Hewitt/Lyons/Suchocki/Yeh

Conceptual Integrated Science

Chapter 25

Surface Processes

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Surface Processes

- Surface or *surficial* processes originate at Earth's surface and reshape its contours. Surface processes include:
  - Weathering
  - Erosion
  - Deposition

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Surface Processes

- Agents of change are mediums through which surface processes occur:
  - Liquid water
  - Ice
  - Gravity
  - Wind

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Surface Processes

- Weathering is the breakdown of rock that occurs at or near Earth's surface.
  - There are two types of weathering: chemical and mechanical (physical).
  - Weathering continues as eroded particles are transported.

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Surface Processes

- Erosion is the physical removal of weathered bits of rock from one place and their transport by liquid water, ice, gravity, or wind to another place.

(a) (b) (c) (d)

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Surface Processes

- Deposition is when eroded particles come to rest.
- Particles are deposited progressively from heavy to light as the transporting medium loses energy.

Example:
In a floodplain, lighter sediments are deposited progressively farther away from the stream that overtops its banks.

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Weathering: A Closer Look

- Mechanical weathering is the breakdown of rock by physical means.

Examples:
ice wedging, biological agents (e.g., tree roots), wind abrasion

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Weathering: A Closer Look

- Chemical weathering is a change in the chemical structure of the minerals in a rock.

Example:
Carbonic acid in rainwater weathers granitic rock. Granite decomposes to become quartz and potassium feldspar. *Quartz is durable; potassium feldspar weathers to clay*.

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Differential Weathering

- Differential weathering
  - is weathering that is varied in its rate or extent.
  - occurs due to variations in the mineral composition of or fracturing in a rock
  - creates fantastic formations such as natural bridges.

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Soil

- Soil is
  - a mixture of organic and nonliving materials.
  - the end product of the weathering of rock.
  - necessary for plant growth.
  - found in thousands of different kinds.
  - composed of layers
  - a finite resource (1 inch per century)

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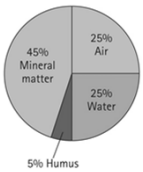
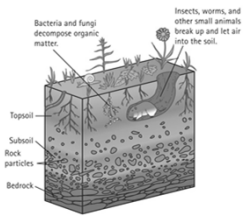
Soil

- Components of soil:





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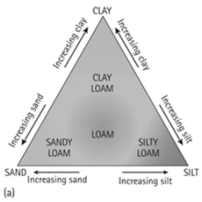
Soil

- Soils are classified by texture (particle size):
  - Sand (2–0.05 mm)
  - Silt (0.05–0.002 mm)
  - Clay (smaller than 0.002 mm)
  - Loam, the best soil, is a mixture of sand, silt, and clay.



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Impact of Running Water

Running water moves across a drainage basin and collects in small streams, tributaries, and rivers. Eventually rivers channel fresh water into the ocean.

Along the way, rivers cause weathering, erosion, and deposition, which together sculpt the landscape and produce various landforms.

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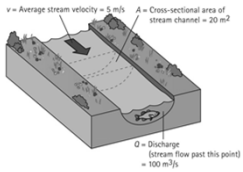
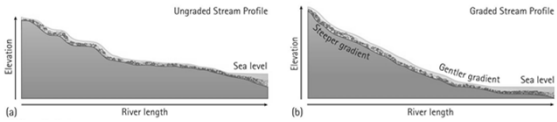
Stream Properties

- Gradient
- Velocity
- Discharge
- Load





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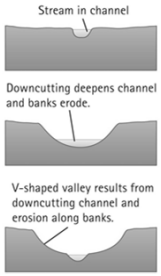
Evolution of a Stream

- Streams change over time.
  - Initially, streams are straight and the water flows fast.
  - Later, streams are meandering.
  - Stream channels deepen and widen.



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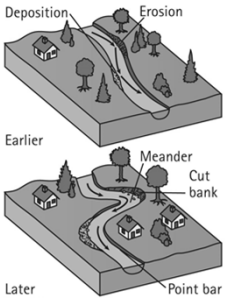

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Landforms Built by Running Water

- V-shaped valley
- Waterfall
- Stream channel
- Delta
- Cut bank
- Point bar
- Channel islands
- Floodplain

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Glaciers

- Glaciers are
- enormous masses of moving ice
- formed by snow that doesn't melt and is compacted by overlying snow
- of two kinds: alpine and continental
- the world's largest depository of fresh water
- melting due to climate change

(a)

(c)

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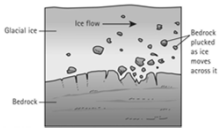
Glacial Erosion

- Means of erosion:
  - Abrasion
  - Plucking
- Evidence of glacial erosion:
  - U-shaped valleys
  - Striations
  - Horns
  - Glacial lakes



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Mass Movement

- Mass movement is defined as the downward movement of soil or rock due to the effects of *gravity* alone.
- Types of mass movement:
  - Falls
  - Slides
  - Flows

Examples:
subsidence, avalanche, lahar, rock fall, landslide, creep, earthflow, mudflow

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Mass Movement

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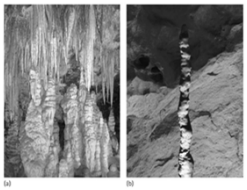
Erosion from Groundwater

- Karst topography
- Caves and caverns
- Sink holes



(a) (b)

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Caves and Caverns

- Caves and caverns are formed by the erosion of limestone rock formations by acidified groundwater.
- They are formed in saturated zones.
- Stalactites and stalagmites are depositional features.
- If the roof is weak, a sinkhole may form.

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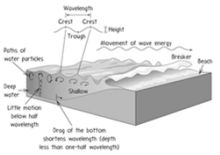
Wave Effects

- Waves mechanically weather a shoreline by pounding rock like a sledgehammer.
- Waves chemically weather a shoreline by dissolving rock.
- Erosional landforms include sea arches, sea stacks, sea caves, and headlands.
- Bars and spits are depositional landforms.



(b)

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Wind

- Wind is a relatively weak agent of erosion and deposition because air is not very dense.
- Over time, wind can produce dramatic effects and landforms, including sand dunes.
- Wind lifts sediments and deposits them; it also acts through abrasion.

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End of Chapter 25

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