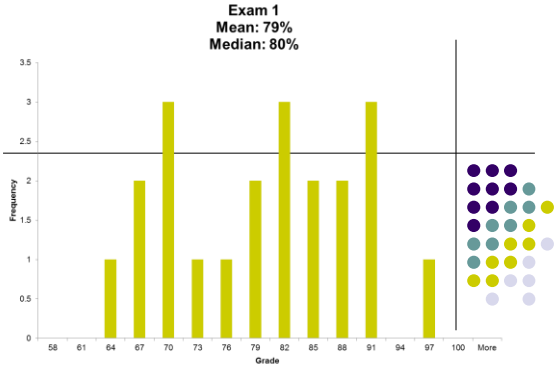


Physical Geography: Landforms

Chapter 3

Overview

- Earth Materials
  - Igneous, sedimentary, metamorphic rocks
- Geologic Time
- Movements of the Continents
- Tectonic Forces
- Gradational Processes
- Glaciers

Igneous Rocks

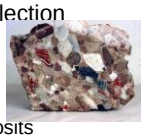
- Formed by the cooling and solidification of molten rock
- **Magma**: molten rock below ground
  - Cooling forms **intrusive** igneous rocks
    - Granite

- **Lava**: molten rock above ground
  - Cooling forms **extrusive** igneous rocks
    - Basalt, pumice, obsidian

  - Rapid cooling – obsidian, pumice
  - Slower cooling - granite

Sedimentary Rocks

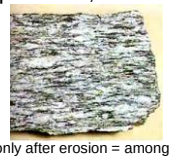
- Composed of particles of gravel, sand, silt, and clay eroded from other rocks
- Surface water carries sediment to collection areas:
  - oceans, marshes, lakes or tidal basins



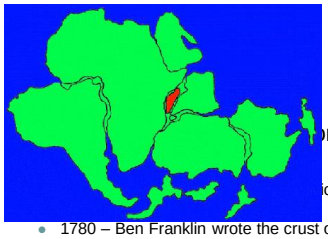
  - Compressed by weight of additional deposits
  - Type of sediment determines rock type
    - Large, rounded particles – conglomerates
    - Sand – sandstone
    - Silt and clay – shale or siltstone
    - Organic materials – limestone or coal

Metamorphic Rocks

- Formed from igneous or sedimentary rocks by earth forces that produce heat, pressure, or chemical reactions
  - Mineral structure is changed
    - Shale becomes slate
    - Limestone may become marble
    - Granite may become gneiss
      - This occurs at great depths – exposed only after erosion = among oldest rocks on Earth.



- Rock Cycle – old rocks are continually made into new rocks by the two processes that alter rocks:
  - Building landforms & Wearing landforms down



…n years ago

- …ica and Africa appeared to fit
  - 1780 – Ben Franklin wrote the crust of the earth must be a shell that can break and shift
- **Continental Drift** – first proposed l… the turn of the 20th century
  - Proposed a single land mass called Pa…
  - Wegener - shapes of continents seeme…
  - A precursor to plate tectonics

Movements of the Continents

- Plate tectonics theory
  - **Asthenosphere**
    - Partially molten layer above the core and lower mantle
  - **Lithosphere**
    - Outermost layer of the earth (the crust and upper mantle)
    - 12 large and numerous small plates that slide or drift slowly over the asthenosphere

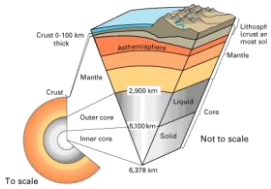


Plate Tectonics

- **Mid-ocean ridge** – a submarine mountain range that…

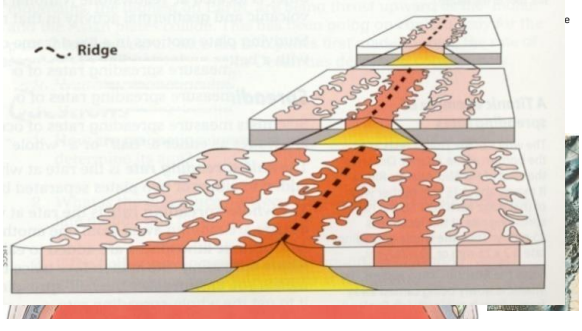
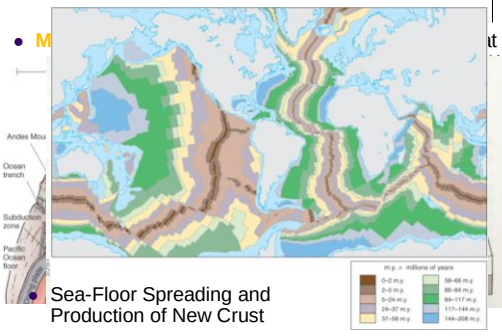


Plate Tectonics

- **M**…



- Sea-Floor Spreading and Production of New Crust

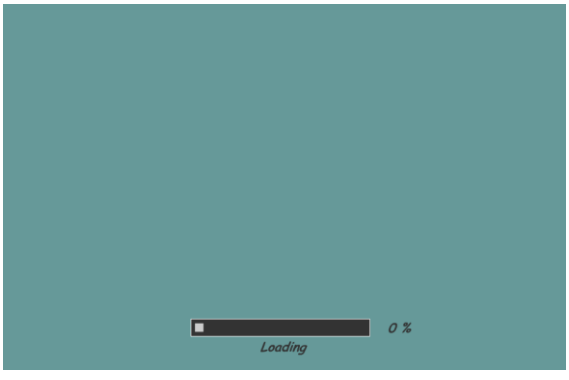


Plate Tectonics

- Besides tectonic theory, there is also fossil evidence that the continents were once part of a larger landmass.
  - Animals and plants fossils
    - found in South America & Africa
    - Africa & India
    - Antarctica & Australia
    - Africa, India & Antarctica
    - South America, Africa, India, Antarctica & Australia

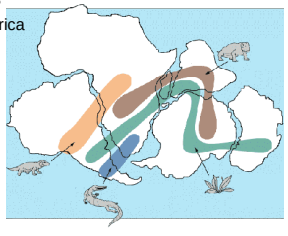


Plate Tectonics

- There are two types of tectonic plates:
  1. **continental plates** – older, thicker and more buoyant
  2. **oceanic plates** – younger and denser
  - These tectonic plates interact with neighboring plates in 3 manners:
    - Divergent (spreading)
    - Convergent (colliding)
    - Transform (sliding)

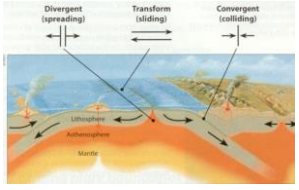


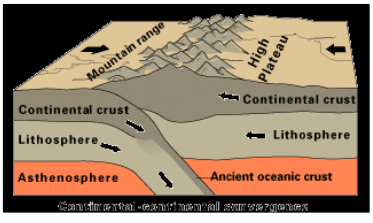
Plate Tectonic

Plate Tectonics

- **Convergent Plate Boundaries** – are the result of the direct collision of one plate into another.
  - There are three different types of convergent plate boundaries:
    1. **Continental / Continental**
    2. **Oceanic / Continental**
    3. **Oceanic / Oceanic**
  - Each resulting in a unique geologic feature……

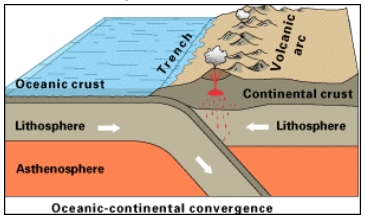
Convergent Plate Boundaries

- **Continental / Continental Convergence**
  - When a collision occurs between two continental plates the colliding edges are crumpled and uplifted
    - producing large mountain ranges.



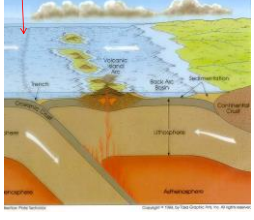
Convergent Plate Boundaries

- Oceanic / Continental Convergence - more dense oceanic plated is subducted, or forced beneath the less dense continental plate – the uplifted continental plate forms mountains.
  - Trench forms along the subduction zone



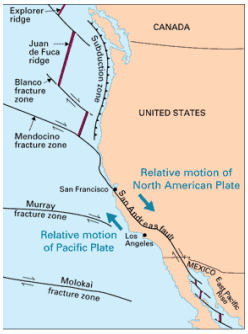
Convergent Plate Boundaries

- **Oceanic / Oceanic Convergence – When two oceanic plates collide a deep ocean trench forms when one of the plates is subducted.**
  - The subducted plate melts and the molten rock rises to the surface, along the trench to form a chain of volcanic islands called an island arc.



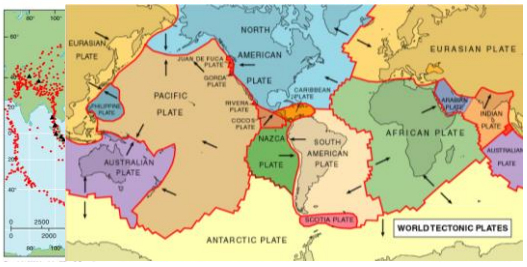
Convergent Plate Boundaries

- **Transform Fault Boundaries** – two plates slide past each other
  - The plate edges do not slide smoothly - dramatic, sudden movements result in earthquakes.
- Ex. - San Andreas Fault



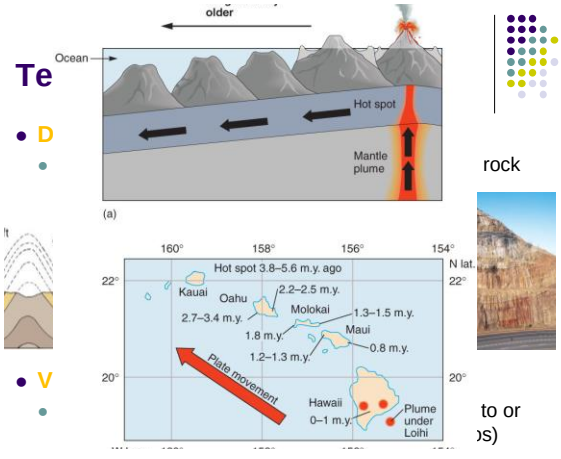
Earthquake & Volcano Activity

- **Earthquake & volcanic** activity is associated with these different types of fault lines – where plate boundaries collide



Te

- **D**
  - rock
- **V**
  - to or



Gradational Processes

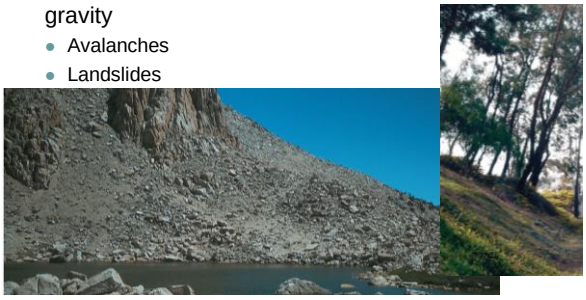
- **Gradational Forces** - forces that scour, wash, and wear down the Earth's surface.
  - External forces
- Reduction of the land's surface
  - Weathering
  - Mass movement
  - Erosion

Weathering

- Processes that fragment and decompose rock
  - **Mechanical**
    - Physical disintegration
      - **Frost action** - expansion of water in cracks
      - **Salt crystals** – evaporation of water, leaves salt crystals
      - **Root action** – tree roots get into joints and break rock as it grows
  - **Chemical**
    - Decomposition as a result of chemical reactions
      - Oxidation – oxygen combines with iron which decomposes rock
      - Hydrolysis – chemical reaction when water and minerals interact
      - Carbonation – carbon dioxide in the atmosphere dissolves in water, creating acid, which decomposes the rock.

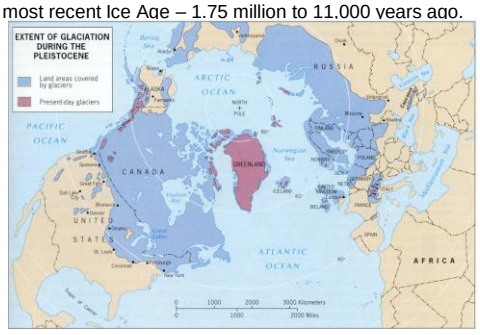
Mass Movement

- Downslope movement of material due to gravity
  - Avalanches
  - Landslides



Glaciers

- most recent Ice Age – 1.75 million to 11,000 years ago.

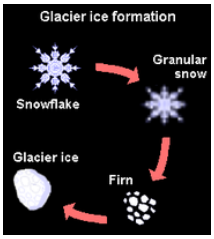


Formation of Lower Hudson & Long Island

- River erosion carved out the coastal plain to form Long Island Sound Basin (<3 mya)
- Glaciers reshaped the area (beginning 3 mya)
- The last ice advance deposited terminal moraine in middle of Long Island
- Recessional moraines (along North Shore of Long Island) were left as glacier receded

Glaciers

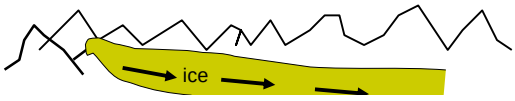
- Glacier: mass of ice composed of compacted snow and recrystallized snow
  - flowing under its own weight under the force of gravity.



Types of Glaciers

1. Valley/Alpine Glaciers: confined to mountain valleys
- Flow down hill
- Few km wide by 10's of km long by several 100 m thick
- Ex: Alaskan Alpine Glaciers

2 km wide x 120 km long x 400 m thick



1. Valley/Alpine Glaciers

Types of Glaciers

2. Ice Sheets: BIG
- Flow out horizontally in every direction from where the snow accumulates the most

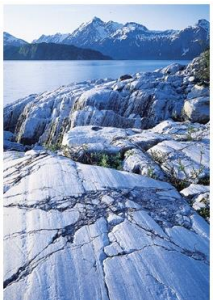
a) Continental Glaciers:
- Largest: 100s of km long/wide by 3-5 km thick
- Ex: Greenland, Antarctica (now) and North America during the last ice age 25,000 years ago (what covered Long Island)

Glacial Eroded Landforms

- Erosion: glaciers carry the sediment within the ice AND grind/polish bedrock via abrasion (rock within the ice grinds below the glacier).
- The plucking and grinding creates the following landforms (become visible after the ice is gone):

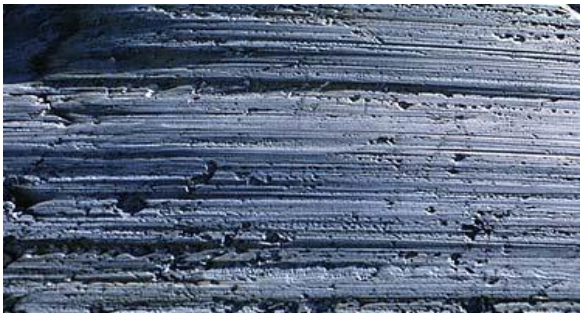
Glacial Polish

smooth bedrock (that shines in reflected light.



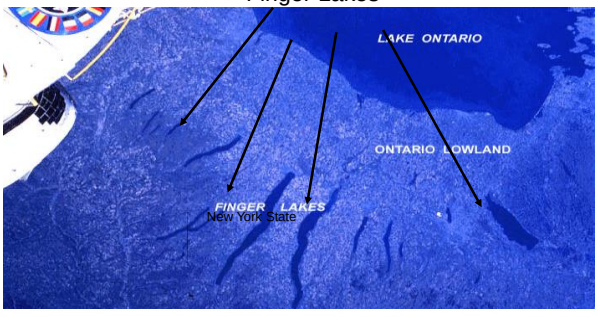
Glacial Striations

hard rocks projecting below the ice cut grooves.



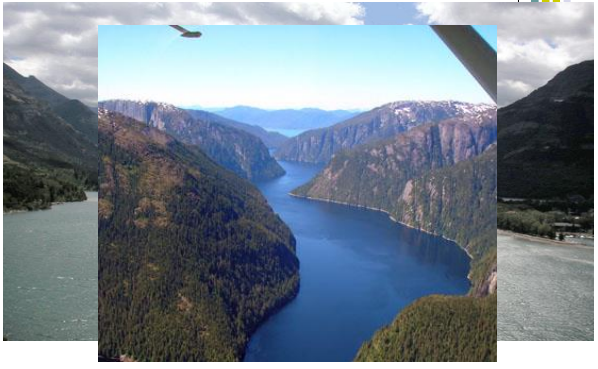
Big Grooves

Finger Lakes



4. U-Shaped Valley/Trough:

Fjords = Submerged U-Shaped Valley



Glacial Deposits:

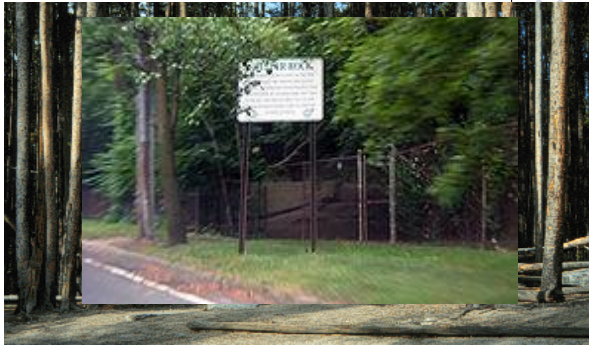
Drift = all glacial sediment (2 types)
1. Glacial till: unsorted and unstratified
Directly deposited by the glacier (like a bulldozer) so it is ur
(no layers)

Unsorted mixture of clay, soil, sand, gravel and boulders at Ronkonkoma moraine.

Glacial Deposits:

- 2. Outwash = Stratified Drift: deposited by glacial meltwater – it tends to be sorted and stratified

Till Landforms

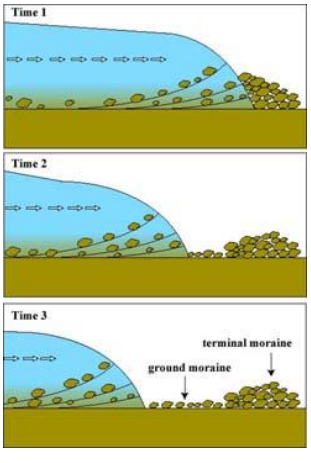


Indian Rock

Moraines

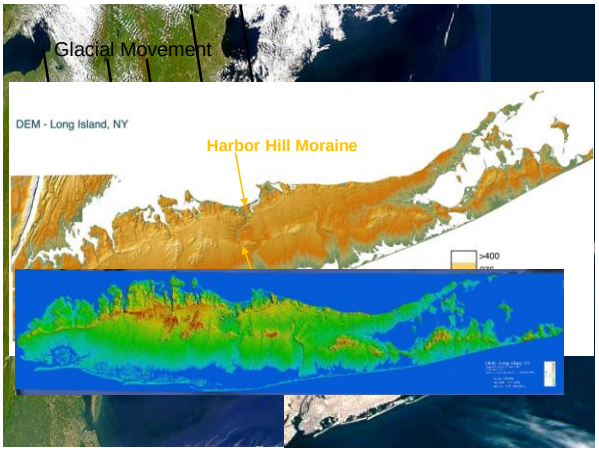
- Long Island, Block Island, Nantucket and Martha's Vineyard islands (MA) are terminal or end moraines that marked the end of massive glaciers.
- They are composed of material carried by glaciers from the interior of the continent.

End Moraine: form beyond the ice front



Ground Moraine

- material pushed under and compacted under the glacier.



Ronkonkoma Moraine

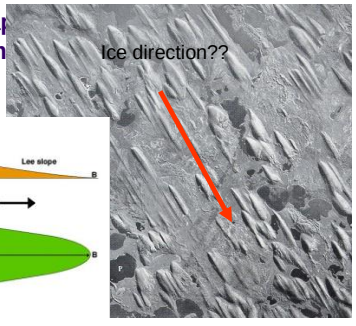
- runs into the South Fork, extending into the ocean past Montauk Point.
- Harbor Hill Moraine - most recent glacial retreat, running across the North Fork.

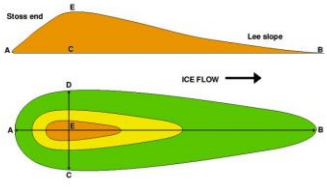
Jayne's Hill

401 feet (122 m), is the highest hill on Long Island

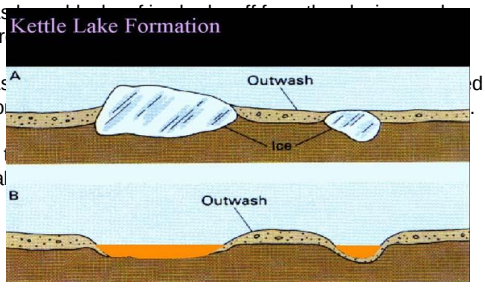
Till Landforms

Drumlins: canoe-shap
glacier over-runs a m
swarm of drumlins.

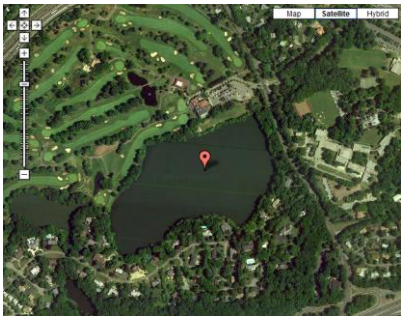




Kettle Lakes

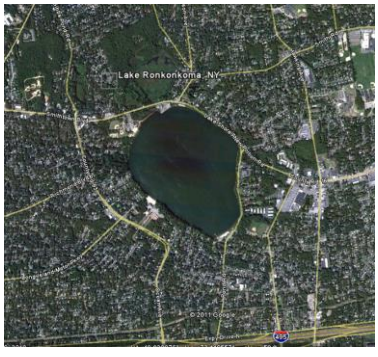


Lake Success



Scuttle Hole, Bridgehampton

Lake Ronkonkoma



Eskers

long winding ridge of glacial deposition

Nearby Esker:
Esker Point Park Groton, CT