

Topic 9 Weathering and Erosion

I. Weathering: (chapter 8 page 131 in text)



Cleopatra's needle are pictured above

1450bc - ny 1881

Different types of particles or sediment

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

ESRTpg11

a. Two Types of Weathering (page 131)

1. _____ Weathering:

Examples are: (page 134)

a. _____: Adding oxygen to a substance.

Most popular example is rusting:

- Iron rusts when it is in contact with oxygen and water.
- Rust is iron oxide, chemical formula for iron oxide is Fe_2O_3 .
- Oxidation also means loss of electrons. The iron loses electrons. An ionic half equation for this reaction is: $Fe (s) = Fe^{2+} (aq) + 2e^-$
- Water is needed for rusting to occur because the electrons that the iron loses travel through the water. If salt is present, rusting happens quicker because the salt makes the water more conductive. It allows the electrons to travel through the water faster.

b. _____: Water will dissolve certain minerals in a rock. Water easily weakens the mineral feldspar and dissolves it. This is what breaks down strong rocks like granite. The feldspar are washed away and will make clay while the quartz is left behind, the quartz makes up the sand.

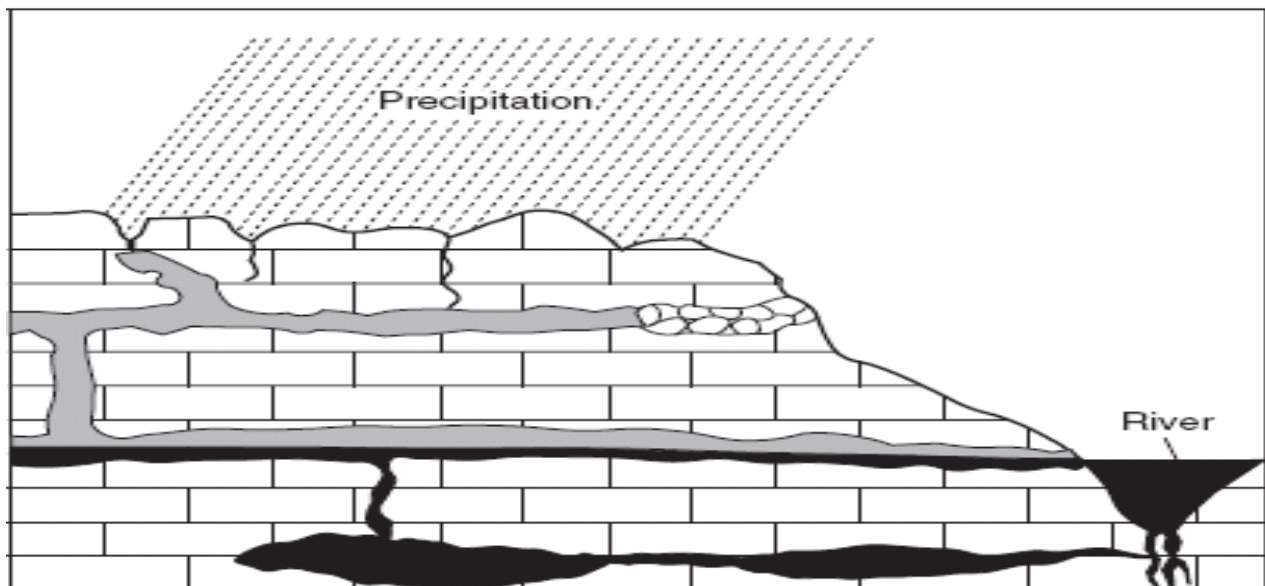
c. _____: -- (H₂SO₄) -- _____
(HNO₃) -- _____

The pollution combines with the rainwater to form sulfuric acid, this can also happen with snow

What are the sources of these pollutants?

What should or can be done?

d. _____: (Page 134) Carbon dioxide (CO₂): can combine with water in the atmosphere to form carbonic acid which when it falls and collects in on the ground, eats away at rock. This affects limestone especially. In a limestone the mineral Calcite (calcium carbonate which is found in Tums and Roloids) reacts to the acid and dissolves, this forms features such as caves, sinkholes, columns, stalagmites and stalactites. (page 162)



e. **Plants** also produce weak acids, given off at the root of the plant, which breakdown rock.

2. _____ weathering: (page 132)

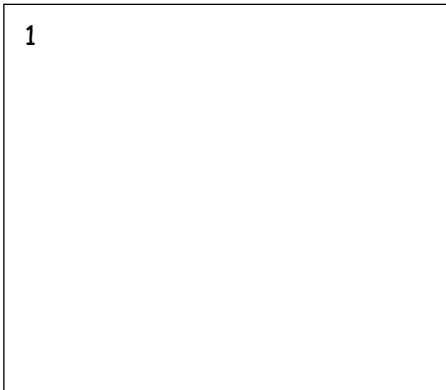
a. _____--(page 133) Is a process that rocks will break apart into smaller pieces by changes in temperature.

1. Rocks are heated in the day by the sun and expand.

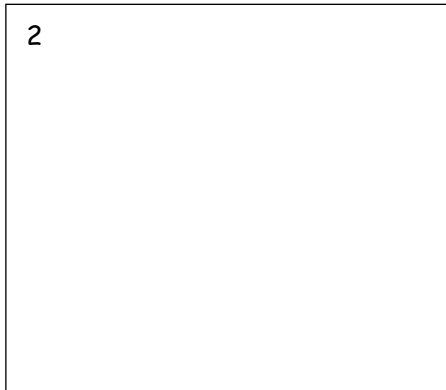
2. At night the rock cools

3. This cycle of expanding and contracting cracks and peels away the outer layers of the rock.

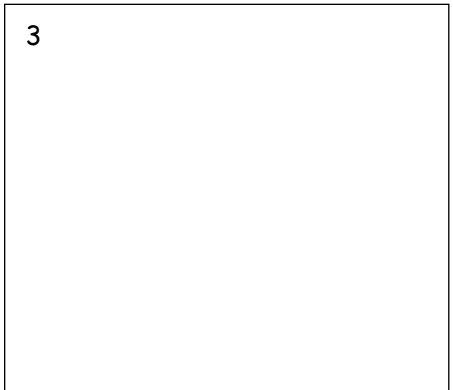
1



2

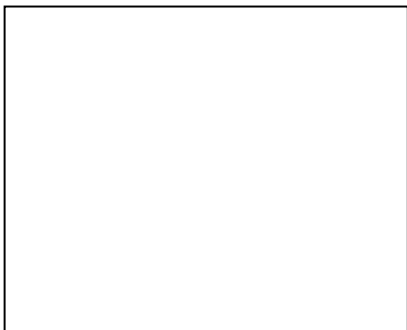


3



b. _____ Action: is caused by the repeating freezing and thawing of water in colder climates (page 132)

Key Factor When water freezes it will _____.



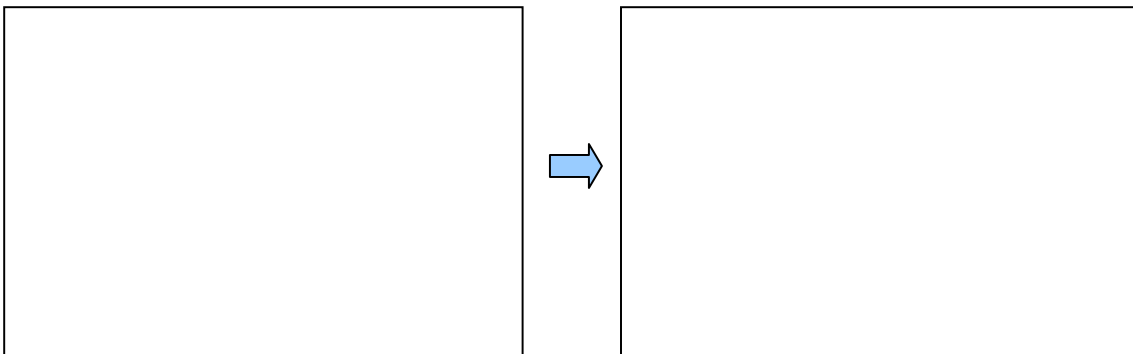
Think?

1. Why is this dominant in the mid-latitudes?

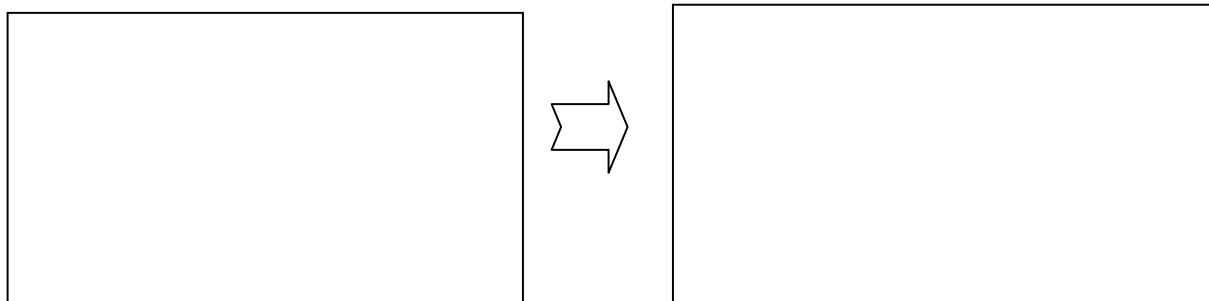
2. Why do we not see this type of weathering dominant in Upper Canada and states like Florida and Texas?



c. _____ -- is when the roots of plants grow in the cracks of rock and as the plant grows it is wedged apart.



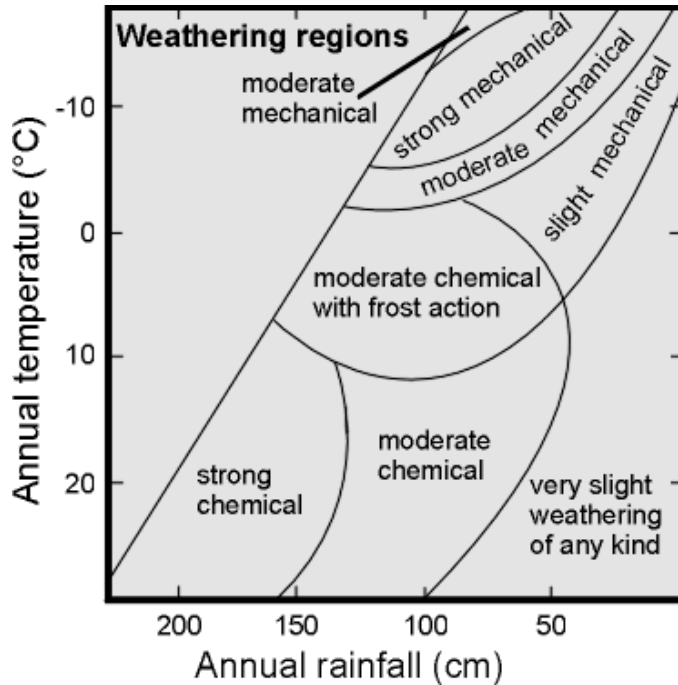
d. _____: is another physical weathering example that occurs in drier climates.



Wind picks up material and it collides into rock.

Factors that affect the rate at which weathering occur (page 136)

1. _____: Is a major factor that affects weathering



Temperature and moisture are the two main factors that will affect the type of weathering that occurs

1. In warm climate _____ weathering is dominate
2. In cold climates _____ type of weathering is dominate

Using the chart above identify the type of weathering

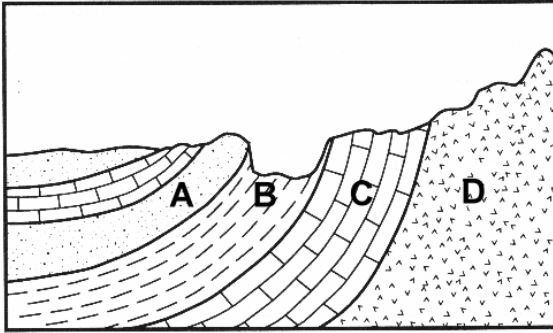
1. Mean average Precipitation: 175 Mean average annual temperature: 22
2. Mean average Precipitation: 50 Mean average annual temperature: -10
3. Mean average Precipitation: 25 Mean average annual temperature: 25
4. Mean average Precipitation: 125 Mean average annual temperature: 5

2. **Exposure:** _____



2. **Rock and Mineral Strength:** (Page 135) some minerals in rock are harder or softer than others minerals. For example quartz is a very hard mineral. Most sand in the world is composed of quartz after billion of years of the ocean waves removing the softer minerals.

It also creates difference in landscapes



Which layer do you think is the weakest rock contained?

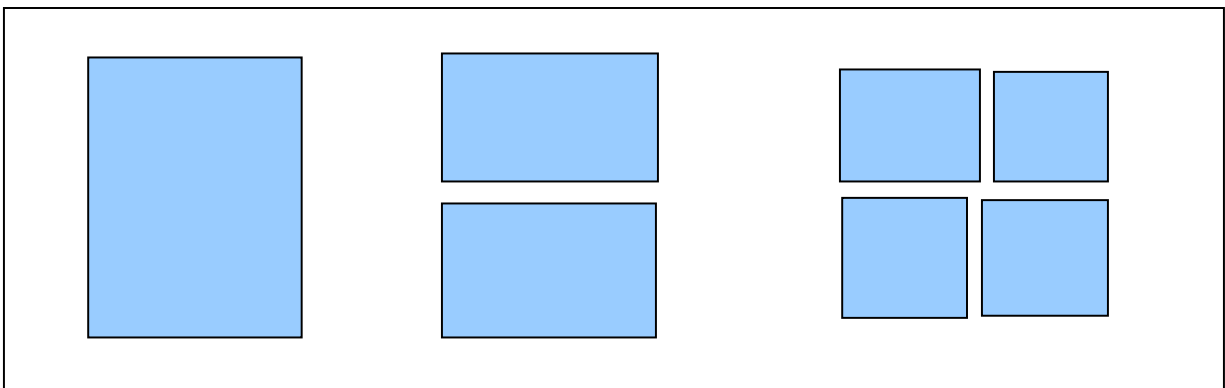
Which layer do you think is made with the strongest rock?

The diagram above shows layers of rock from a profile. Stronger layers stick out further and weaker layers are worn down to lower elevations.

Example: The Great Lakes are made because the glacier was able to break the weaker shale layers

3. **Particle Size:** Since weathering takes place on the outside of a rock. The amount of surface are exposed is a factor.

Which of the examples do you think will weather fastest?



Smaller size particles show more surface area per unit of volume than larger particles that is why _____ will weather faster

II. Products of Weathering (page 138-139 in text)

A. Name the different size particles that would result in weathering (ESRT pg11)

Colloids are the smallest and are so small even in still water they will stay suspended.

Ionic particles are actually dissolved in water. and may turn back into a solid when the water evaporates

With a lot of dissolved particles this may be called _____ water

With no dissolved minerals this is called _____ water

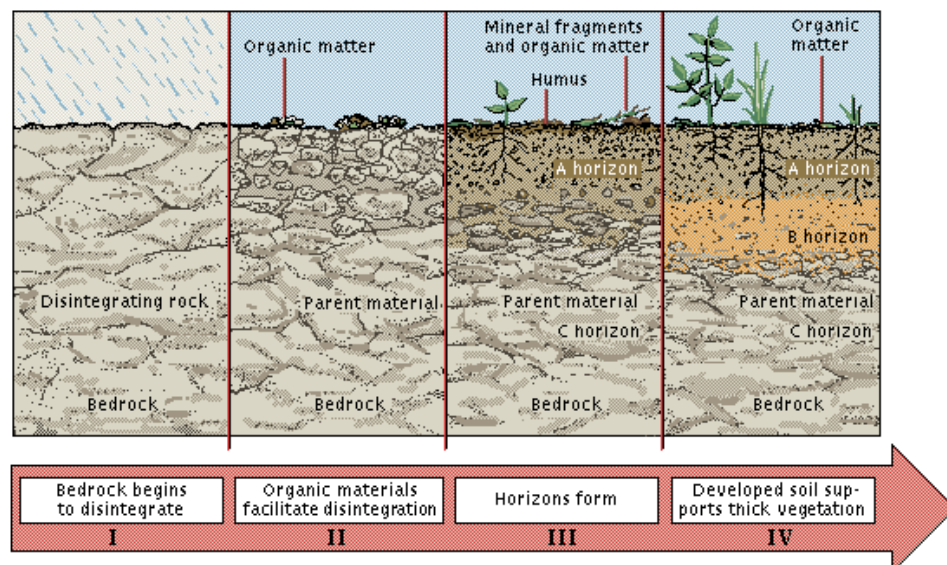
B. Soils Formation:

Over time weathered material will form Soils:

Besides weathering what other processes are involved in making a good soil?

Mineral composition, plant growth, organic matter, and number classify layers called _____

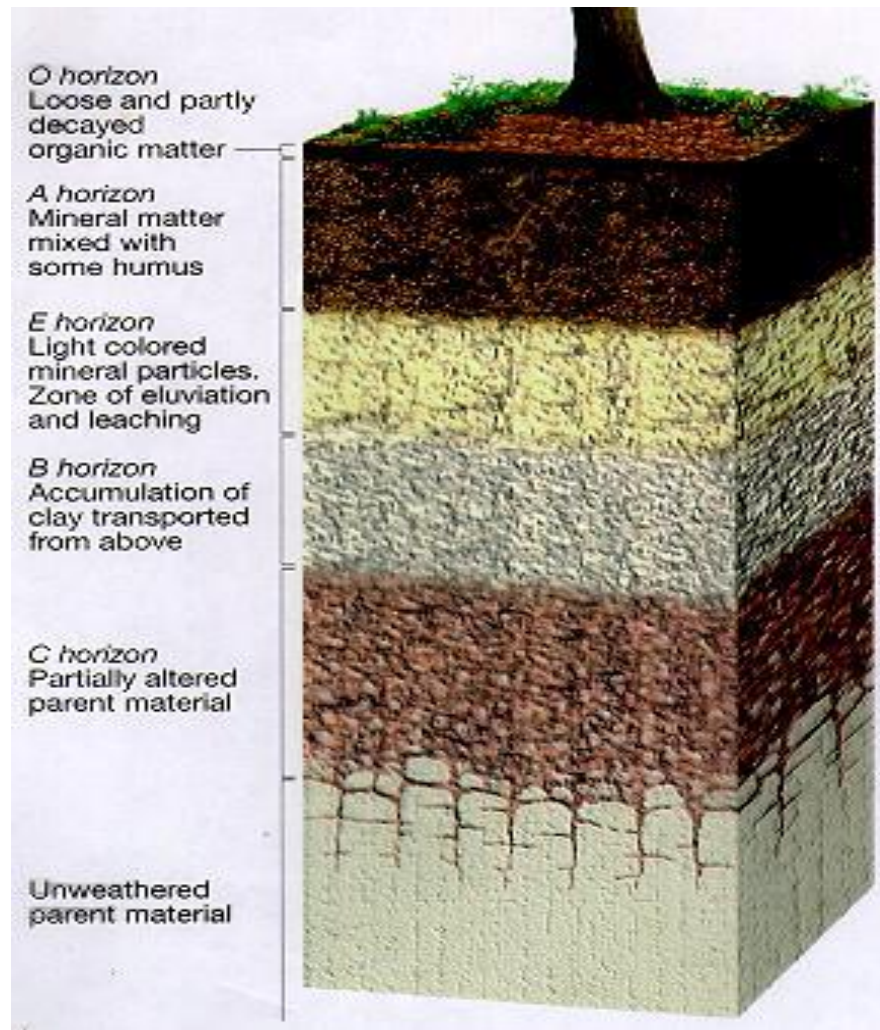
As time goes by, soils will change in depth. (Page 138)



Immature soils have _____ horizons

Mature soils have _____ horizons

Each horizon has certain characteristics



C. Residual soils and Transported Soils (page 138 in text)

Residual – _____

Transported – _____

****In New York State what types of soils are most popular?

What may have transported most of the soils away?

The only place where you can find residual soils is parts of Allegheny State Park.

I. Erosion:

Defined: _____

Erosion is a system.

It contains several different parts and they all have to work in order for the system to work.

Part 1 is an **Agent**

1. The agent of erosion is a material or a force that moves sediments from one place to another

There are four Agents of erosion

1	2	3	4
---	---	---	---

Part 2 is a **Driving Force** _____ is the primary driving force

- It can act by itself or it pulls on the other agents to start the erosion systems

Part 3 is the **Material** that is moving.

Part 1 the Agents:

A. Gravity

Acting by itself: Gravity erosion samples are called (page 141)

_____ - _____

This type of erosion is dependent on two opposing forces

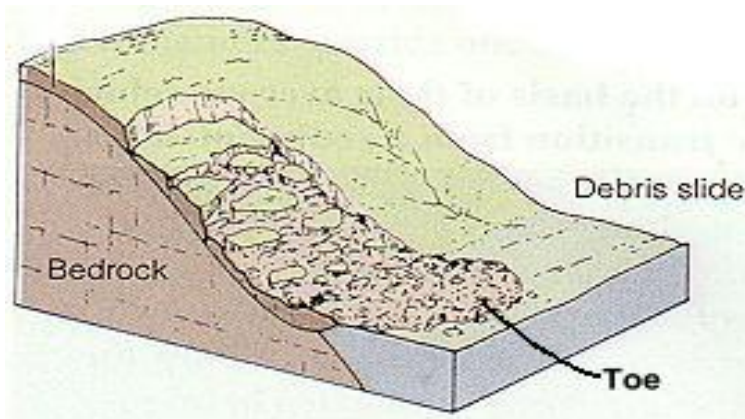
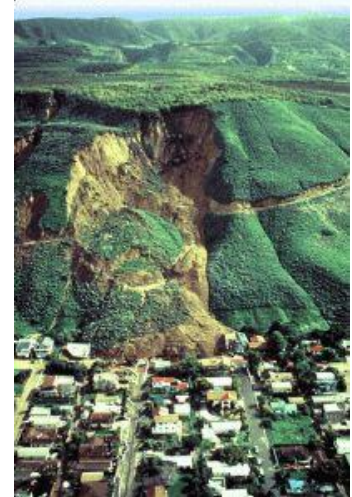
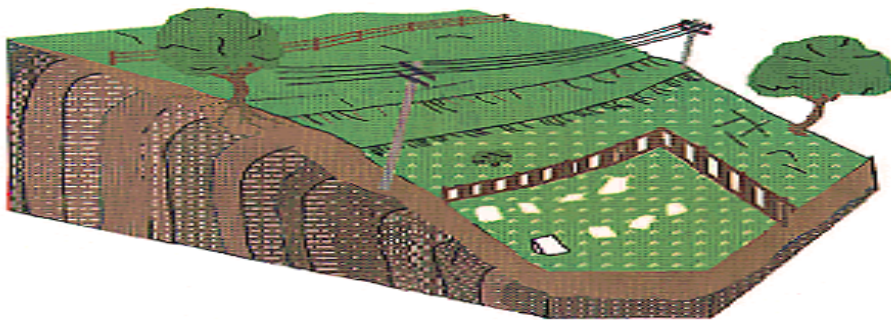
1. Gravity
2. Friction

Have you ever noticed a group of trees on a slope where the base of each tree bows outward in the down-slope direction?

Where retaining walls try to hold the sloping lawns in place? Where some of the retaining walls is failing, bulging out over the sidewalks?

If you can answer yes to these questions then you have witnessed

_____ (page 141) the very slow flow process of soil movement!



The above diagram and picture above show a movement that has several names

- _____
- _____
- _____

B. Erosion with running water (Chapter 10 page 169)

One thing you must remember is that running water is the chief source of erosion at the present time for New York, and most of the world.



Rain impact, runoff, streams (rivers) all sculpt the landscapes.

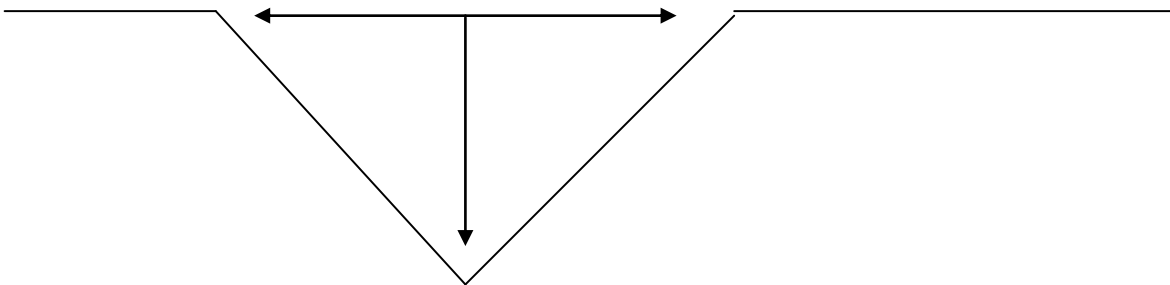
Streams

i. Erosion of a stream (page 172)

Any water confined to a channel is a stream (creeks, rivers).

There are two forces that cut into a stream.

There is a downward force and a side to side force.



These forces cut into the rock making a V shaped channel

At high volume the downward force is favored, and at low flow the side force is favored

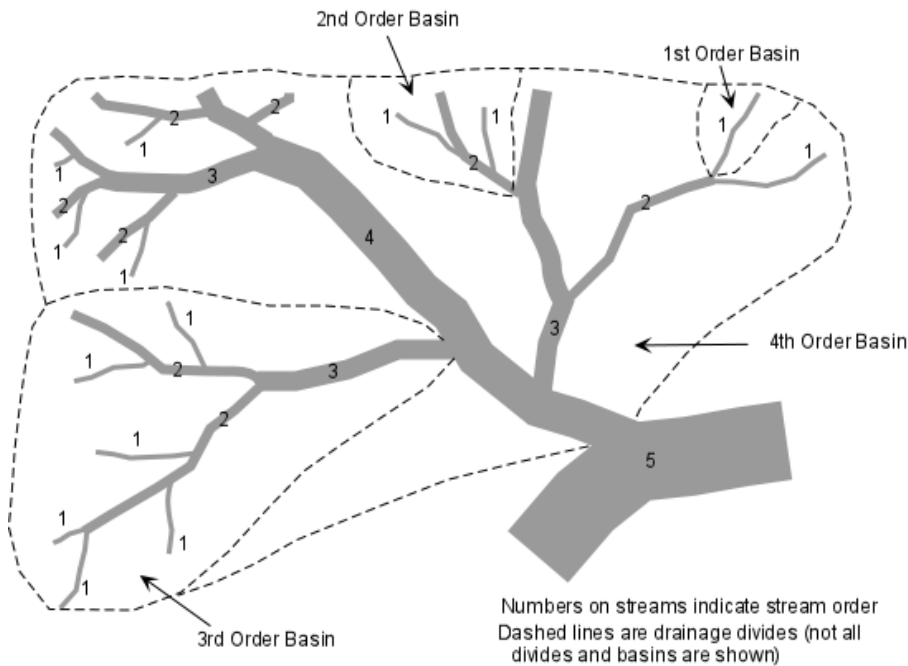
ii. Stream Drainage (page 174)

The area of land drained by the stream is called its _____

Or _____

The Chesapeake watershed drains most of the northeast.

The Mississippi River drains most of the 48 states



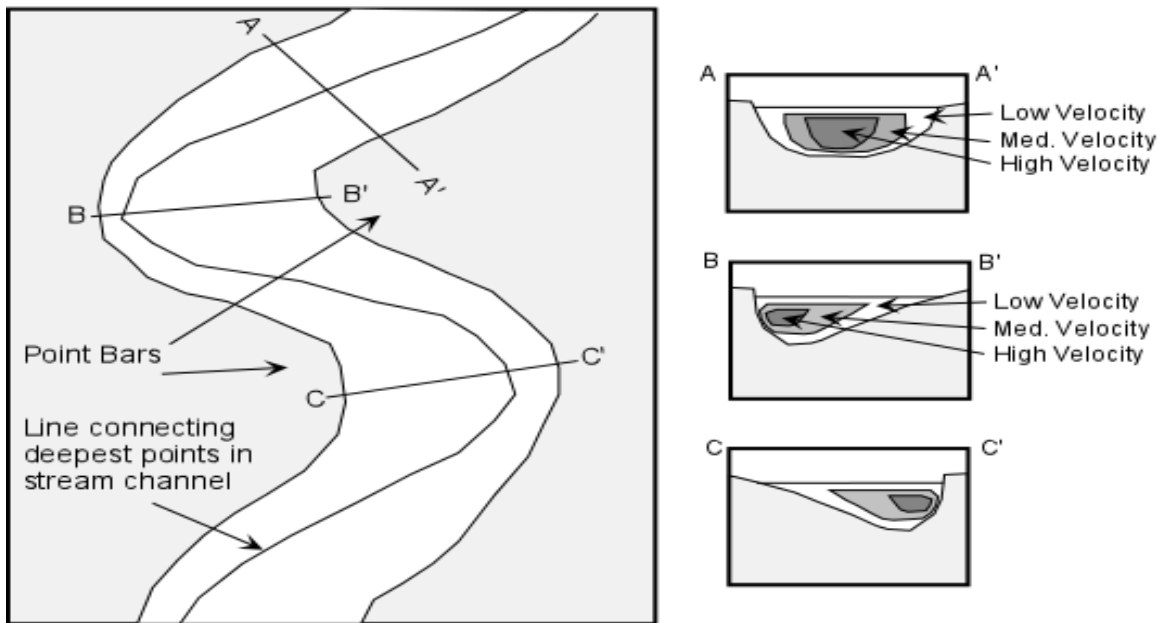
iii. Stream Velocity

a. Factors that affect Stream Velocity page 171 textbook

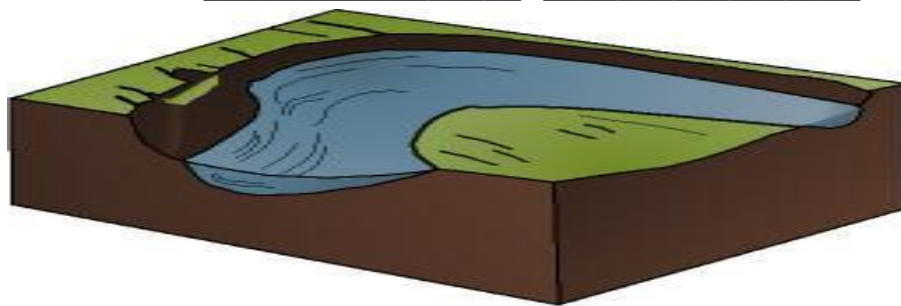
1. _____ -- Or slope
2. _____ -- Or volume of water
3. _____ -- the shape of the bed of rock or loose materials that confine the stream

b. Stream velocity Changes as the shape of stream changes

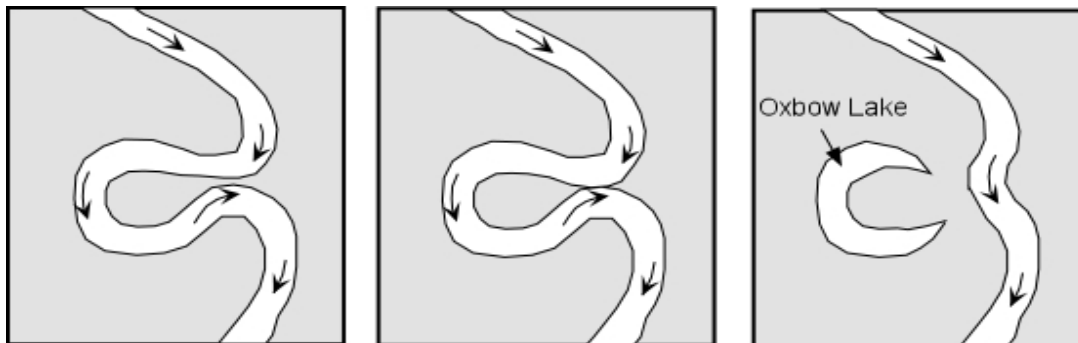
Meandering Channels



The outside curve of the stream where the velocity is highest is where erosion is dominant is called the _____ - _____



Sometimes the cut-bank is so exaggerated it forms a loop and can actually be cut off from the main stream. This forms a _____ (Page 179)

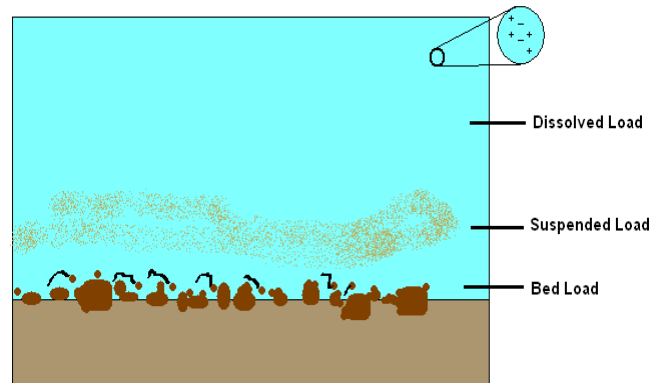


How does a stream carry sediment? (page 170)

a. _____ --
minerals dissolved in the water

b. _____ --
small particles carried with in the
water

c. _____ --
larger particles rolling and
bouncing along the bottom



Because of this ***rolling and bouncing*** eventually sediments that are carried by water have two characteristics

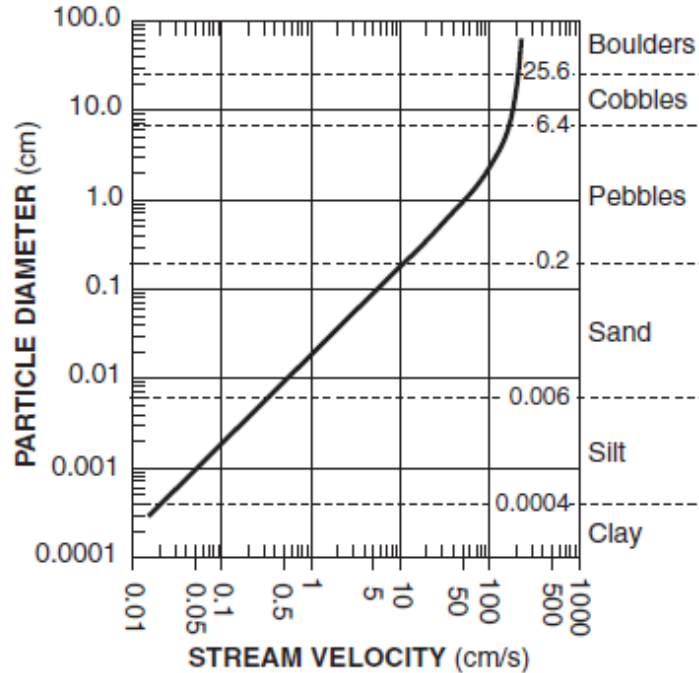
a. _____ and they are

b. _____.

The material that is carried in a stream is called its (page 171) _____.

At different velocity the streams can carry different size sediment. The chart above is used to determine what size sediment a stream can carry.

Relationship of Transported Particle Size to Water Velocity



This generalized graph shows the water velocity needed to maintain, but not start, movement. Variations occur due to differences in particle density and shape.

Stream Velocity	Sediment Carried
50 cm/sec	
100 cm/sec	
300 cm/sec	

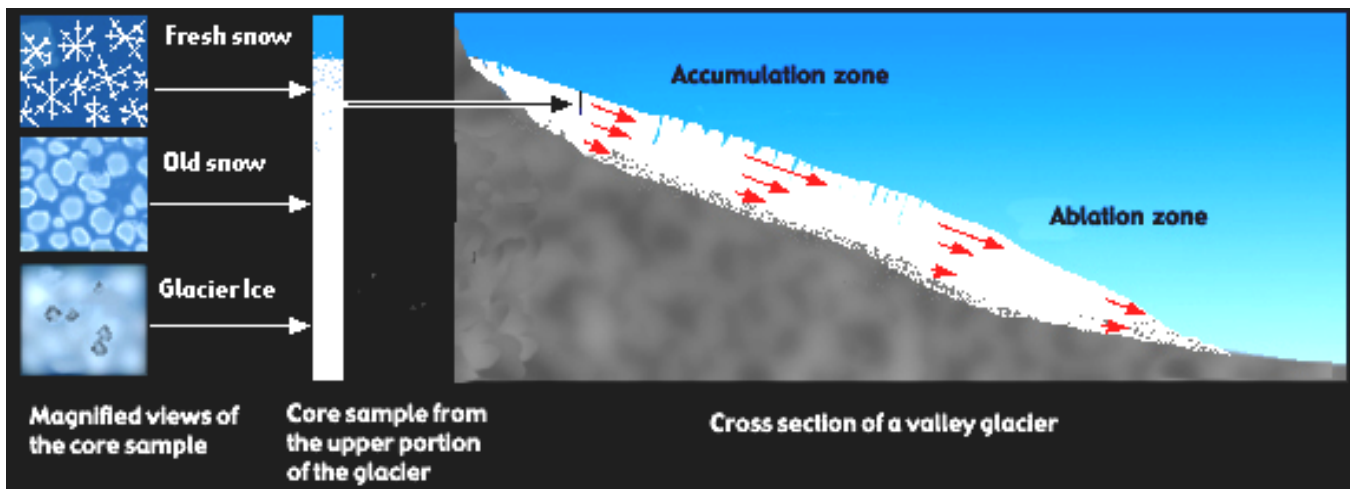
1. What is the largest size sediment that a stream can carry if its velocity is 10cm/sec?
2. What is the stream's velocity if it is carrying sediments the size of cobbles but not boulders?
3. What is the velocity of a stream if it is carrying clay silt sand but not pebbles?

B. Ice Erosion (chapter 11 page 191)
Two types of glaciers Page 191 and 192)

1. _____ (Alpine) – these are found on top of mountains where ice can collect for over thousands of years.
2. _____ -- These are huge expanses of ice that can cover a entire continent.

Examples a. _____ b. _____

- The ice forms from thousands of years of accumulated snow. That eventually
- Forms into ice with the pressure from the overlying layers.



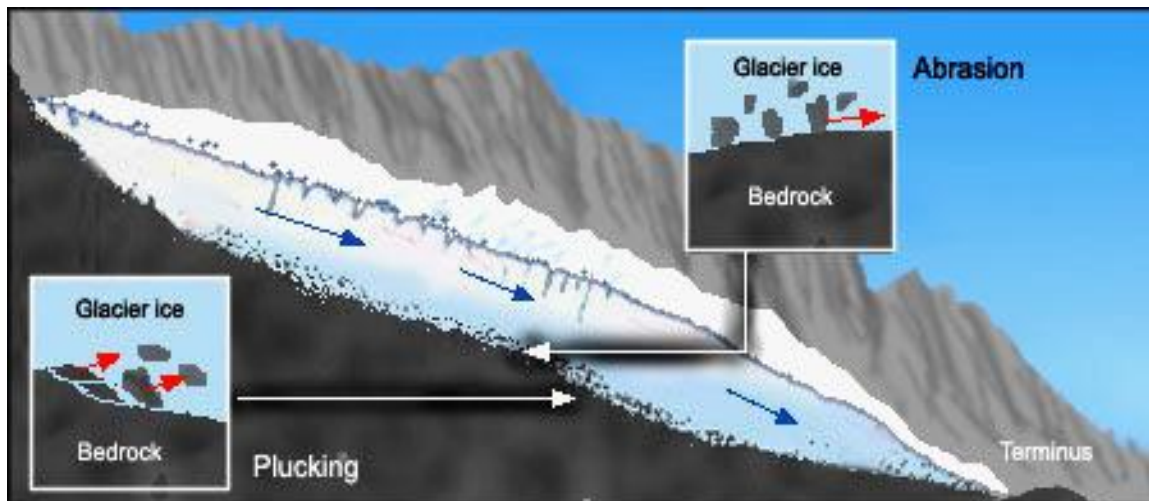
How does erosion happen with ice?

Two major erosion processes occur at the base of a glacier:

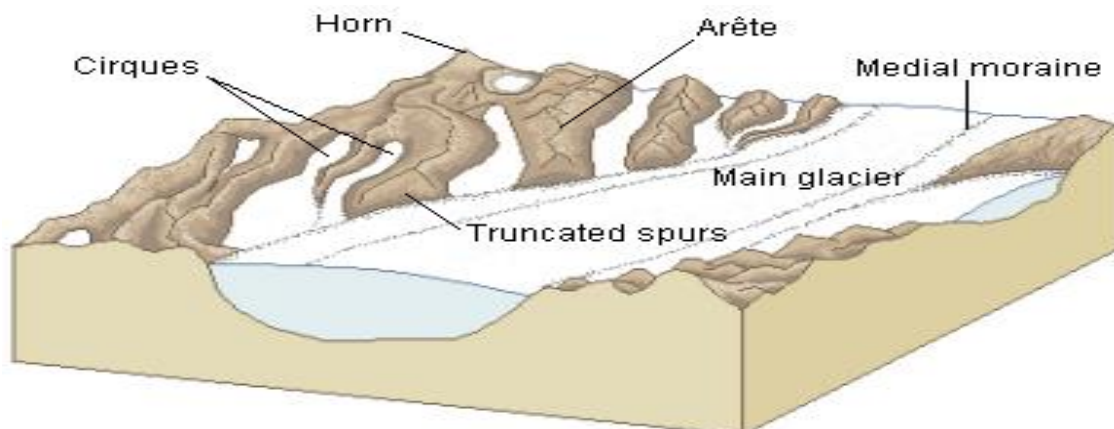
A. Large amounts of loose rock and sediment are incorporated into the moving glacial ice by partial melting and re-freezing. The process of erosion involves the abrasive action of the held rock and sediment held by the ice on the surface underneath the glacier. This abrasive process is known as

B. Erosion process that occurs at the base of a glacier is _____.

Plucking is the process of particle detachment by moving glacial ice. In this process, basal ice freezes in rock surface cracks. As the main body of the glacial ice moves material around the ice in the cracks is pulled and plucked out.



The erosion affects valley formerly occupied by streams the large amounts from glacial features on the diagram below. They flow very much like a stream.



Evidence of glacial

Sediments that are carried by ice tend to be more _____ and they have some _____.

The land will have _____ - and/or the rock will be highly _____

Once v-shaped valleys will be eroded into _____ valleys

C. Wind Erosion chapter 12 page 211

This type of erosion is dominant in arid climates or where there is loose sediment like along a beachfront.

Two processes dominate erosion by wind one process is called _____ (Pg 212)

Which is when wind picks up small loose sediment and carries it away which lowers the land surface?

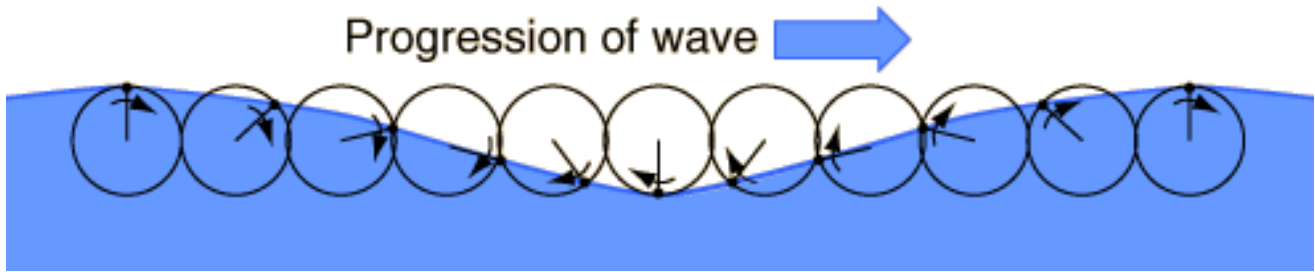
The other process is called sandblasting

Sediments carried by wind tend to be rounded and pitted because of the tumbling and the sand blasting this is called _____



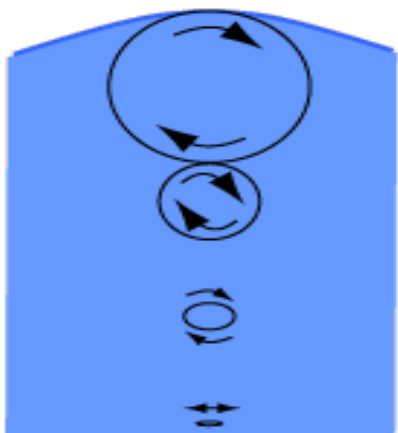
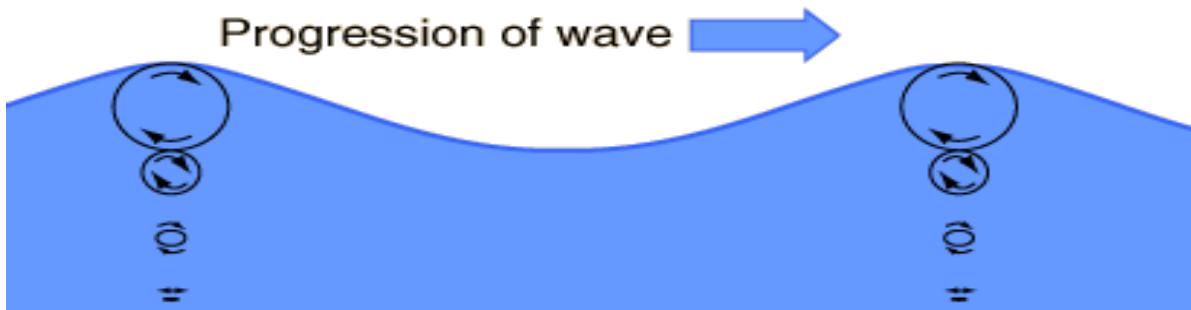
D. Wave erosion

The mechanics of a wave



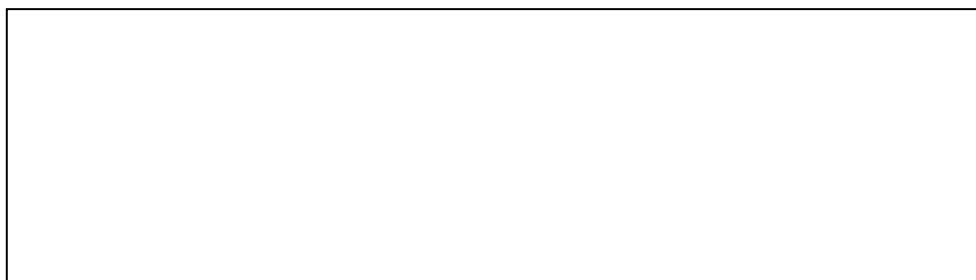
Waves crashing onto shore cause fast and devastating erosion.

Hydrostatic pressure—is when waves push themselves into cracks and force the water to break apart rock. This destroys cliffs



Nature of water circulation scaled from data in Basom. The diameter of the orbit of the circulatory motion is about halved at a depth of about 1/9 the wavelength. At twice that depth the orbit becomes flattened and eventually is just a forward and backward surge.

Waves also create long shore current



Below are some diagrams that show erosion and depositions features formed by waves.

