

WEATHERING AND EROSION NOTES

WEATHERING

- **Two types of Weathering:**
PHYSICAL (a.k.a. Mechanical Weathering) and **CHEMICAL**
- **PHYSICAL WEATHERING** is the “breaking down” of rocks *in place*. No movement of the pieces of broken rock occurs.
- **Examples of Types of Physical Weathering:**
 - **FROST ACTION**: Water enters cracks in rocks, freezes, expands as ice and wedges cracks wider. Eventually pieces of the rocks break off.

Common in “Mid-Latitudes” where freezing and thawing occur often.

Climate: Cold and Moist

Frost Action is the dominant form of weathering in New York where a freeze/thaw cycle can sometimes occur nearly every day or so for months at a time.
 - **ANIMAL ACTIVITIES**: **Burrowing animals wear away rocks.**
 - **PLANTS**: plants roots grow into cracks and wedge rocks apart. Acid secreted by roots chemically dissolves rocks.
 - **PRESSURE UNLOADING**: As rocks that formed underground become exposed at Earth’s surface, they expand and crack. Ex: Granite.
- **CHEMICAL WEATHERING**: the breaking down of rocks due to chemical changes. **New substances are formed!**
- **Examples of Types of Chemical Weathering:**
 - **OXIDATION**: oxygen combines with iron in rocks to form rust. This breaks down rocks. Oxygen in the air will cause iron bearing rocks and other substances to oxidize (rust).
However, water speeds up this process!
 - **CARBONATION**: carbon dioxide in air combines with rain to produce a *weak acid (Carbonic Acid)* which dissolves rocks containing CALCITE. Ex: limestone, dolostone, marble.
 - **Some rocks DISSOLVE in WATER.** Example: Rock Salt, which contains the mineral “halite”.
 - **HYDROLYSIS**: Some rocks chemically react in water to produce new substances.
Example: feldspar and olivine in rocks turn into clay.
- **An increase in SURFACE AREA speeds up weathering of rocks.** In other words: small rocks weather faster than larger-sized rocks.

- **CLIMATE AFFECTS WEATHERING:** Rocks weather faster in **Warm, Moist** climates.
- **Some minerals RESIST weathering more than others.**
Example: Quartz, which has a hardness of 7 on the Mohs Scale, is a very resistant mineral.
Rocks made of quartz take longer to break down than rocks made of softer minerals like calcite.

EROSION

Erosion is the **movement** of weathered (broken) rock material from one place to another.

- **AGENTS OF EROSION:**
 1. **RUNNING WATER:** the most important (dominant).
 2. **WIND:** mainly in arid (desert) areas.
 3. **GLACIAL ICE:** mainly in polar regions or at high elevations.
 4. **GRAVITY:** the FORCE that drives 1-3 above and it is the force that brings loose rock material at high elevations tumbling down to the ground below.

STREAMS & RIVERS

- Running water is the chief agent of erosion.
- The amount of water in a stream is called the stream's **DISCHARGE**.
- The bottom of the stream channel is called the **STREAMBED**.
- **There are 3 stages of stream formation:**
 1. **Youthful:**
 - high elevations
 - V-shaped valleys
 - rapids and waterfalls present
 - no floodplain
 - capable of moving very large sediment (ex: boulders)
 2. **Mature:**
 - "S"-shaped curves in river called MEANDERS are present.
 - Floodplain exists.
 - Not capable of moving large-sized sediment.
 3. **Old Age:**
 - Many MEANDERS present.
 - Very large floodplain; swamps.
 - Oxbow lakes and Meander Scars present.
 - Yazoo Streams alongside main river.
 - Capable of carrying ONLY the smallest-sized sediment: silts and clays.

Streams carry their sediment in several ways:

1. Rolling and bouncing of large sediment on streambed.
2. Saltation of sand-sized pieces.

3. Suspension of fine silt and clay-sized pieces.
4. Dissolved salts.
5. Flotation of very light materials on surface of stream.

Except for dissolved sediment.....other sediment carried by stream NEVER MOVES FASTER THAN THE VELOCITY OF THE STREAM!

- **The FASTEST moving water in a channel is:**

Toward the **CENTER** of the channel
Just BELOW THE SURFACE of the water.

- There are both EROSION and DEPOSITION of sediments where river **MEANDERS** exist.

EROSION occurs on the **OUTSIDE CURVES**.
DEPOSITION occurs on the **INSIDE CURVES**.

- **DEPOSITION:** the leaving behind (dropping) of sediment as a stream's velocity slows down.

- **A Stream's Velocity is affected by:**

1. Slope
2. Discharge (amount of water in stream)
3. Width and Shape of the Channel

- **Deposition of Sediments is affected by:**

1. Particle **Size** - The largest particles settle faster.
2. Particle **Shape** - Round particles settle faster than flat particles of the same material).
3. Particle **Density** - If particles are the same size and shape, the heavier particles settle faster.

- As sediment is deposited, particles may be either **horizontally** or **vertically sorted**.

- **HORIZONTAL SORTING** occurs when the larger particles fall close to shore and grade to smaller particles farther from shore.
Example: deposition by a stream into an ocean.

- **VERTICAL SORTING** occurs when sediment is deposited into calm, still water.
Example: deposition by a stream into a lake.
Large particles are found on the bottom and smaller particles on the top.

Sorting of sediments into graded beds can occur many times during several flood stages of a river's lifetime. These separate events are called: **PULSES**.

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