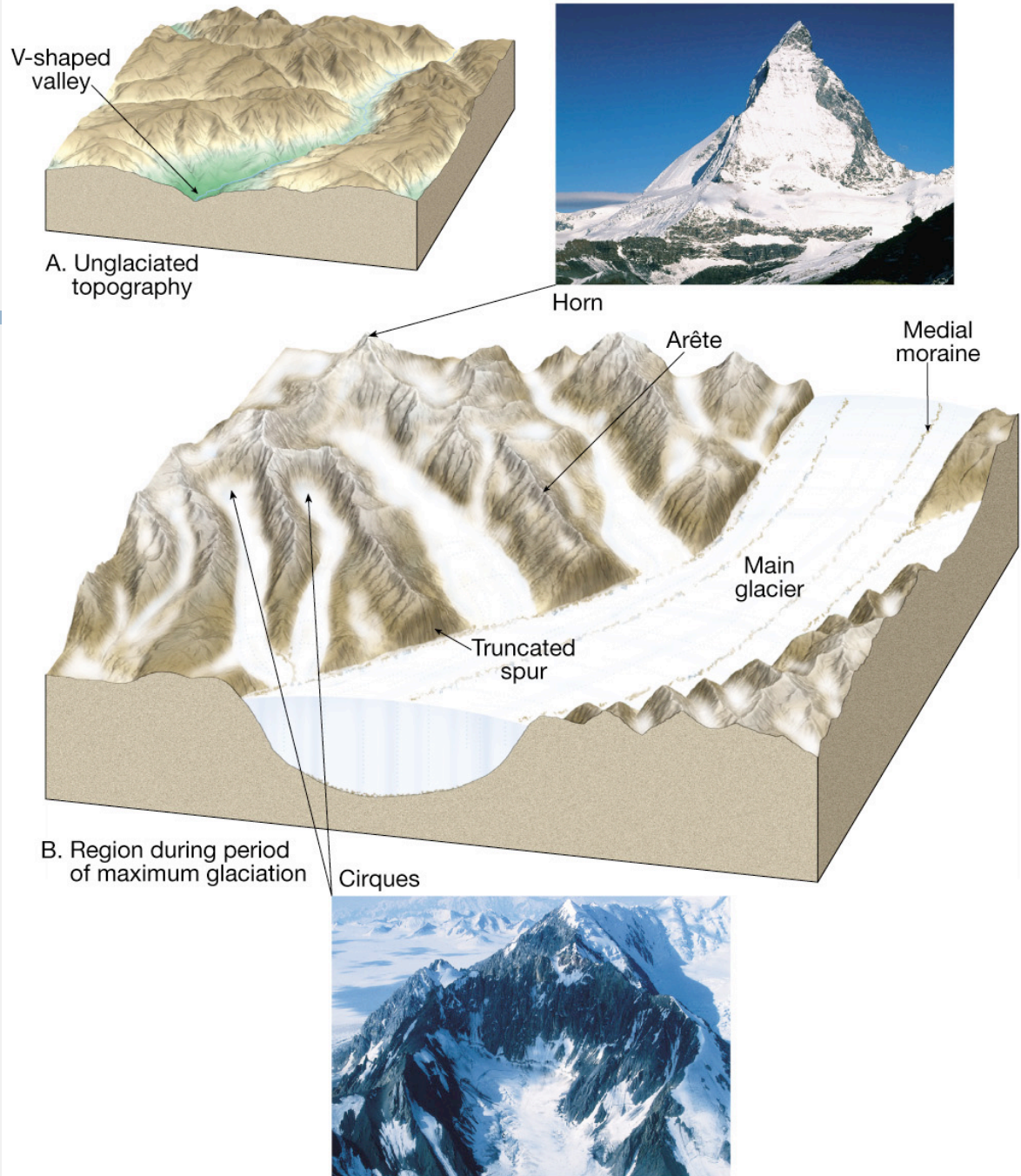


Figure 18.15 AB

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The Matterhorn in the Swiss Alps



Glacial Material

- **Glacial drift – refers to all sediments of glacial origin**
 - **Types of glacial drift**
 - **Till** – material that is deposited directly by the ice
 - **Stratified drift** – sediments laid down by glacial meltwater

Glacial till is typically unstratified and unsorted



Close up
of cobble

Figure 18.19

Glacial Transport

Moraines

- Lateral
- Medial
- End



Glacial depositional features

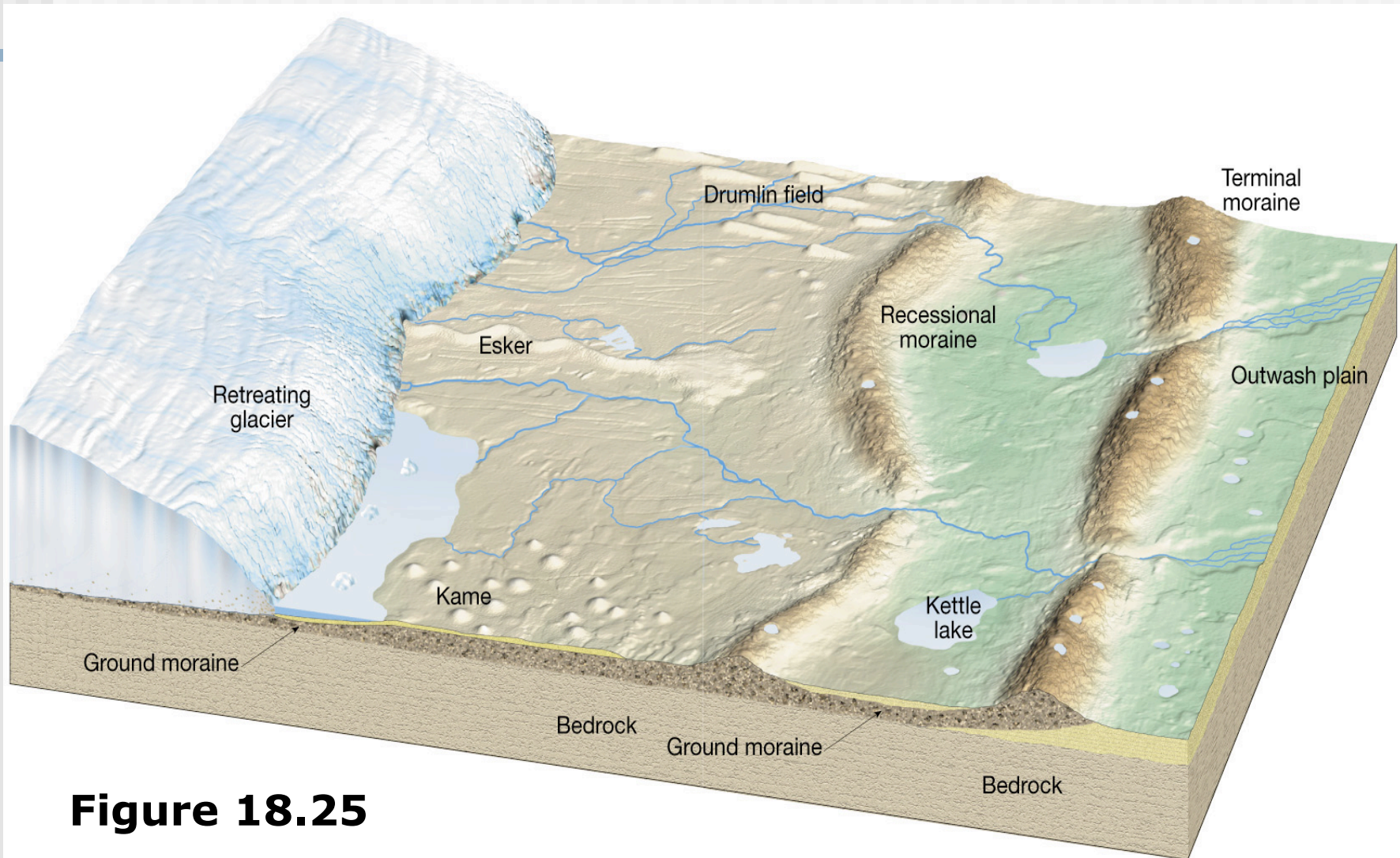
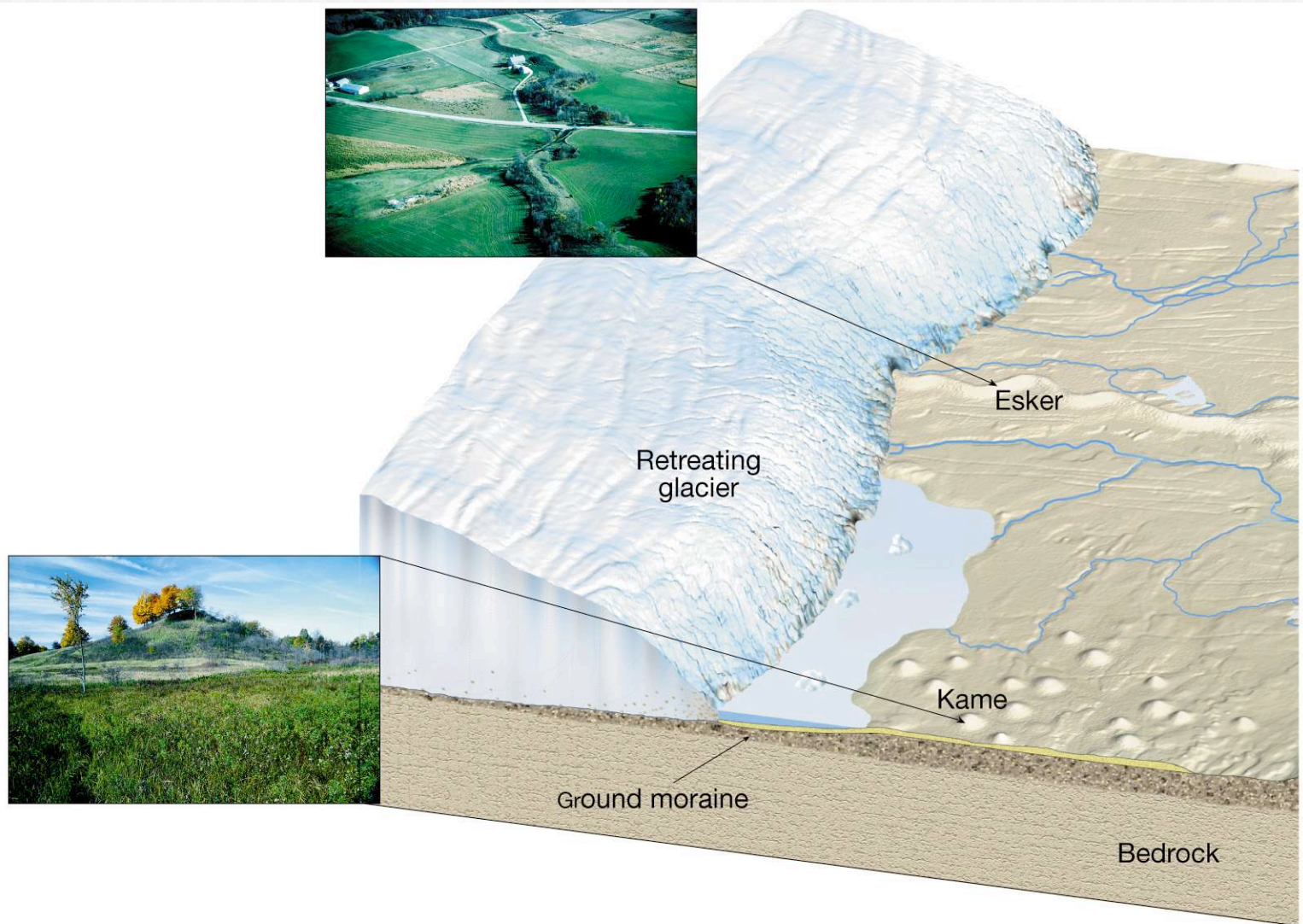


Figure 18.25

A drumlin in upstate New York



Eskers & Kames

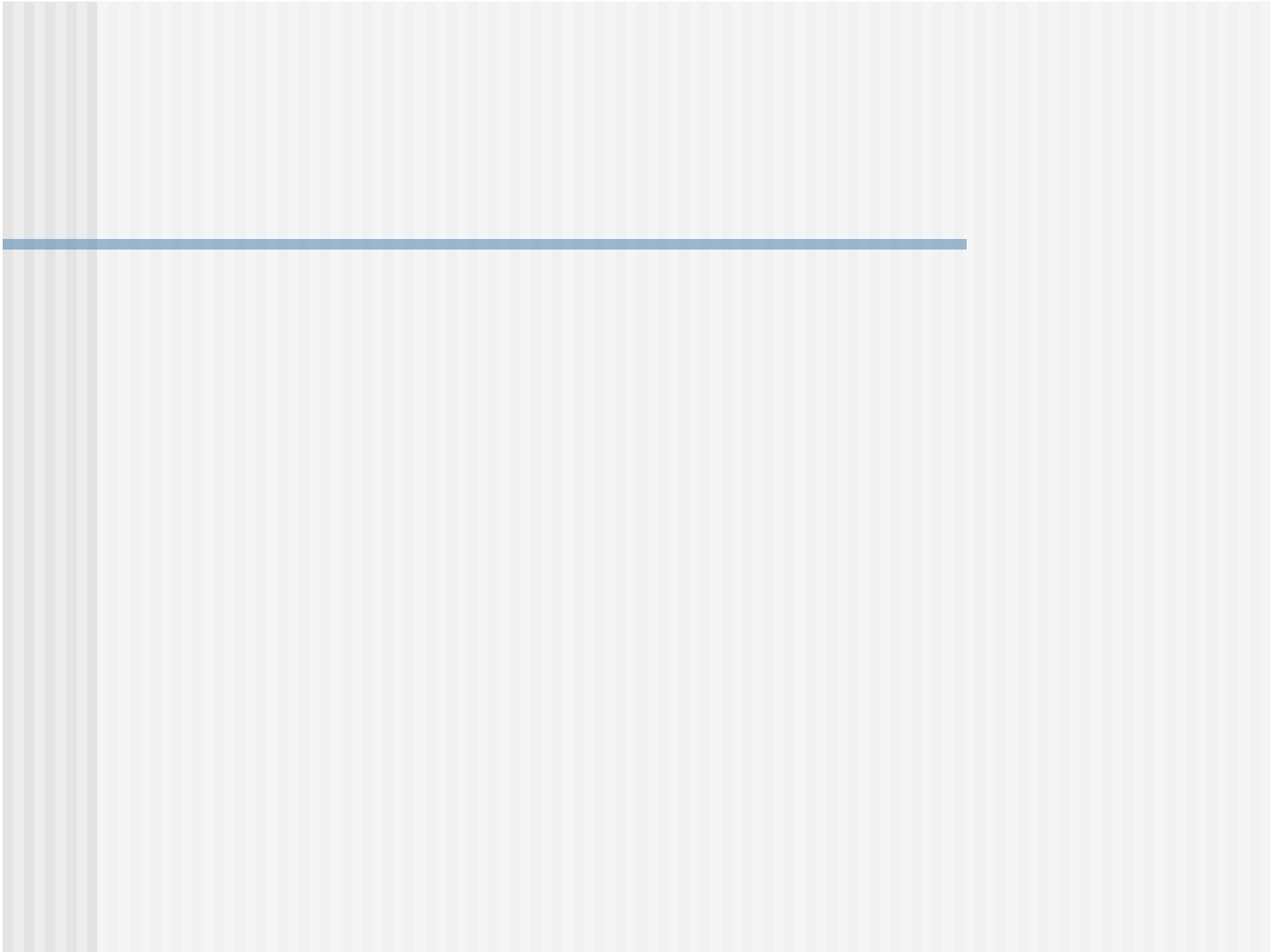


Why Study Glaciers?

1. Impact on Earth's Surface?
2. What Causes Them?
3. How Many in the Past?
4. Are they Advancing or Retreating?
5. What would be the Impacts?



End Glacier 1



Glaciers of the recent past

■ Ice Age

- **Four major stages recognized in North America**
 - **Nebraskan**
 - **Kansan**
 - **Illinoian**
 - **Wisconsinan**
- **Ice covered 30% of Earth**

Crustal rebound following the removal of glacial ice

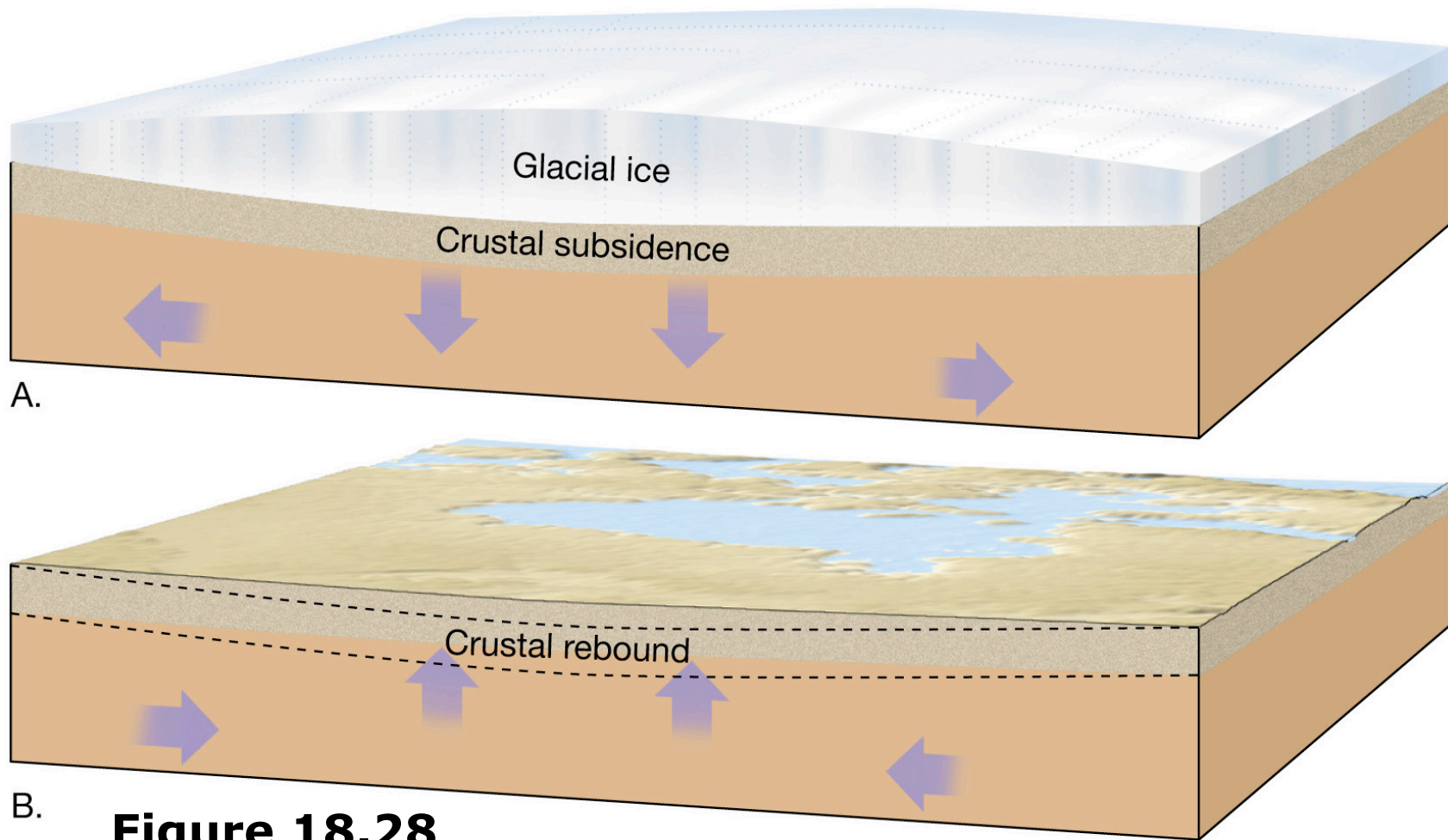


Figure 18.28

Maximum extent of ice during the Pleistocene Ice Age

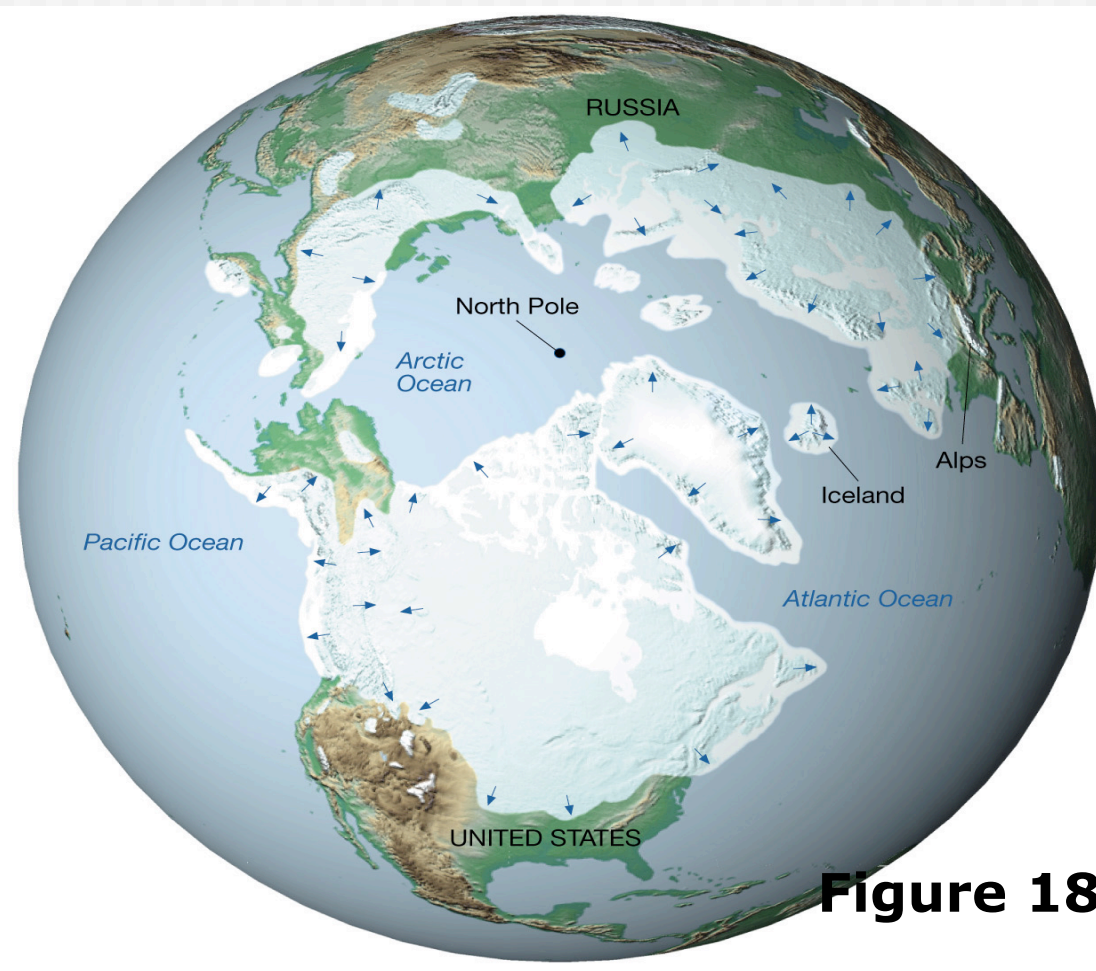
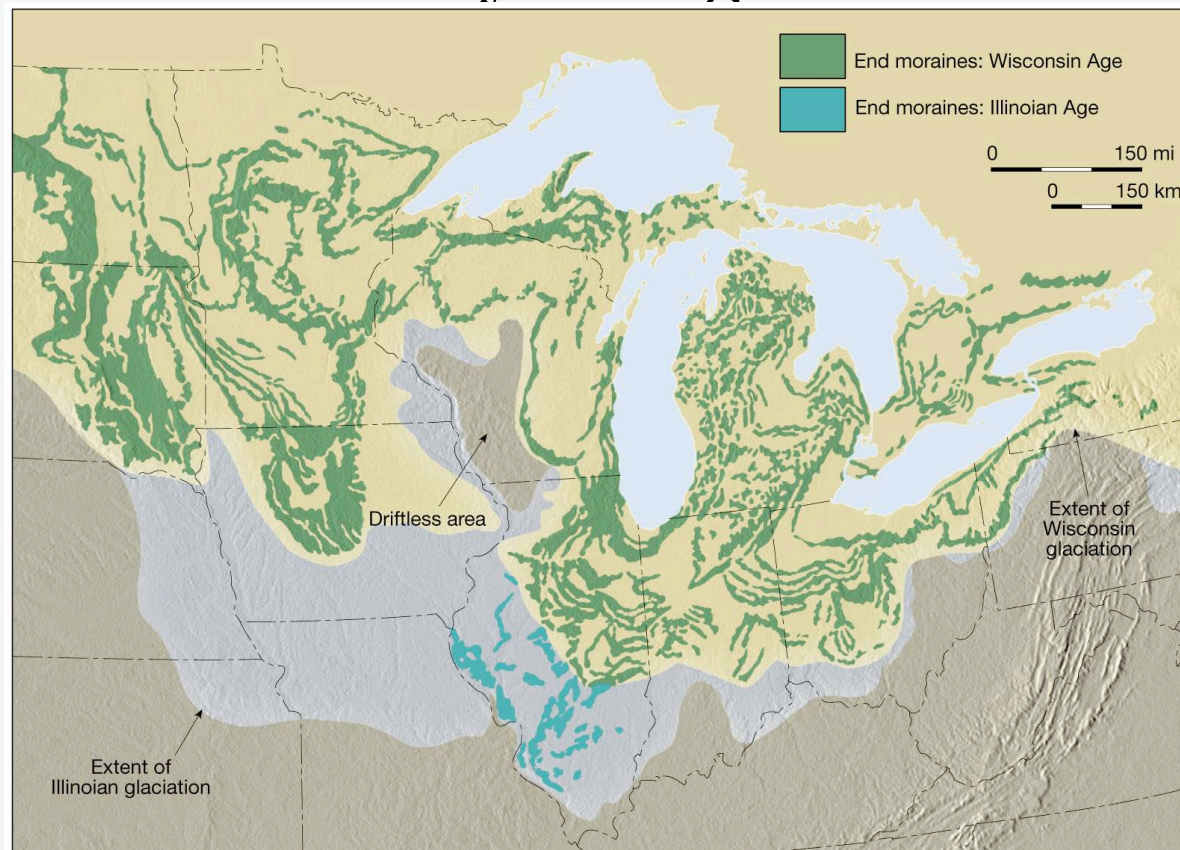


Figure 18.27

Glaciers of the past

■ Pleistocene Ice Age

- The Ice Age began between two million and three million years ago



Ancient Ice Ages....



250 mya



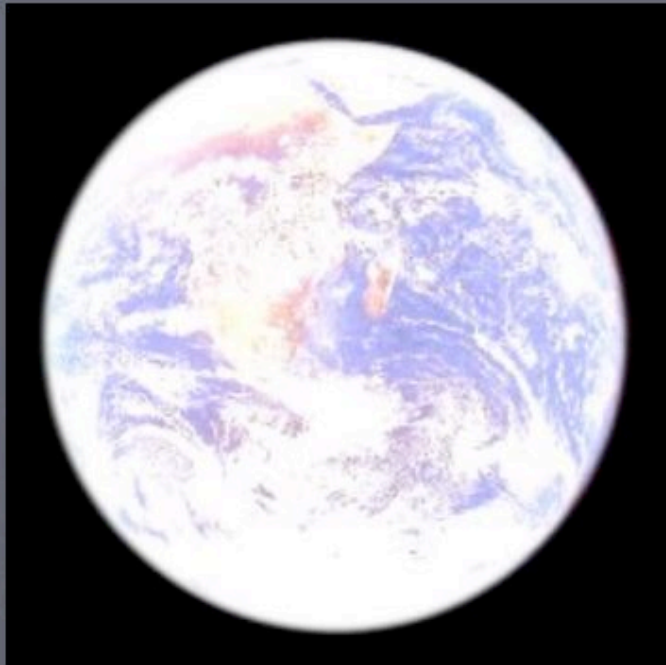
500 mya



2-3 billion yrs ago

Snowball Earth

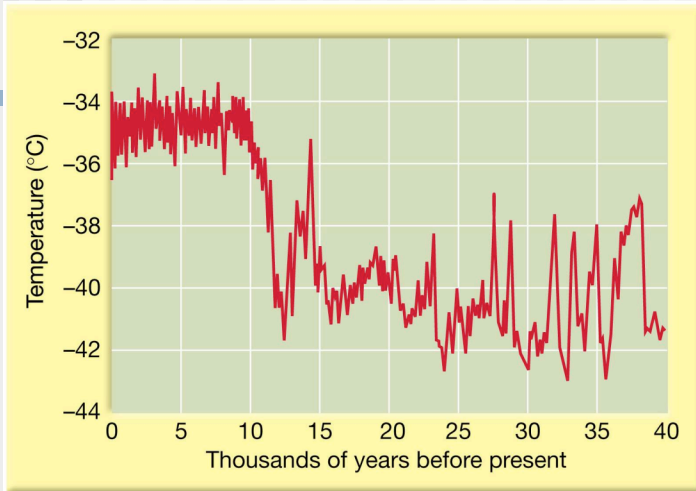
Snowball Earth?



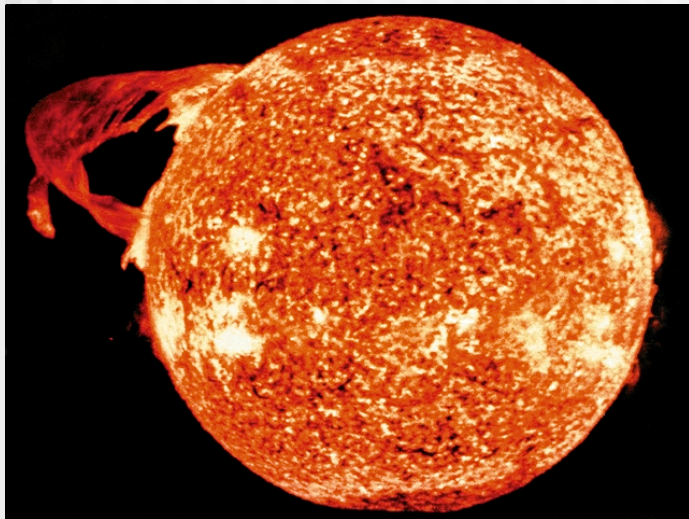
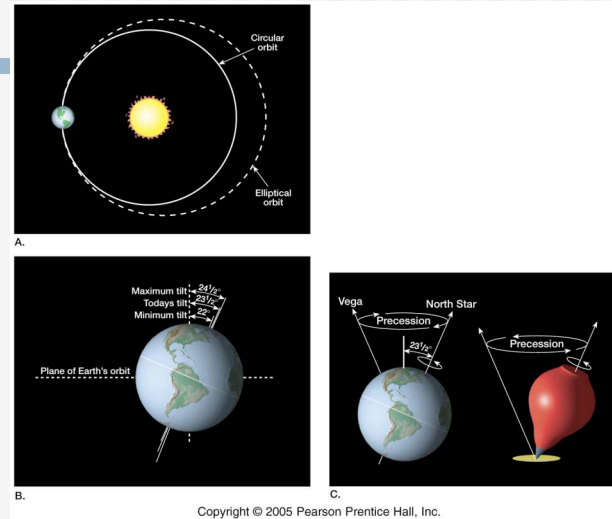
Glaciers of the past

- **Indirect effects of Ice Age glaciers**
 - **Forces migration of animals and plants**
 - **Changes in stream courses**
 - **Rebounding upward of the crust in former centers of ice accumulation**
 - **Worldwide change in sea level**
 - **Climatic changes**

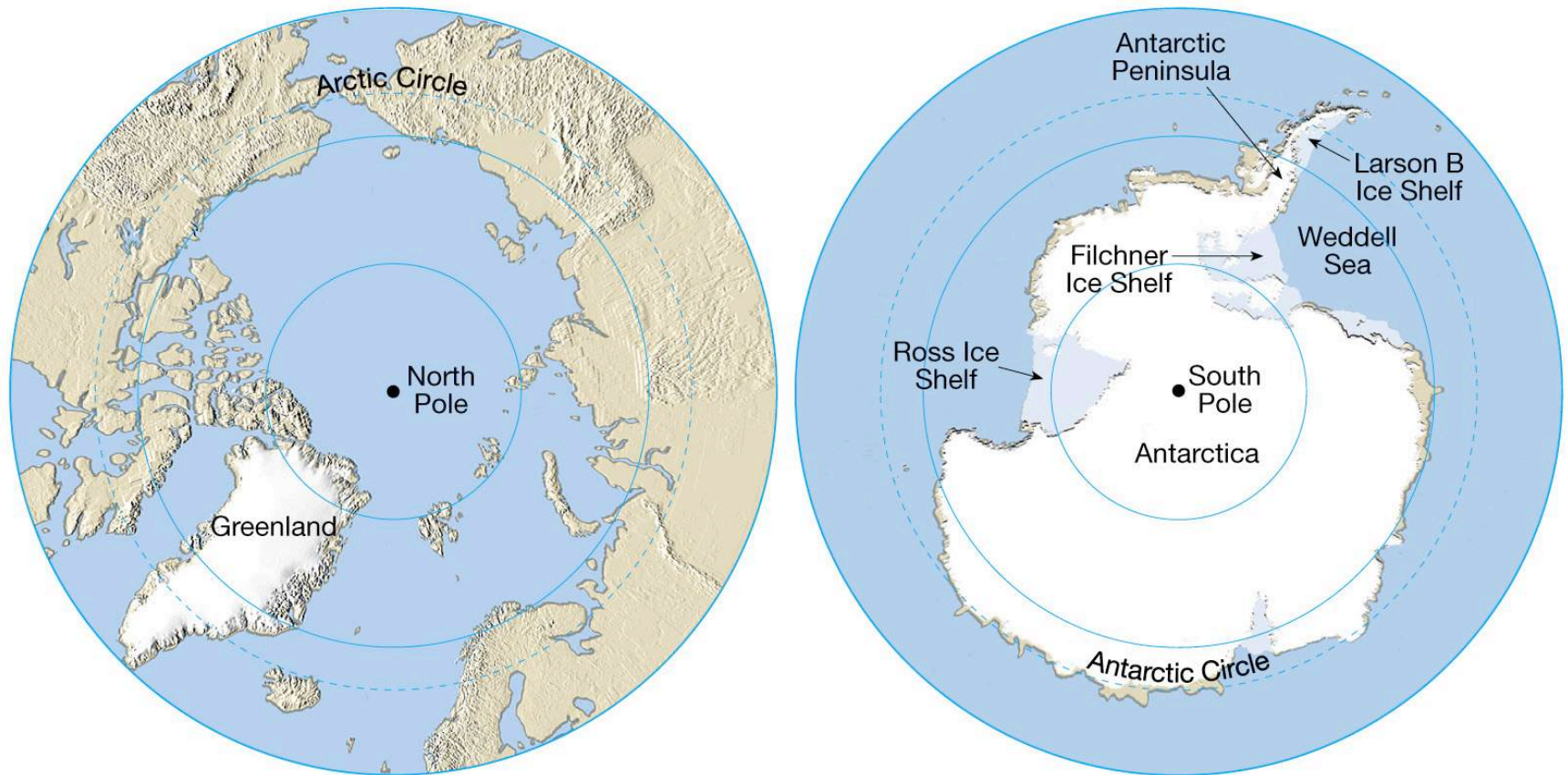
Causes of glaciation?



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Today....The Poles...



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If they Melted...



End of Chapter 18
