Chapter 17: Glaciated Coasts

Glaciers: formation, movement, types

Pleistocene Glaciation:
Effects on Coastlines:
Examples: Cape Cod, LI

Glaciers

Located on most continents
Occur as narrow ribbons of flowing ice in high mountain regions
Occur as thick ice sheets covering vast continental areas
Occupy 10% of continental landmass (30% during last ice age)

Glacier Formation

Large mass of ice that flows internally
Antarctica (oldest glacier active 8mya)
Climate permits more snow accumulation during cooler months than ablates (ice wasting) during warmer months

Glacial ice: forms at ~50 m depth, blue in color

Glacier Movement

Plastic Flow: internal deformation or movement
Basal Slip: sliding along the bedrock of the entire glacier

Types and Distribution of Glaciers

Alpine or Valley Glaciers:
formed in mountainous regions where winter are long and summer are short and cool
flow down old river valleys
Types and Distribution of Glaciers

Ice Sheets or Continental Glaciers:
- several km thick, cover vast land areas
- Greenland (3 km thick), 80% of the island
- Antarctic Ice Sheet (4.2 km thick)
- Ross and Filchner Ice Shelves

Pleistocene Glaciation

Pleistocene Epoch
(1.65 mya)
- Ice Ages extended
2.2-2.4 mya
- More recent: ice age periods 100,000 yr

Plate Tectonics: control on ice ages

300 mya
- Land mass must be high latitudes for extensive ice sheets to form

Milankovitch Cycles: control on recent glacial periods

The Late Pleistocene:
Wisconsin Ice Age
- 70-90,000 ya
- 18,000 maximum extent
- 10,000 ya rapid sea level rise
- Holocene
- 6,000 barrier islands

Glacial Effects on Coastlines

- Waxing and waning of ice sheets = various coastal landforms (fjords, moraines, bays etc.)
- Erosion: ice wedging, plucking (material freezes to glacier), abrasion (striations)
- Ice sheets: tend to reduce relief along rocky coasts
- Depositional Features:
  - end or terminal moraines
  - outwash plains
  - drumlins
Drumlin (Depositional bedform features)
15-50 m, 2-2 km

Example Coastlines & Morphology

Terminal Moraine: Long Island

Shoreline Retreat During The Flandrian Transgression
-50 m -40 m -30 m
-20 m -10 m 0 m

Terminal Moraine & Outwash Plain

Bluff Coastlines
North Shore Bluffs 33 to 100 ft (10 to 30 m) in elevation, indented by deep bays that form good harbors for small crafts.

Cliff or Bluff Coast

Gravel, sand

Barrier Island

South Shore Bluffs reach elevations > 80 ft (24 m)

North Shore Bluffs > 100 ft

South Shore Bluffs 80 ft

North Shore Bluffs

South Shore Bluffs

Bluff Erosion Processes

- Direct Precipitation
- Surface Runoff
- Groundwater Seepage
- Surface Erosion
- Mass Wasting Along Hardpan (clay layers)
- Wave Undercutting of Bluff Toe
- Overloading near the edge of the Bluff

**IMPROVING SURFACE DRAINAGE**

- Eliminate drainage over the edge of the bluff and down the face
- Reduce impermeable surfaces

**IMPROVING SUBSURFACE DRAINAGE**

- French Drainage System
Toe Armoring (Revetment)

Filter Box Terracing

Vegetation
- low shrubs and grasses, no trees

Slope Reduction
Angles < 45° are stable