CC **Topic IX**

W E A T H E R I N G and E R O S I O N

I. **Weathering** - the physical and chemical breakdown of rock into sediments at or near the earth's surface.

A. **Physical weathering** - breaking rock into pieces by a force
   1. abrasion - grinding off the outer surface, like sand blasting
   2. plant roots - will force rocks apart as they grow in cracks
   3. frost action - breaks rock apart when water in cracks ***expands*** when it freezes
      a) not found in tropics (too warm)
      b) mostly occurs on tops of high mountains (frequent freezing/thawing)

B. **Chemical weathering** - breaking down of rock by *chemical* reactions
   1. oxidation - iron in rock combining with oxygen (rusting)
   2. dissolving - due to weak acids reacting with rock (limestone)
      a) **occurs mostly in warm and moist climates**

II. **Factors affecting weathering**

A. **Exposure** - more exposure to weather (wind & rain) means more weathering
B. **Particle size** - a rock broken into pieces has more surface area than one solid rock, so the **smaller** pieces will weather **FASTER** than the solid rock.
C. **Mineral composition** - rocks containing harder minerals will weather **slower**
D. **Climate** - weathering of rocks in general happens faster in a warm and moist climate.

III. **Soil** - results from **weathering** and **biological activity** over a long period of time.

A. **Residual** - formed from **bedrock below**, and NEVER transported elsewhere
B. **Transported** - moved in by some agent of erosion like glaciers, wind, or water (streams/rivers)
   Most soil in New York State is **transported**, by glaciers.

1.) Residual soil forms in layers, called **horizons**
   a) **top soil** - lots of **organic** (once living) material in it, called humus.
   b) **subsoil** - lighter in color
   c) **partly weathered bedrock**
   d) **unweathered rock**

2.) An increase in biological activity in an area means faster/thicker soil development.

IV. **Erosion** - the removing of and transporting of weathered sediments

A. **Gravity** - the primary driving force of all erosion
   1. Gravity occasionally acts alone.
      a) **Mass movement** - materials moving downslope due to just gravity. (avalanches, landslides, mudflows, creep)

B. **Agents of Erosion** - what actually moves the sediments
   1. **Rivers (running water)** - most effective agent for all the earth
   2. **Glaciers** - most effective in cold climates (mountain tops)
   3. **Wave action** - along shorelines
   4. **Wind** - most affective in arid (dry) climates (and shorelines)

V. Streams/Running water

A. **Watershed** - area drained by a stream and its tributaries (small streams joining main one)

B. Materials are removed by:
   1.) lifting
   2.) dissolving (in solution)

C. Materials are transported in the water by:
   1.) bouncing along the bottom (**bed**) of the stream
   2.) suspension - colloids floating *within* the water (looks muddy)
   3.) dissolving - like salt going into solution

D. **Stream velocity** - the speed of the stream

E. **Maximum velocity** (fastest water) is where the **MOST** erosion takes place (has the highest kinetic energy)

Maximum velocity occurs:
   1.) when stream has a **steep gradient** (see equation in Ref. Tables).
   2.) when there is a **greater discharge** (volume, or amount) of water.
   3.) along the **outside** of meanders (stream bends). Most erosion occurs along the **OUTSIDE** of a bend, through slumping, so the stream is deepest there.
      a) **Channel shape** - deepest where the velocity is greatest, which causes more erosion.
         1) In middle of channel for ***straight*** part of stream.
         2) Along outside of bends for ***meanders*** (curves).

F. **Sediment size and stream velocity**
   1.) The **FASTER** the stream, the **bigger** the sediments it carries (see Ref. Tables... page 6)
   2.) Sediments are always transported ***SLOWER*** than the stream velocity.

G. **Roundness of pebbles** - extended abrasion during transport causes the edges of sediments to wear off, making them become **rounder** and **smaller**.

H. Stream erosional features
   1. V-shaped valleys - cross-section view

VI. Wind

A. Deflation - blowing away loose sediment
B. Sand blasting - abrasion from wind-blown sand

VII. Glaciers (moving **ice)**

A. Result in the formation of:
    1. U-shaped valleys
    2. parallel scratches
    3. grooves in bedrock

VIII. Wave action

A. Waves approaching the shoreline move sand parallel to the shoreline within the zone of breaking waves.
    1. Causes sediments to become **round** due to abrasion.
B. Erosion changes the shape of the beach
    1. Structures and property can be lost during storms due to beach erosion.

IX. Human impact

A. Careless removal of vegetation (plants/trees) results in erosion of topsoil.