EARTH SCIENCE

UNIT 5 -KEY

WEATHERING,EROSION, DEPOSITION

YOUR PLANET

YOUR INHERITANCE

YOUR LEGACY

UPDATED AND ADAPTED FROM DAVID J. MILLS 2001

UNIT 5
WEATHERING, EROSION, & DEPOSITION

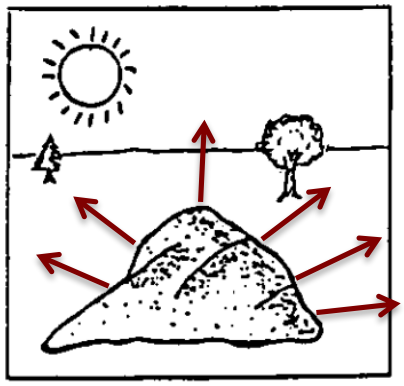
I. **Weathering is**: **THE PHYSICAL AND CHEMICAL BREAKDOWN OF ROCK INTO SMALLER PARTICLES CALLED SEDIMENT**.

II. Types of Weathering:

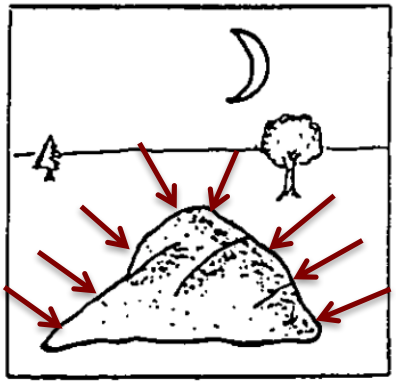
A. **PHYSICAL** weathering = **ANY PROCESS THAT CAUSES A ROCK TO CRACK OR BREAK INTO PIECES WITHOUT CHANGING IT CHEMICALLY**. **ONLY THE SIZE AND SHAPE CHANGES!**

1. **TEMPERATURE CHANGE**

Rocks are heated by the sun. As the outside of the rock heats up, it begins to **EXPAND**.

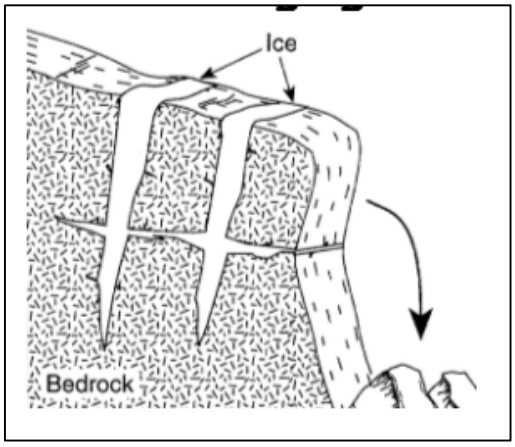


When temperatures fall, the outside of the rock cools and **CONTRACTS**.



This cycle of heating and cooling causes the surface of the rock to break off in slabs or layers. This process is known as **EXFOLIATION**.

2. **FROST ACTION** – also called **FROST WEDGING**
HYDROFRACTURING

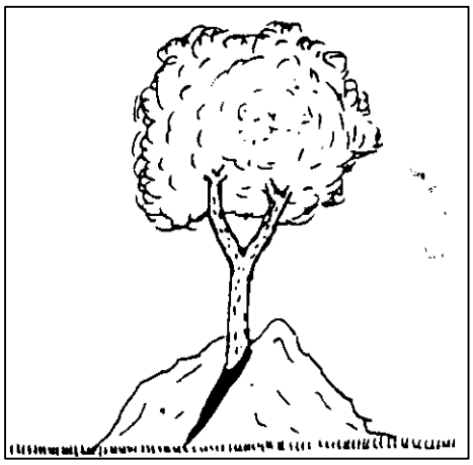


This occurs when water seeps into the cracks in a rock. When the water freezes (ice), it **EXPANDS**.

The cycle of freezing and melting causes rocks to break apart.

This same process happens to our roads and produces what we call **POTHOLES** in the road.

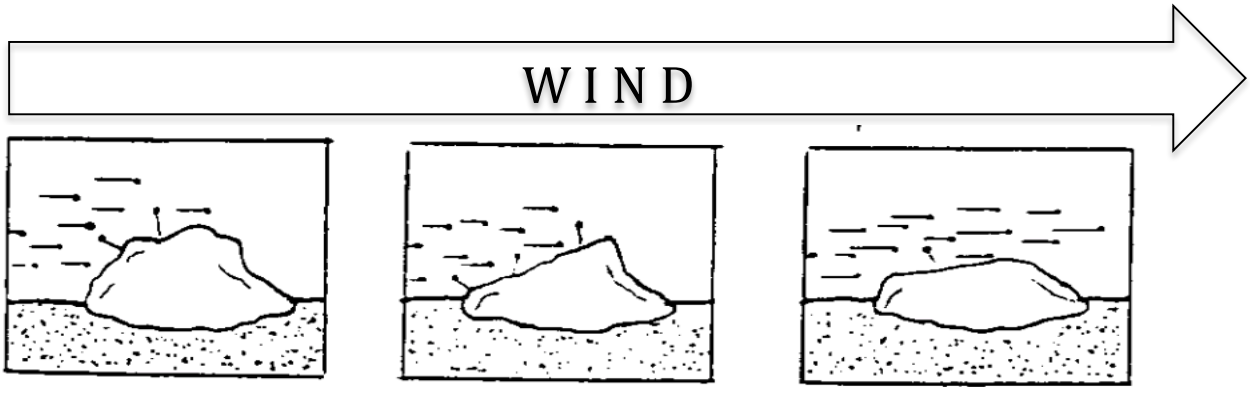
3. **ORGANIC ACTIVITY**



Trees and shrubs can grow through cracks in rocks. Their roots wedge into the crevices, prying the rock apart. Even moss and lichen wedge their hair-like roots between the grains that make up rock.

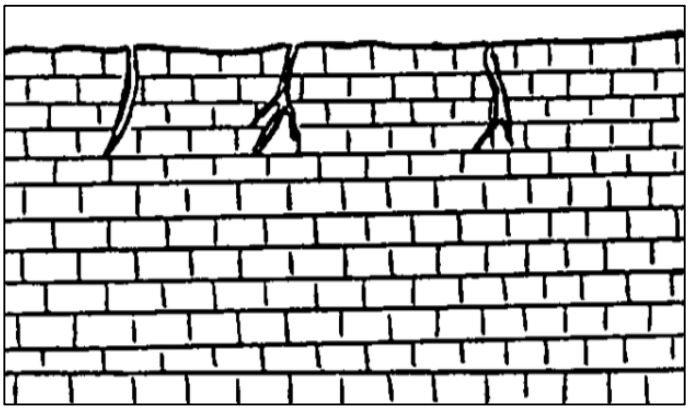
4. **ABRASION**

This process occurs when sediments carried by a stream, and wind-blown sand causes particles to collide into each other and the surrounding rock, "sanding" them smooth.

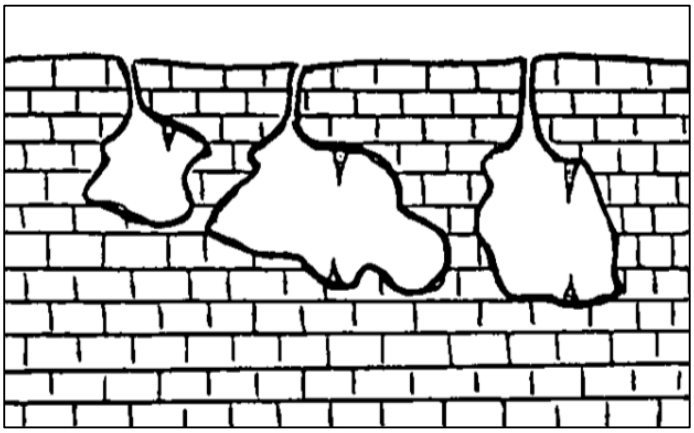


B. **CHEMICAL** weathering = **ANY PROCESS THAT CAUSES ROCKS TO BREAKDOWN BY CHEMICAL ACTION AND RESULTS IN A CHANGE IN THE MINERAL/ CHEMICAL COMPOSITION**.

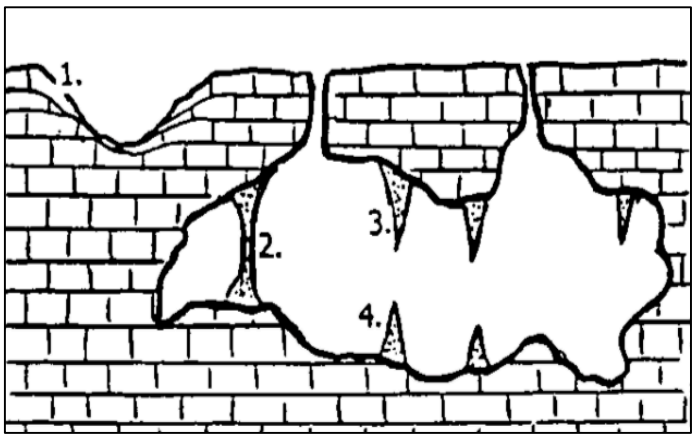
1. **CARBONATION** – Occurs when **carbon dioxide** in the atmosphere dissolves in the droplets of water that make up clouds. This forms a weak carbonic acid. Carbonic acid reacts with certain rocks and minerals that include: **CALCITE**, **LIMESTONE**, **MARBLE**, AND **CHALK**



LIMESTONE
BEDROCK



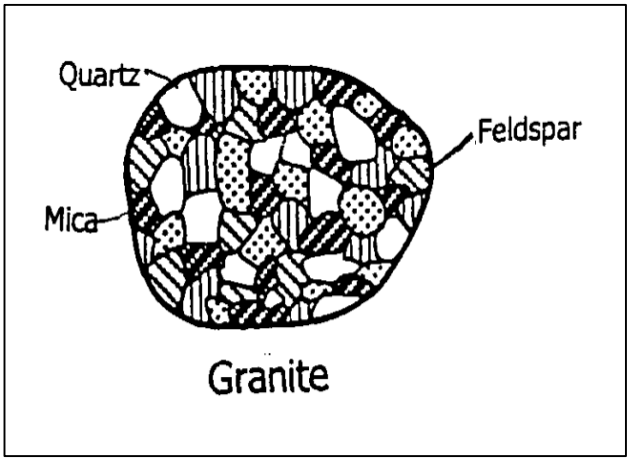
Carbonic acid rain water seeps into the limestone bedrock through cracks. The water dissolves the limestone rock.



A cavern forms, Other features may include:

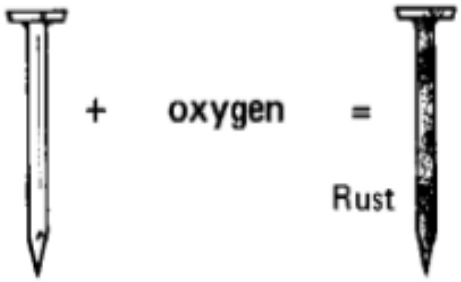
1. SINKHOLES
2. COLUMNS
3. STALACTITES
4. STALAGMITES

2. **HYDRATION**= occurs when water dissolves certain minerals in a rock. For example, granite is very stable in cool, dry climates, but in moist climates, rainfall dissolves much of the mineral feldspar. The feldspar becomes clay, which is too weak to keep the rock from falling apart. The mineral quartz remains behind as sand.



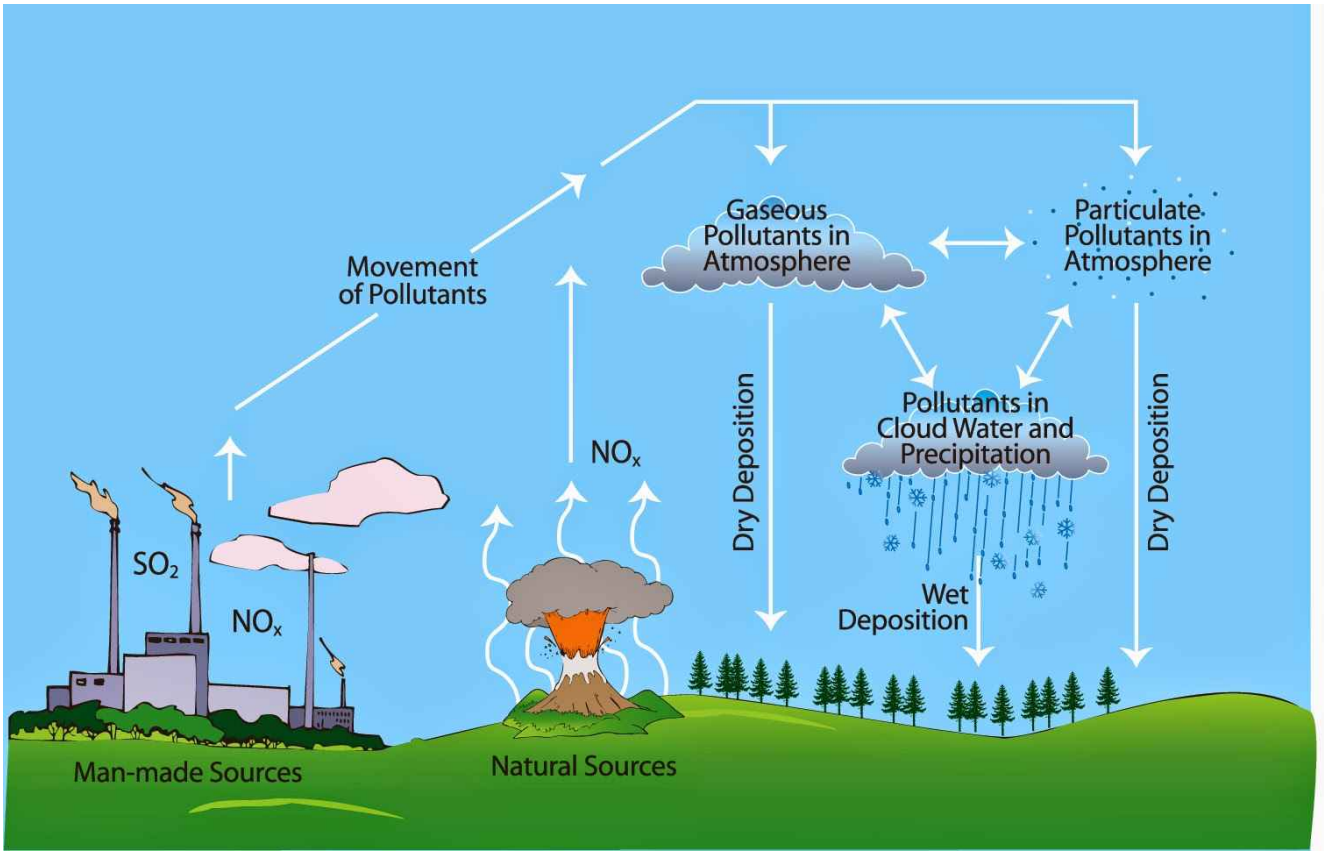
3. **PLANT ACIDS**= Plants produce weak acids that can dissolve certain minerals in a rock, weakening the rock.

4. **OXIDATION**= occurs when oxygen in the atmosphere combines with certain minerals in a rock. For example, when oxygen combines with iron minerals, iron oxide (rust) forms. The chemical change of the minerals weakens the rock and the rock crumbles.



5. **MAN-MADE ACIDS**= Gases produced by humans can dissolve in the water droplets of a cloud to produce **ACID RAIN**. These acids include:

H_2SO_4 – SULFURIC ACID
HNO_3 – NITRIC ACID



A BRIEF GUIDE TO ATMOSPHERIC POLLUTANTS

A number of different chemical entities, from a range of sources, can contribute towards atmospheric pollution, the consequences of which can include global warming and smog. This graphic looks at a selection of major groups of atmospheric pollutants, their major sources, and their effects.

CARBON MONOXIDE

A gas generated by the incomplete combustion of fuels – primarily from road transport. Affects human health, as it reduces oxygen-carrying capacity of the blood. It also reacts with other atmospheric gases to produce ozone.

CARBON DIOXIDE

A gas generated by the burning of fossil fuels in the production of electricity. Also emitted by natural processes. Human emissions are linked with rising atmospheric CO_2 levels and anthropogenic global warming.

NITROGEN OXIDES

Primarily created by combustion in road transport. Nitrous oxide is an important global warming contributor, whilst nitrogen dioxide is involved in ground-level ozone forming reactions, and is also a component of smog.

SULFUR DIOXIDE

The primary source of sulfur dioxide is the burning of fossil fuels to generate electricity. It can contribute to smog, reacts with water to produce acid rain, and can also cause wheezing and breathing problems for asthmatics.

AMMONIA

Ammonia's primary atmospheric source is from its use in agriculture, such as manure & fertilisers. It can react with other pollutants to produce particulate matter. It also has the ability to over-enrich ecosystems with nitrogen.

VOCs

VOCs (volatile organic compounds) are emitted naturally by vegetation. Amongst significant human sources is road transport, as well as solvents. They can contribute to formation of ground-level ozone and smog.

OZONE

The ozone layer shields us from UV radiation, but ground-level ozone is a major pollutant. It's formed from other pollutants in the presence of sunlight. Ozone is a major component of smog, and can also cause health effects.

POPs

POPs (persistent organic pollutants) are volatile chemicals released into the atmosphere, often from agricultural or industrial uses. They persist in the environment and can have health effects on both wildlife & humans.

PARTICULATE MATTER

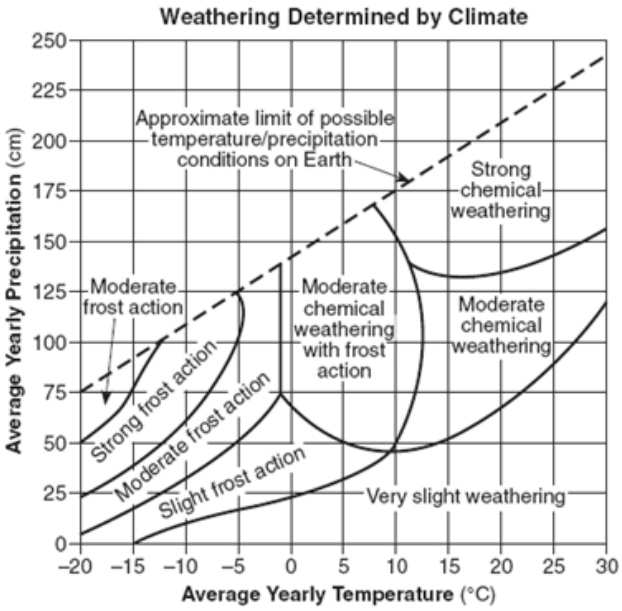
Particulate matter is composed of a huge number of different components. Some are directly emitted, while others are generated by reactions in the atmosphere. They cause haze and can also cause lung problems if inhaled.

HEAVY METALS

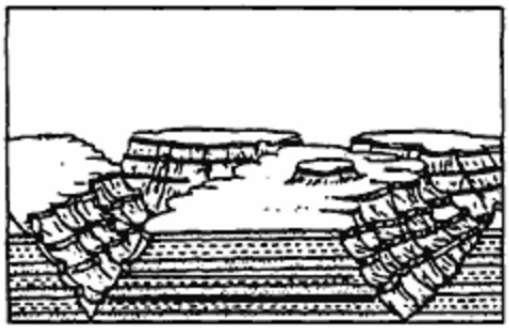
Heavy metals are released into the atmosphere from a range of sources, including burning of fossil fuels and road transport emissions. Some, such as mercury and lead, have toxic health effects in humans.

III. Rates of Weathering.

A. **CLIMATE** is the major factor that affects the rate of weathering.



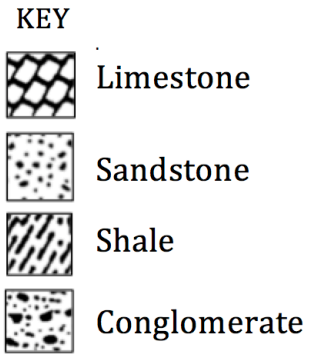
1. **TEMPERATURE**:
   a. In warm climates **CHEMICAL ACTION** is the dominant type of weathering.
   b. In cold climates **FROST ACTION** is the dominant type of weathering.
2. **PRECIPITATION**:
   a. As precipitation increases, the amount (or rate) of weathering by frost action **INCREASES**.
   b. As precipitation increases, the amount (or rate) of chemical weathering **INCREASES**.
3. Chemical weathering is most rapid in **WARM** and **MOIST** climates
4. Due to climate and different weathering processes, landscapes develop differently.

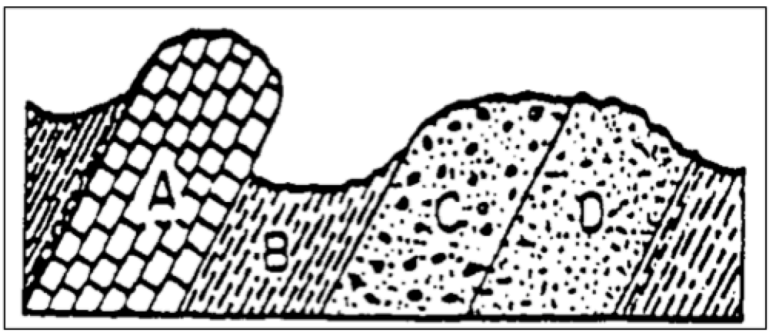


ARID CLIMATE

HUMID CLIMATE

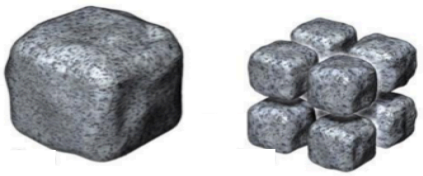
B. **DIFFERENT TYPES OF ROCKS** cause differential weathering. Differential weathering is the process by which softer, less weather-resistant rocks wear away, leaving harder, more weather-resistant rocks behind.





Which type of rock is MOST resistant to weathering? **LIMESTONE**
Which type of rock is LEAST resistant to weathering? **SHALE**

C. **PARTICLE SIZE** – Weathering takes place on the outside surface of rocks. So the more **SURFACE AREA** that is exposed to weathering, the faster the rock will be broken down. Note: the diagram shows the same type and mass of rock.



As rock breaks into smaller pieces, the **SURFACE AREA** increases. As surface area increases, the rate of weathering **INCREASES**.

IV. Products of weathering

A. **SOLID SEDIMENTS**

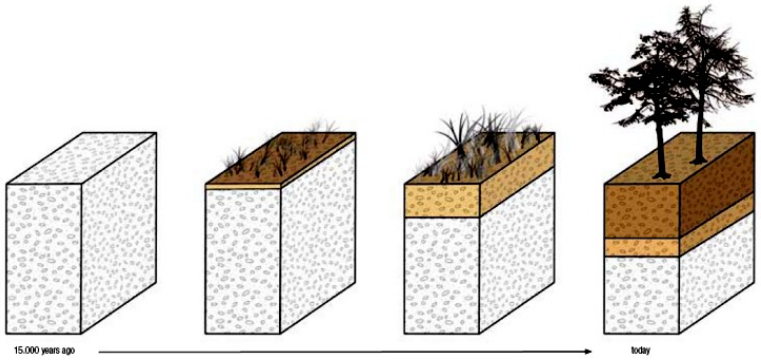
NAME OF SEDIMENT	SIZE (cm)
Boulders	
Cobbles	
Pebbles	
Sand	
Silt	
Clay	
Colloids	Less than .00001

COLLOIDS are very small solid particles (sediment) that are too small to be seen with an ordinary microscope and too light to settle in water. Even in calm water, they remain suspended within the water

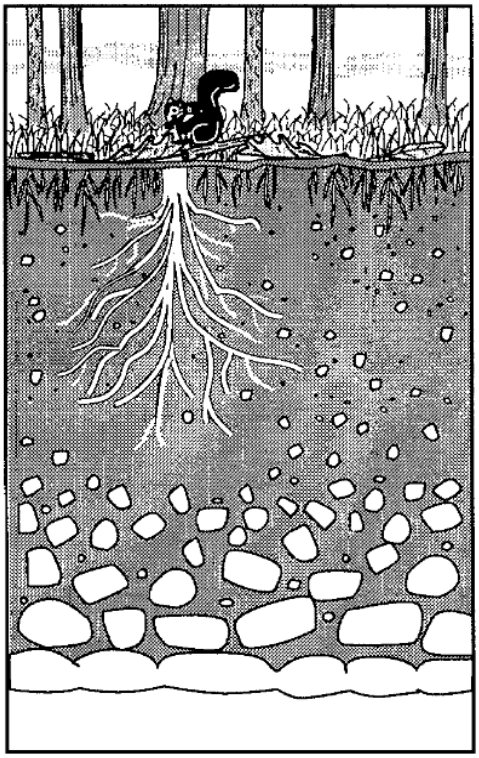
B. **DISSOLVED MINERALS** – dissolved minerals cause the "hardness" in ground water (and surface water)

C. SOIL

1. Soil is a combination of **WEATHERED ROCK** and **ORGANIC MATTER**.
2. **HUMUS** = decayed plant and animal material found in soil. Soil that contains 20-3-% humus is considered rich for plant growth.
3. Soil Development



4. Soil Layers – The Soil Profile



TOPSOIL or **A HORIZON** = the top layer of soil that contains more humus than the layers below.

SUBSOIL or **B HORIZON** = Consists of clays and dissolved minerals that have been washed down from above. Contains less humus.

C HORIZON = Consists of weathered rock fragments, usually from the parent rock below.

BEDROCK = the layer of rock beneath the soil. Frequently the parent rock of the soil above.

5. **Residual vs. Transported**

If the bedrock matches the rock fragments of the C Horizon, the soil is most likely **RESIDUAL**. If it does not, the soil has most likely been **TRANSPORTED** from somewhere else.

V. EROSION AND DEPOSITION

A. **Erosion** is **THE PROCESS BY WHICH WEATHERED SEDIMENTS ARE CARRIED / TRANSPORTED**

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

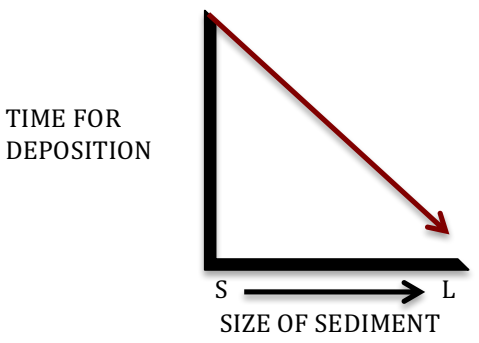
2. Agents of erosion include: **RUNNING WATER**, **WIND**, **GLACIERS**, **WAVES**, AND **GRAVITY**.

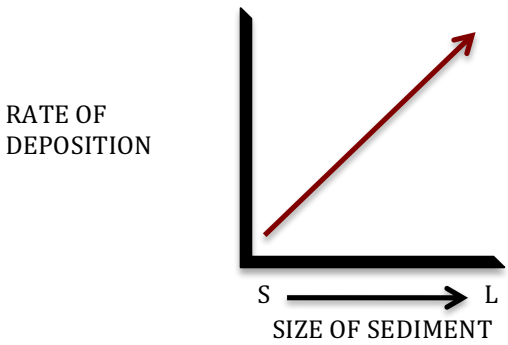
B. **Deposition** **IS THE PROCESS BY WHICH SEDIMENT IS DROPPED OR SETTLES**.

1. Deposition occurs when then the velocity (speed) of running water or the wind **DECREASES**, and/or when the discharge (volume of water) **DECREASES**.

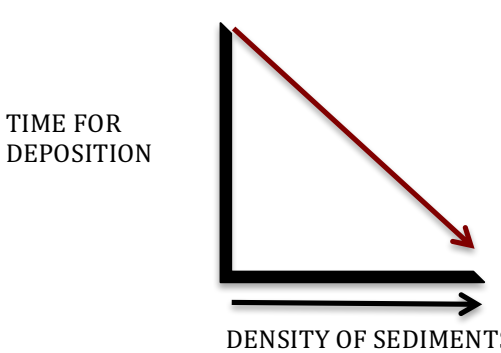
2. Factors that affect the deposition of sediment:

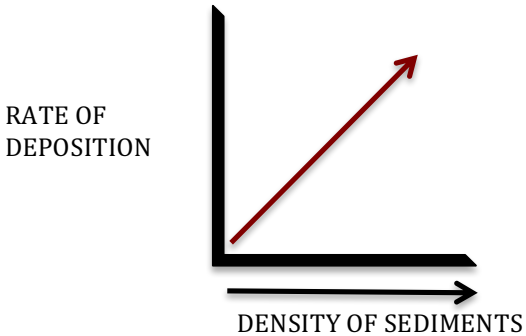
a. Size: **AS THE SIZE OF THE SEDIMENT INCREASES, THE RATE (SPEED) OF DEPOSITION INCREASES**.



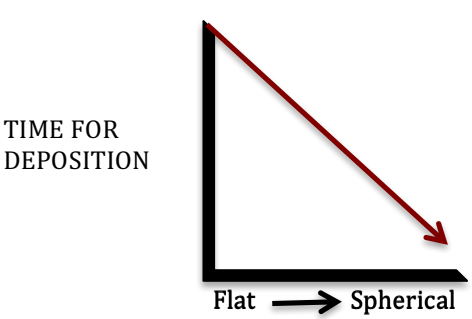


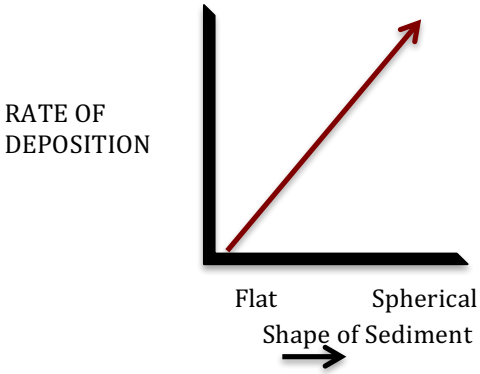
b. Density: **AS THE DENSITY OF THE SEDIMENT INCREASES, THE RATE (SPEED) OF DEPOSITION INCREASES**





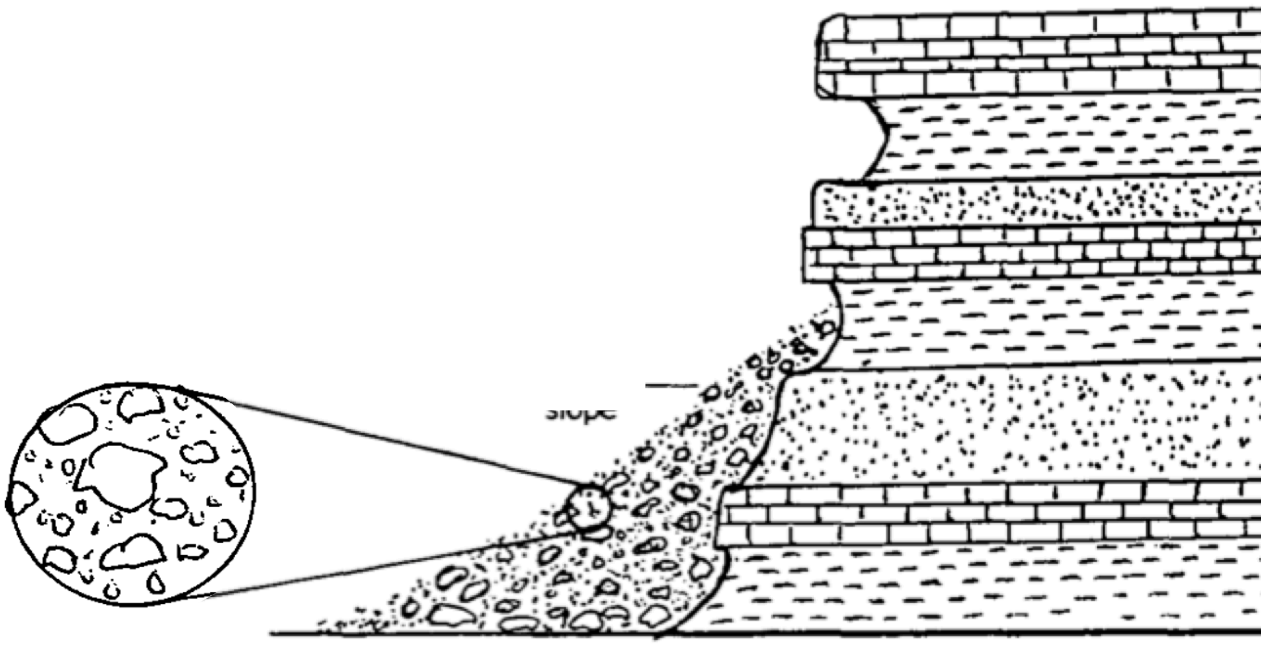
C. Shape: **AS THE SHAPE BECOMES MORE SPHERICAL (ROUNDER) THE RATE (SPEED) OF DEPOSITION OF THE SEDIMENT INCREASES**.





C. **Gravity** – erosion and deposition

1. Gravity pulls sediments down slopes.
2. The downhill movement of sediments by gravity is called MASS WASTING.
3. Types of mass wasting include: LANDSLIDES & MUDSLIDES
4. Deposition resulting from gravity:



UNSORTED AND SHARPER / JAGGED

sediments

5. Gravity is the underlying force behind all erosion; it may act alone or with a transporting agent (agent of erosion):

a. **GRAVITY** causes water to flow downhill

b. **GRAVITY** causes glaciers to flow down a valley or spread outward.

c. **GRAVITY** causes winds by pulling heavier (more dense) cold air down beneath lighter (less dense) warm air

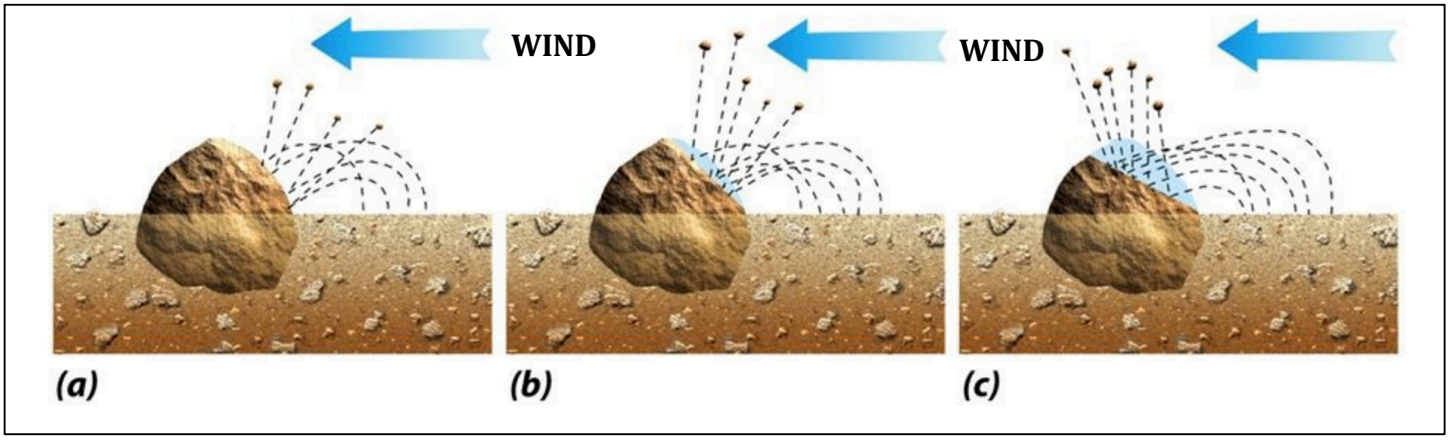
D. **Wind** – Erosion & Deposition

1. The amount of erosion caused by the wind depends on:

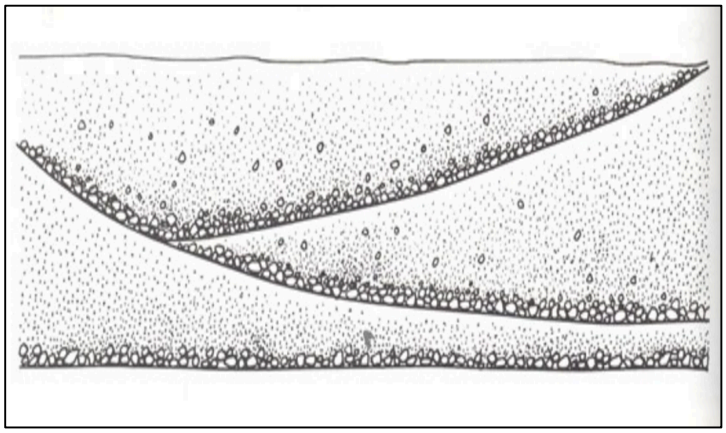
a. The **SIZE** of the sediments being carried

b. The **SPEED** at which the wind is blowing

c. The amount of **TIME** that the wind continues to blow.



d. Deposition by wind:



WELL-SORTED / LAYERED / TILTED

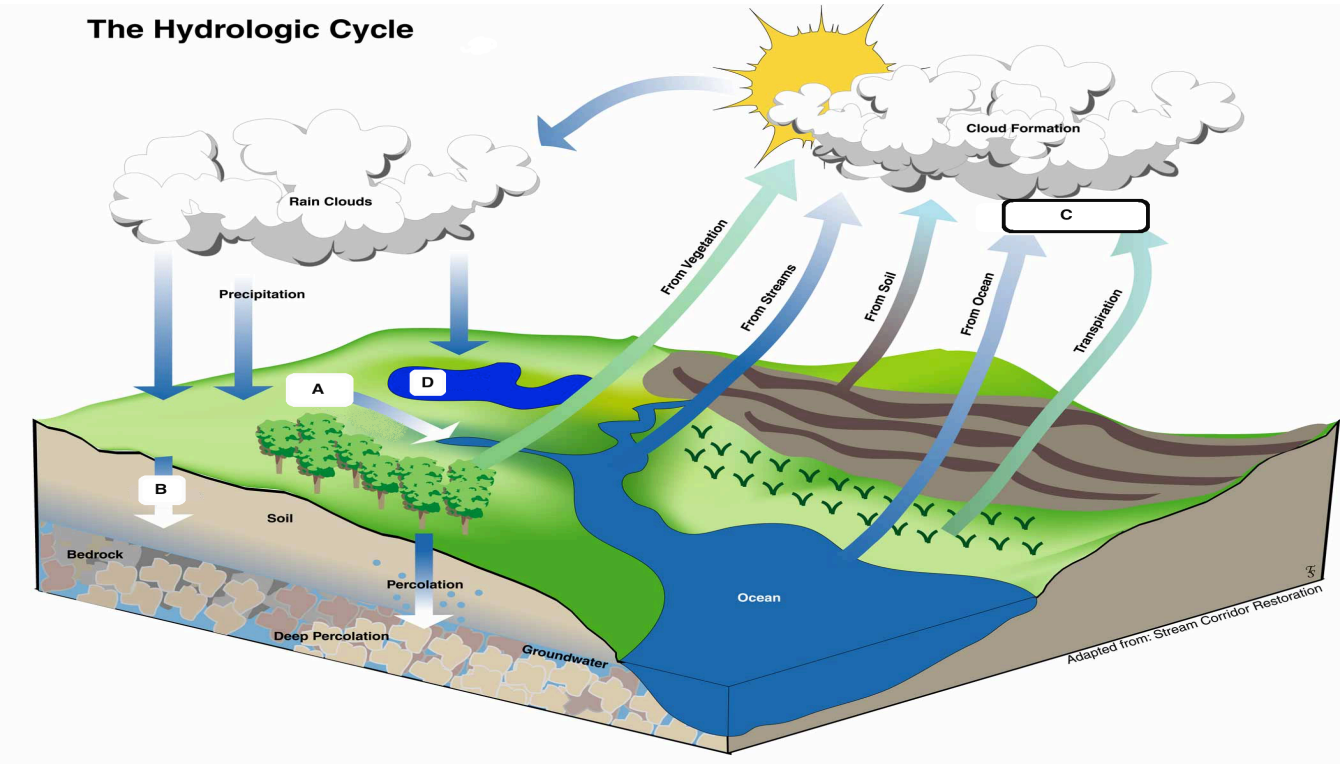
SEDIMENTS PITTED

Sediments

E. Running Water – erosion

1. Running water is the **DOMINANT FORM OF EROSION**

2.



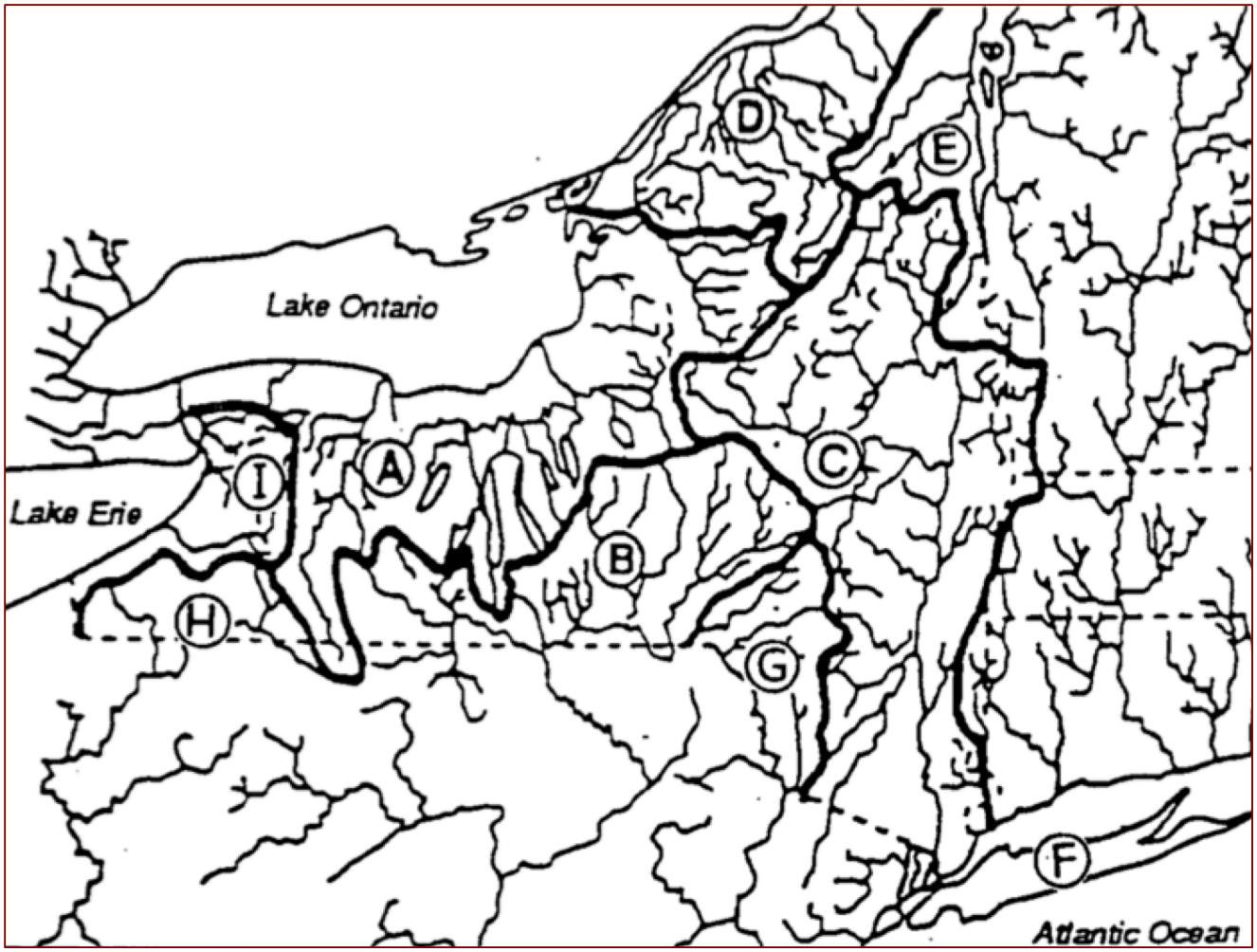
3. When rain falls onto the surface of the earth, several things can happen to the water:
   a. **RUNOFF – FLOW OVER THE LAND BACK INTO THE SEA**
   b. **INFILTRATE- (SINK) INTO THE GROUND**
   c. **EVAPORATE – CHANGE FROM LIQUID TO GAS AND RE-ENTER THE ATMOSPHERE**
   d. **STORED – IN PONDS, LAKES, AND ACCUMULATED SNOW**

4. The volume (amount) of water in a stream is classes the stream's **DISCHARGE**. Factors affecting a stream's volume are:
   a. Season – spring vs. fall; usually greater in the **SPRING**
   b. Climate – Arid vs. Humid; usually greater in **HUMID CLIMATES**
   c. Weather – Daily changes in precipitation affect the volume of a stream.

d. Ground / Soil – Saturated or unsaturated; greater when the soil is **SATURATED**

e. **Drainage Basin** – **(WATERSHED) – THE AREA OF LAND DRAINED BY A RIVER SYSTEM – THE MAIN RIVER AND ALL ITS TRIBUTARIES.**

Tributary – **A SMALLER STREAM THAT FLOWS INTO A LARGER ONE.**



KEY

A- ONTARIO – ST. LAWRENCE

B- SUSQUEHANNA-CHESAPEAKE

C- MOHAWK - HUDSON

D- ST. LAWRENCE

E. CHAMPLAIN – ST. LAWRENCE

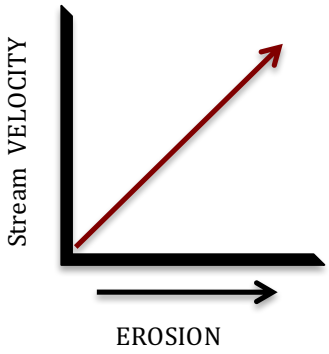
F. LONG ISLAND SOUND

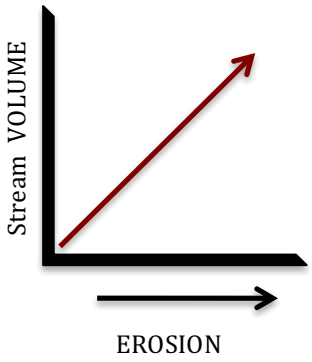
G. DELAWARE

H. ALLEGHANY - OHIO

I. ERIE – ST. LAWRENCE

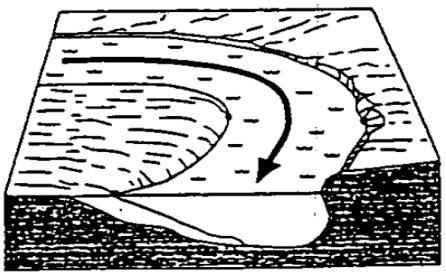
5. Stream factors that cause erosion:
   a. **VELOCITY – AS VELOCITY INCREASES, EROSION INCREASES**
   B. **VOLUME – AS VOLUME INCREASES, EROSION INCREASES**



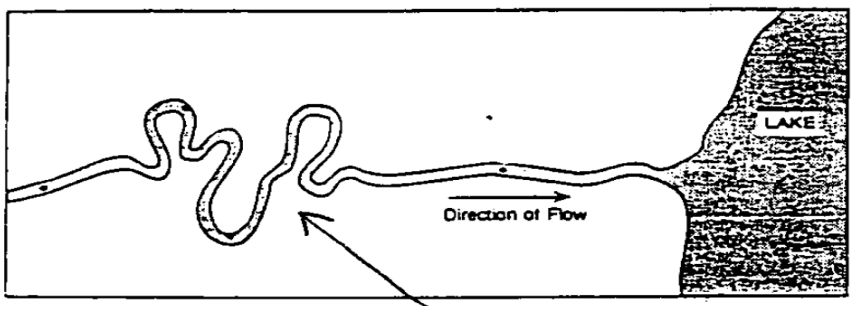


6. Factors that affect stream velocity:
   a. **GRADIENT – AS GRADIENT INCREASES, STREAM VELOCITY INCREASES**
   b. **VOLUME – AS STREAM VOLUME INCREASES, STREAM VELOCITY INCREASES**

   C. **Channel** = the path that a stream follows.
   When a stream flows through its channel, its speed will change due to the curvature of the channel.



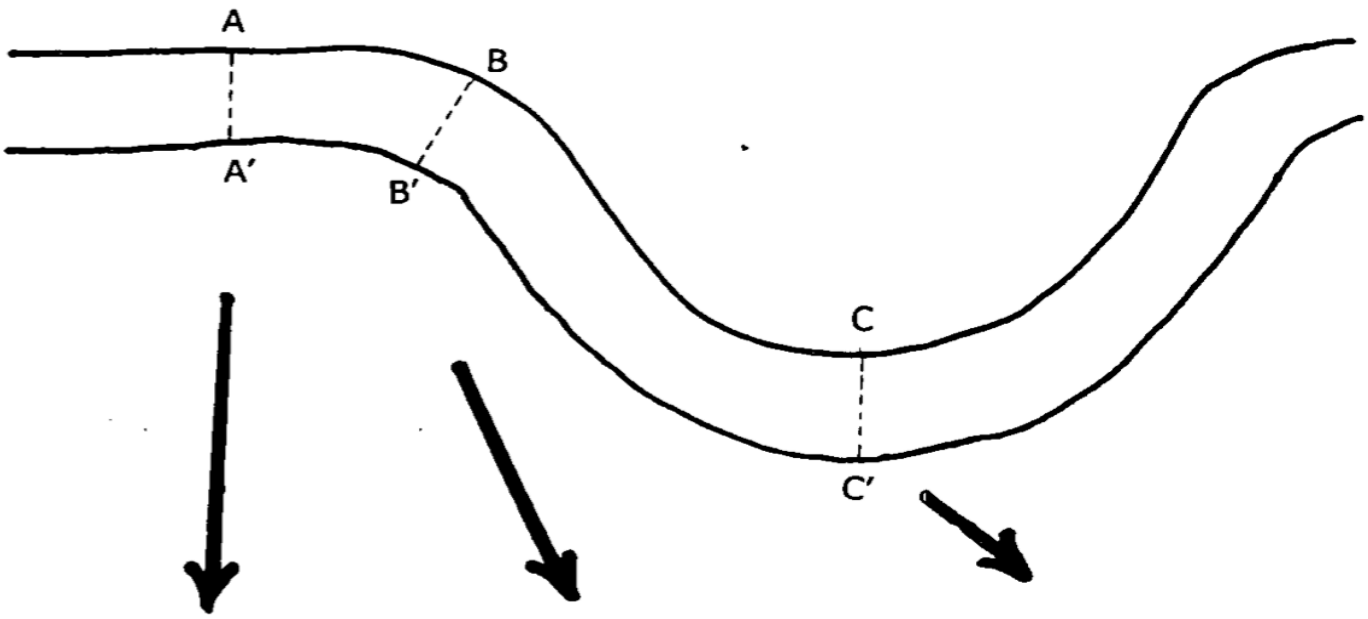
Profile of a stream channel



Aerial/map view of a stream channel

The bends in a stream's channel are called **MEANDERS**

Arial / Map View of a Stream Channel



Profile/Side View

Key: = deposited stream sediment

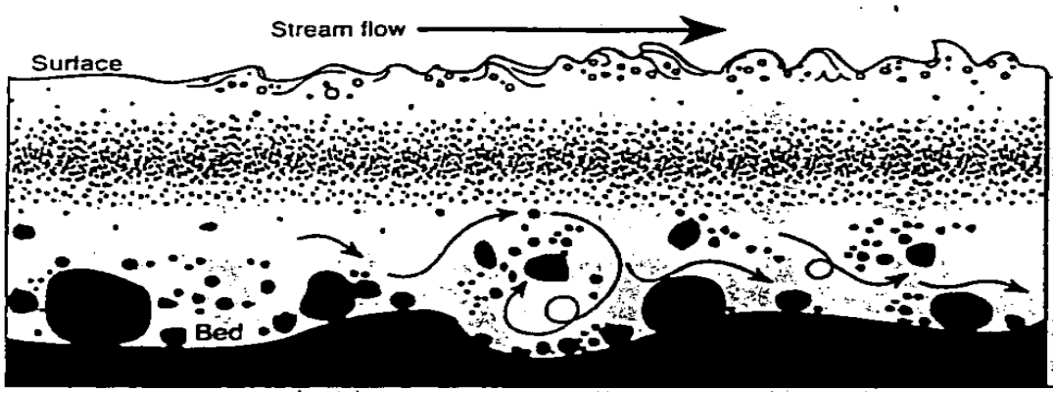
X = location of maximum velocity

At the outside of a curve, the stream velocity **INCREASES**. Therefore, **EROSION** occurs.

At the inside of the curve, the stream velocity **DECREASES**. Therefore, **DEPOSITION** occurs,

7. Stream Load

Side View of a Stream

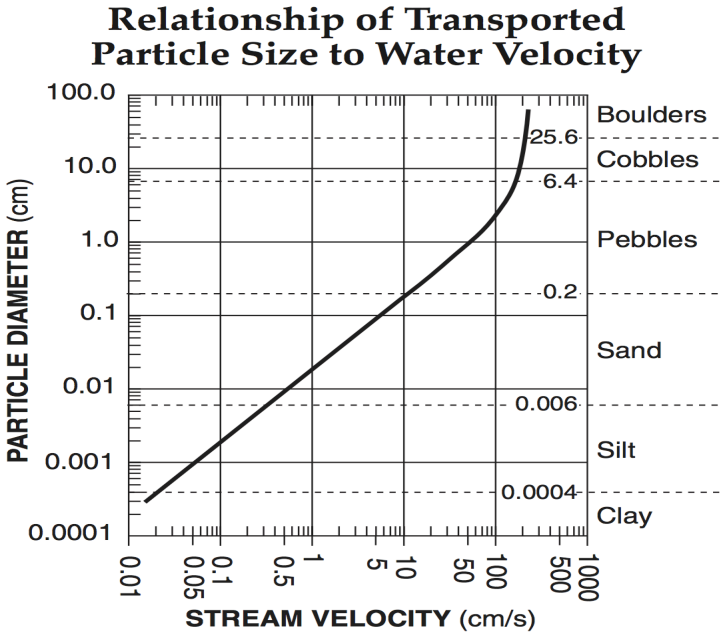


a. **SOLUTION** – Minerals dissolved in water

b. **SUSPENSION** – Small particles carried within the water

c. **SALTATION** – larger particles rolling and bouncing along the bottom

8. Particle Size vs. Stream 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.

What is the largest size sediment that can be transported by a stream in which the water velocity is:

a. 5 cm/sec: **SAND (maybe some small pebbles)**

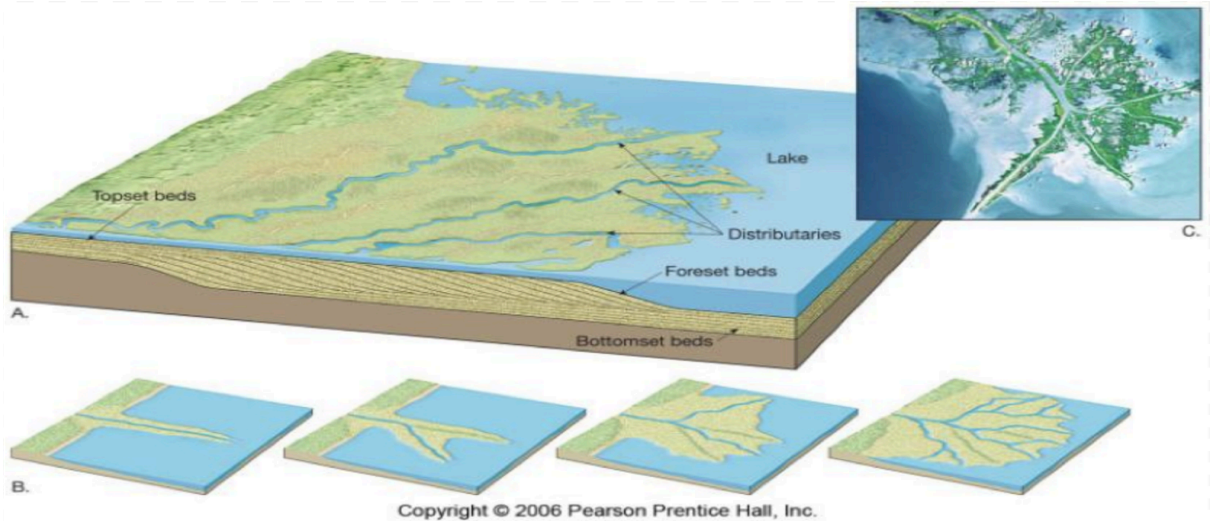
b. 30 cm/sec: **PEBBLES**

c. 200 cm/sec: **COBBLES**

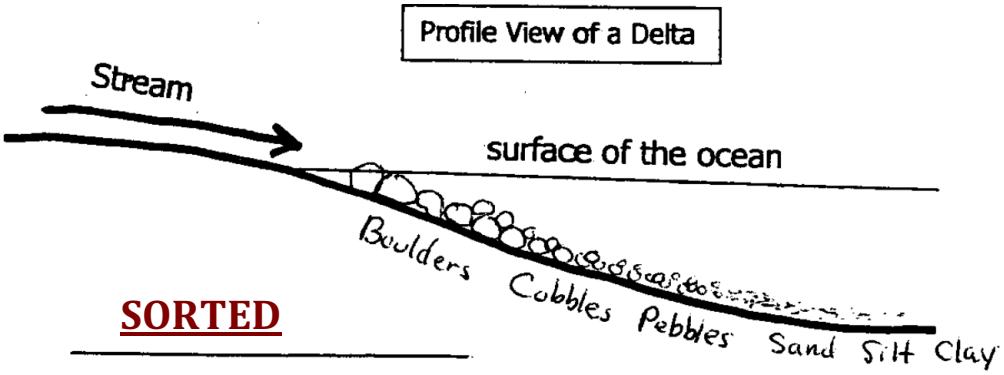
F. Running Water – Deposition

1. When a stream enters a body of water, its speed will **DECREASE**, and therefore, the **DEPOSITION** of sediments occurs.

   A deposit at the mouth of a stream where it enters a large body of water is called a **DELTA**



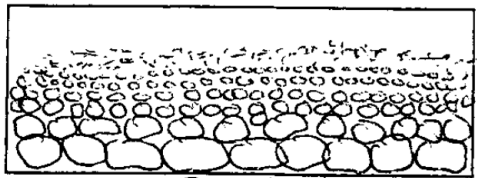
2. A delta is an example of the **HORIZONTAL** deposition of sediments in water.



SORTED

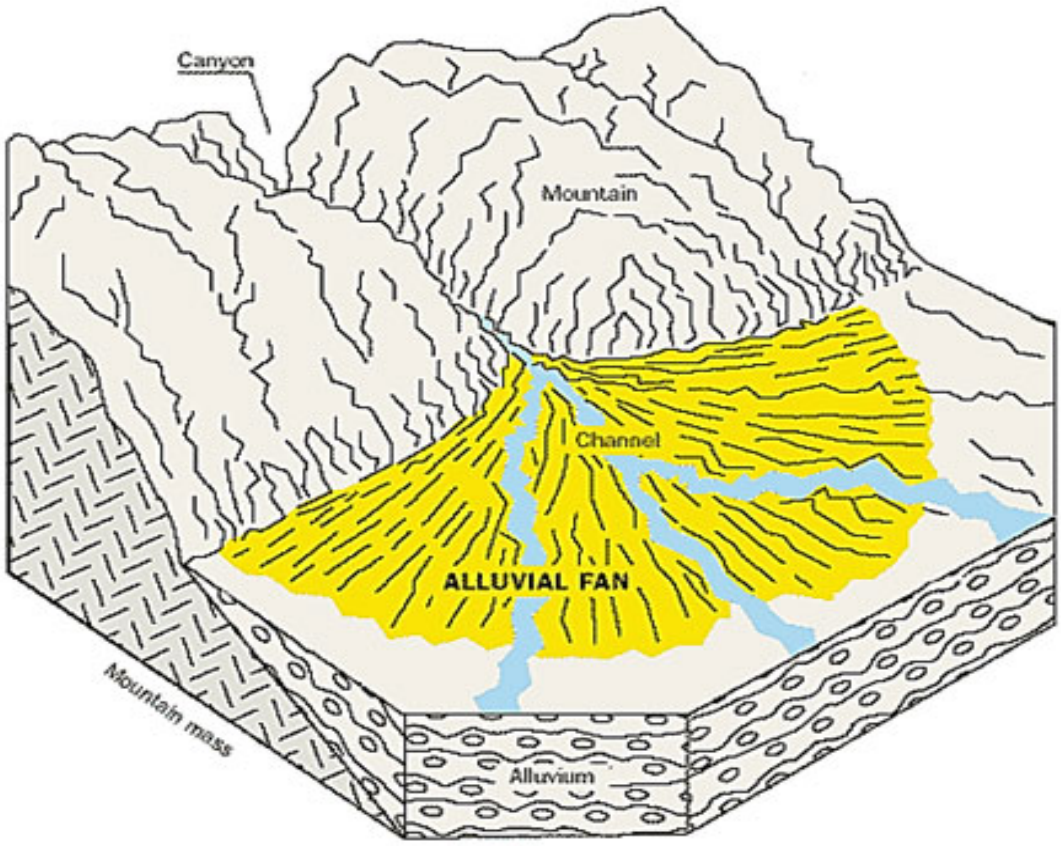
sediment

3. Deposition can also occur in _ **vertically** This results in **vertical** sorting.

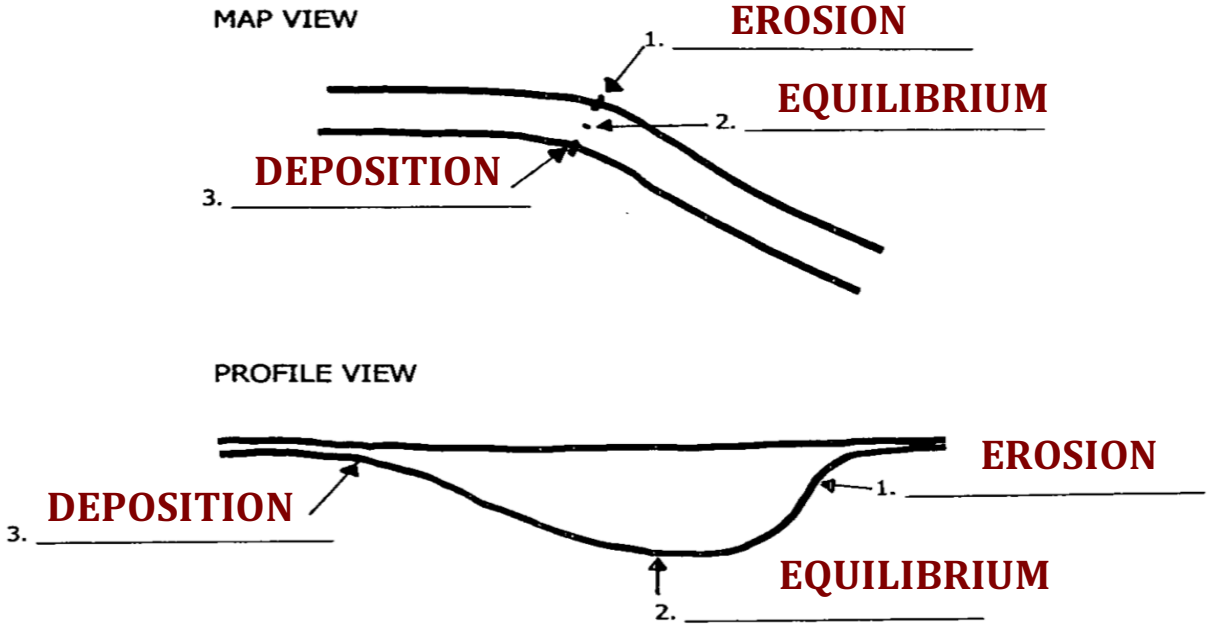


SORTED SEDIMENTS

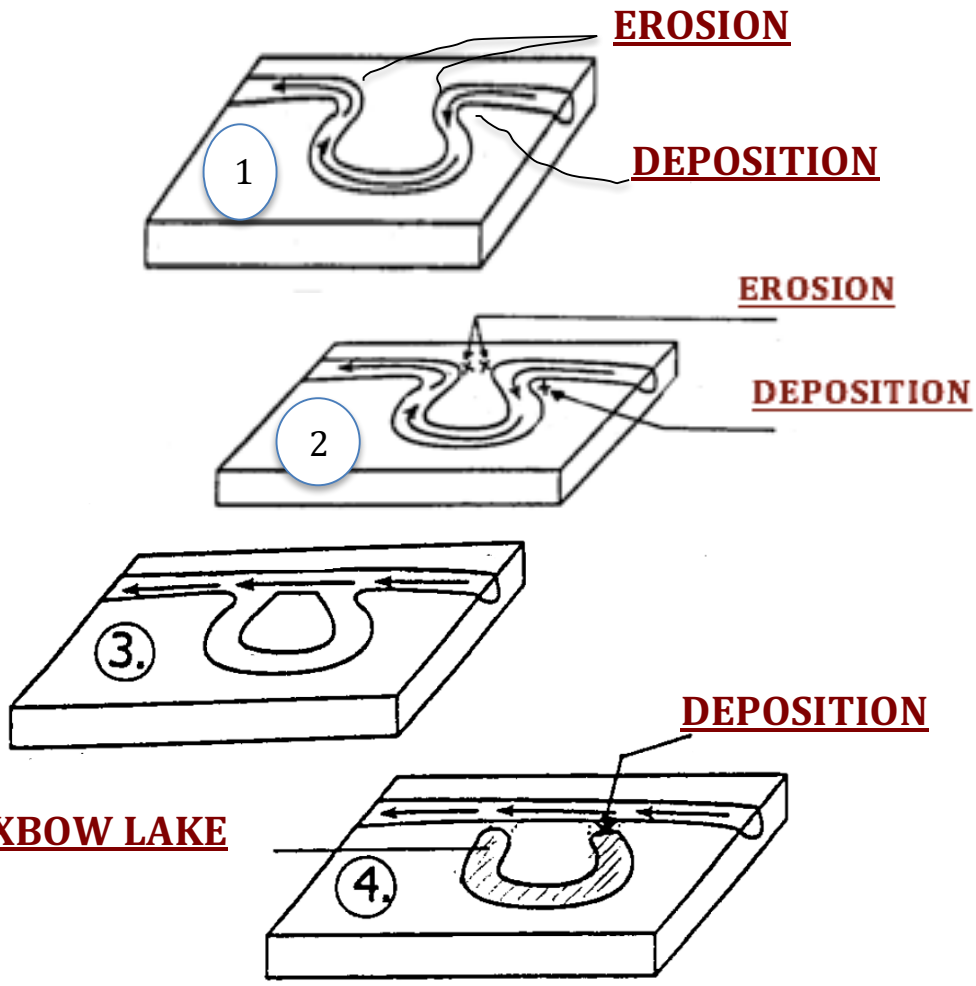
4. Stream deposition on land can occur. This deposit is called a(n) **ALLUVIAL FAN**.



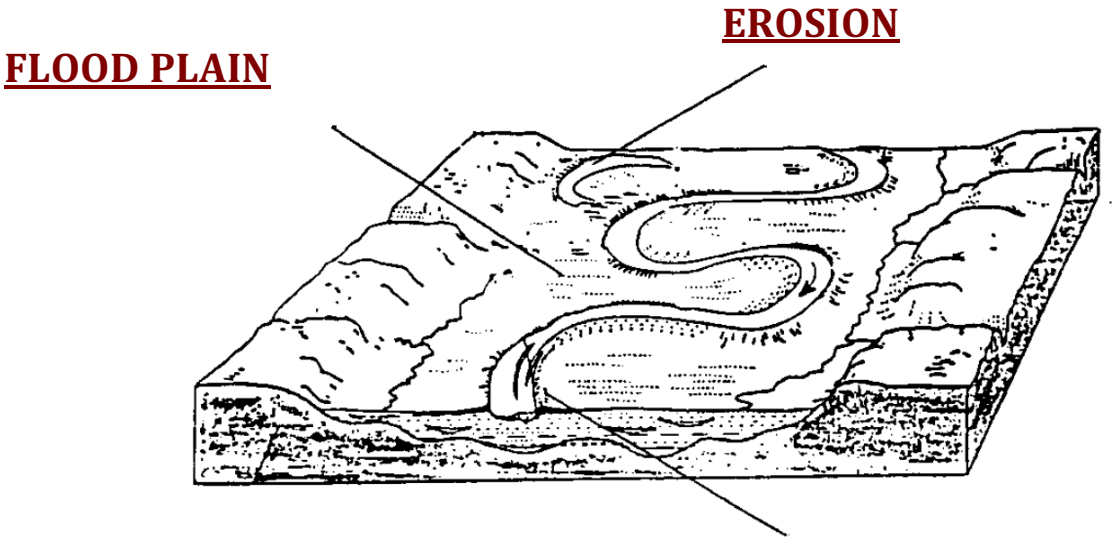
5. Equilibrium: Erosion = Deposition



6. Formation of an Oxbow Lake – the work of erosion and deposition



7. Stream Landscape Features:

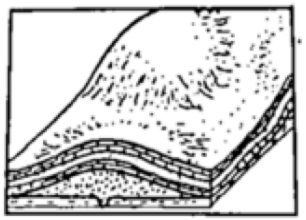


8. Stream Drainage Patterns and Landscapes

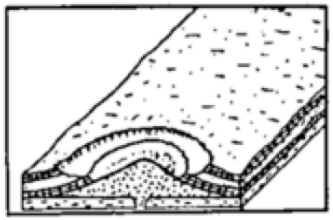
Landscape

Topographic Map

1.



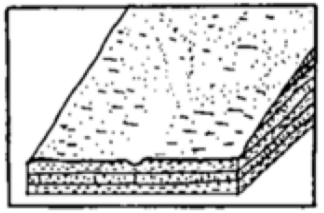
2.

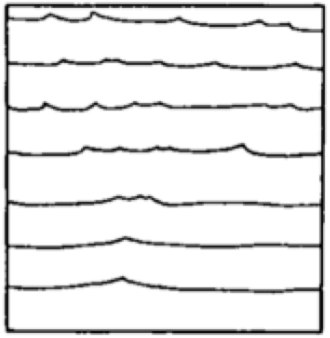


Landscape

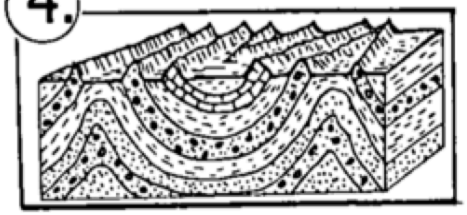
Topographic Map

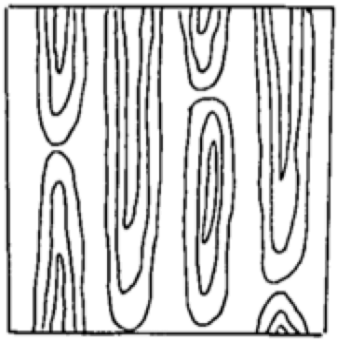
3.





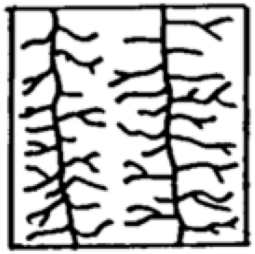
4.





DENDRITE

3



TRELLIS

4

RADIAL

1

ANNULAR

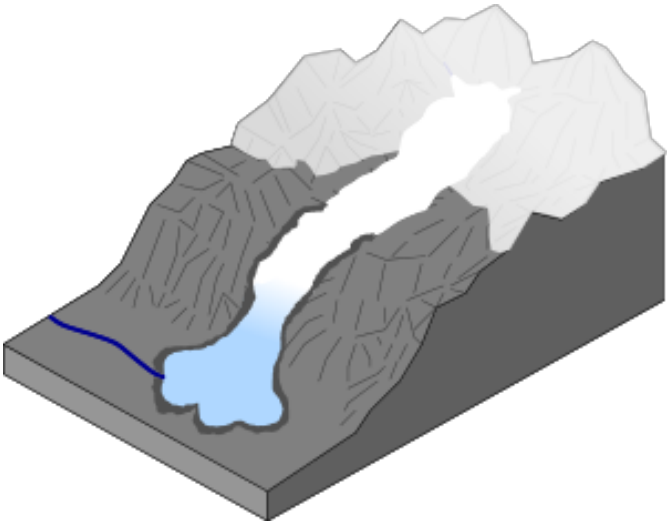
2

G. Glaciers – erosion and deposition

1. A glacier is **A LARGE MASS OF MOVING ICE AND SNOW**
2. Types of Glaciers:
   a. **VALLEY / ALPINE** glaciers form in mountain valleys at high elevations.

Example locations:

ALPS
ROCKIES
HIMALAYAS
ANDES



b. **CONTINENTAL** Glaciers form over vast areas of land.

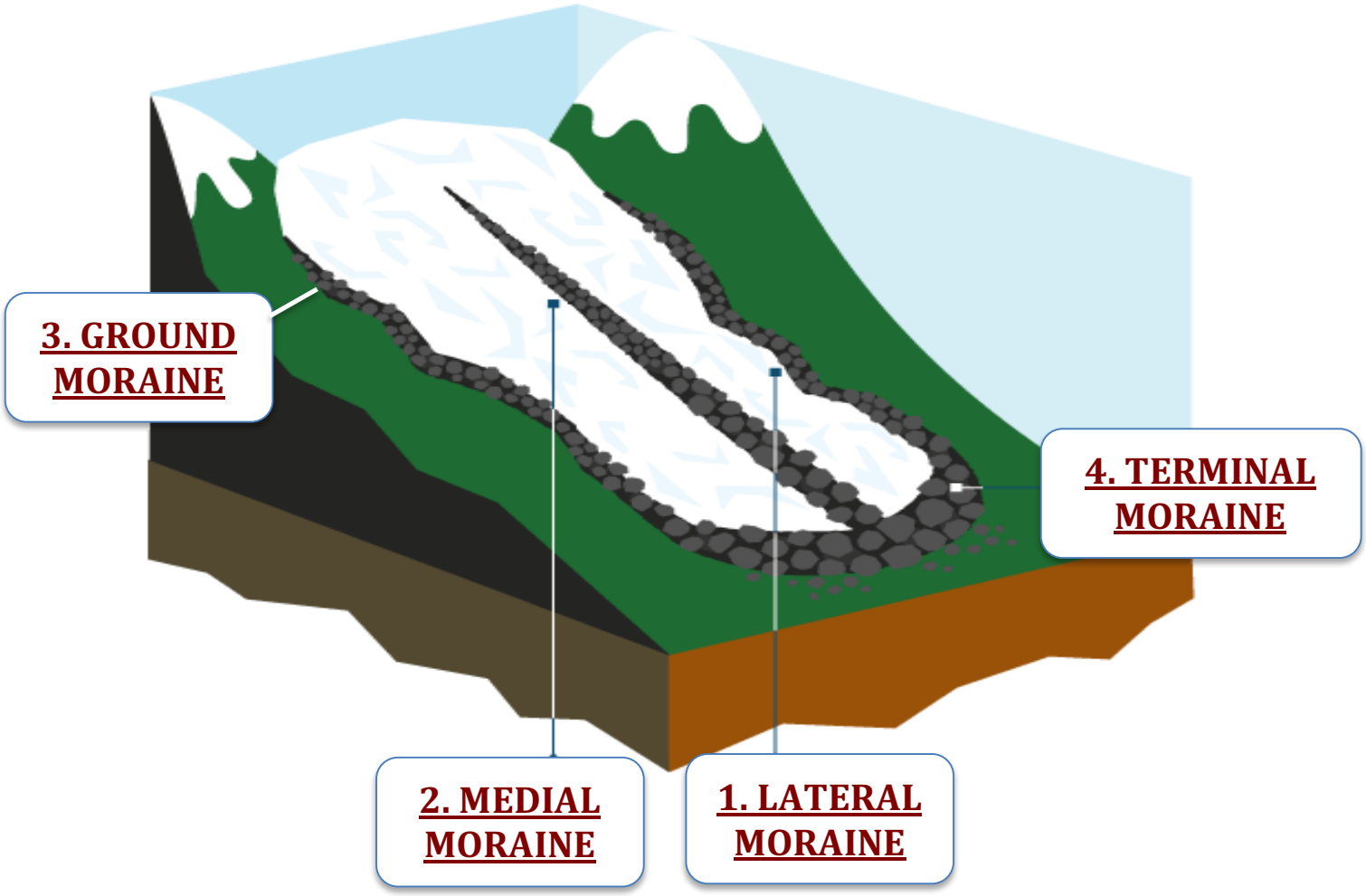
Example locations:

GREENLAND

ANTARCTICA

3. Valley Glaciers and Erosion

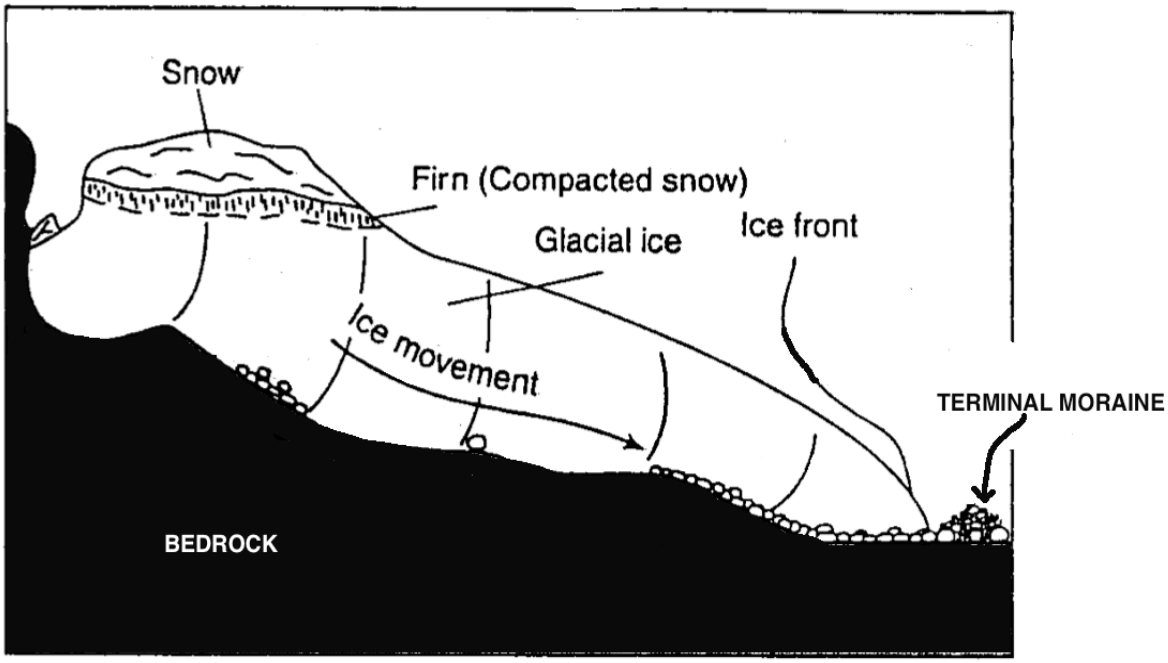
a. Movement of a valley glacier -



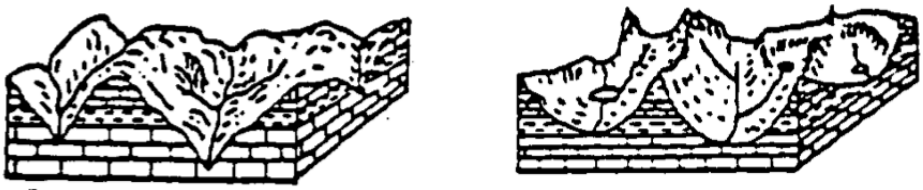
B. Moraine – UNSORTED ROCK MATERIAL CARRIED AND DEPOSITED BY A GLACIER.

1. **LATERAL** moraine – unsorted rock on the glacier along the valley walls.
2. **MEDIAL** Moraine – unsorted rock on the glacier in the central region resulting from the merging of two smaller valley glaciers.
3. **GROUND** moraine – unsorted rock trapped at the bottom of the glacier.
4. **TERMINAL / END** Moraine – unsorted rock trapped at the leading edge or "end" of the glacier.

Profile of a Valley Glacier

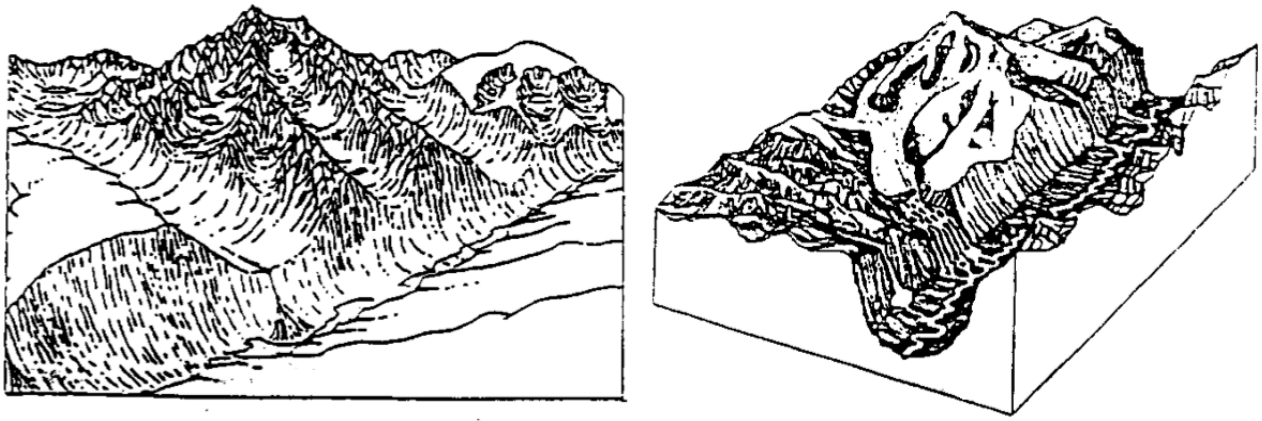


c. Glacier Valleys:



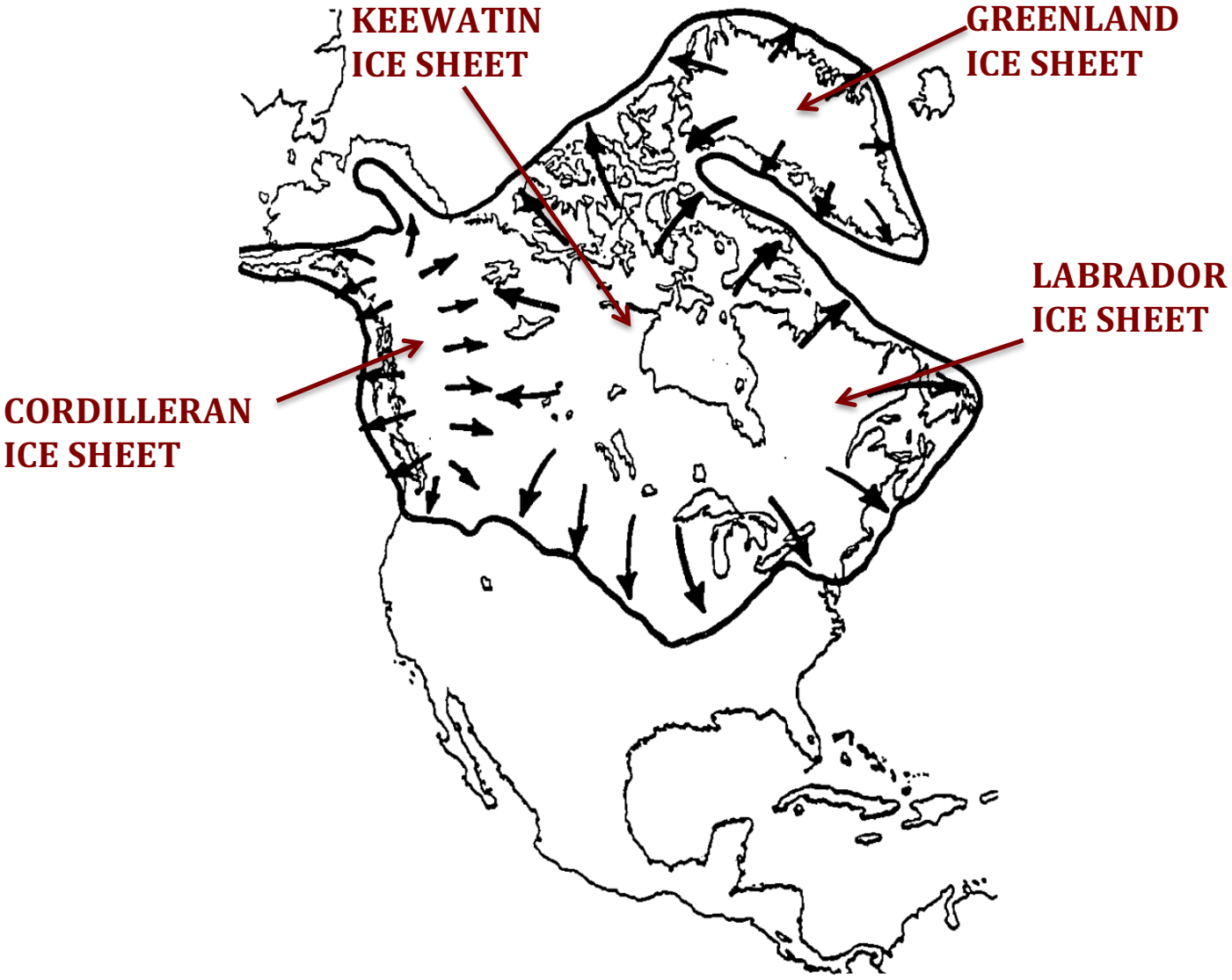
STREAM _____ eroded valley **Glacier** _____ eroded valley

Examples of **U** - shaped glacier valleys:



4. Ice Age Continental Glaciers

In the geologic past, a much colder climate resulted in ice sheets covering much of Earth's surface.

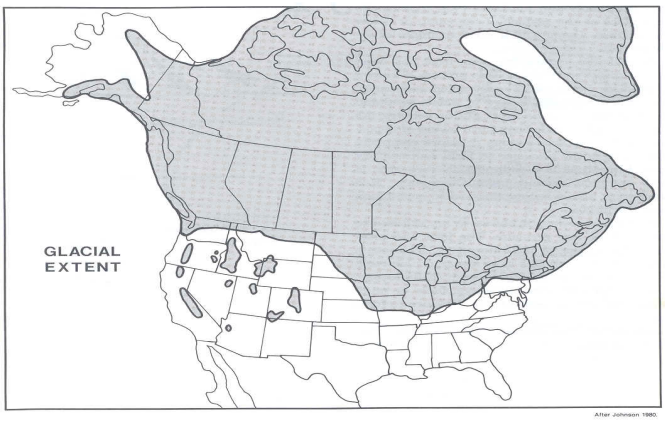


There is evidence of at least **4** major ice ages during the last 2 million years.

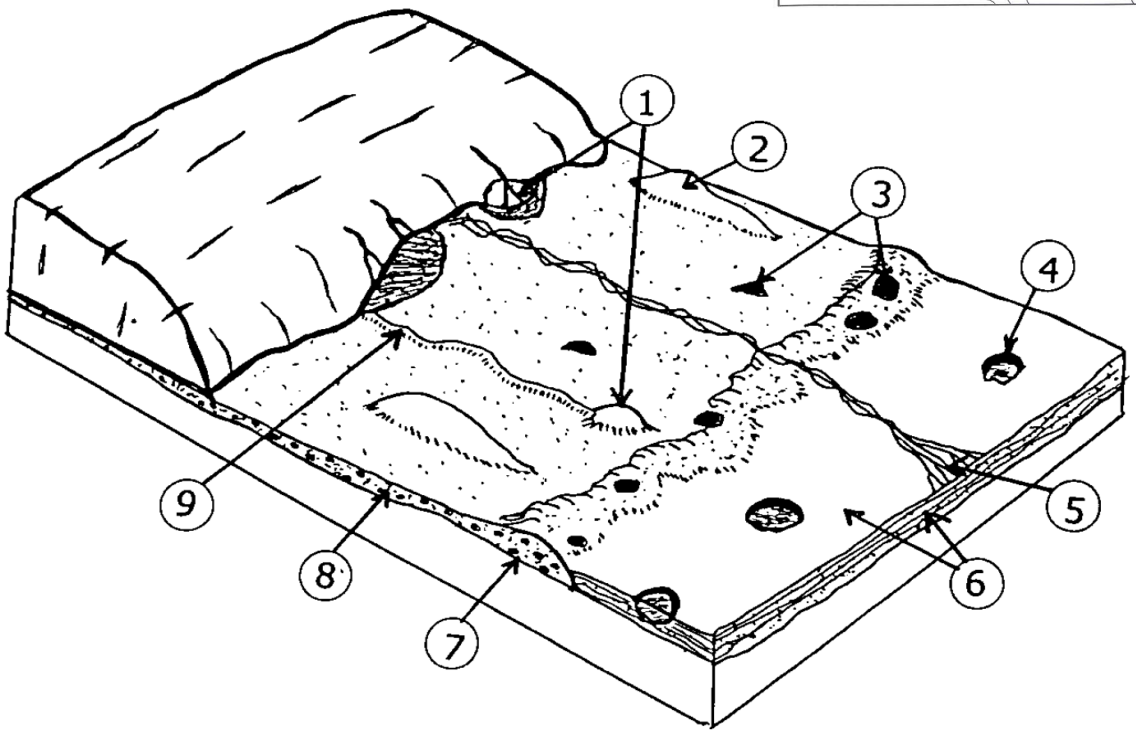
a. The time period between ice ages is called **INTERGLACIEL PERIODS**

b. The most recent ice age ended only about **11,000** years ago.

Extent of Glaciation in New York State

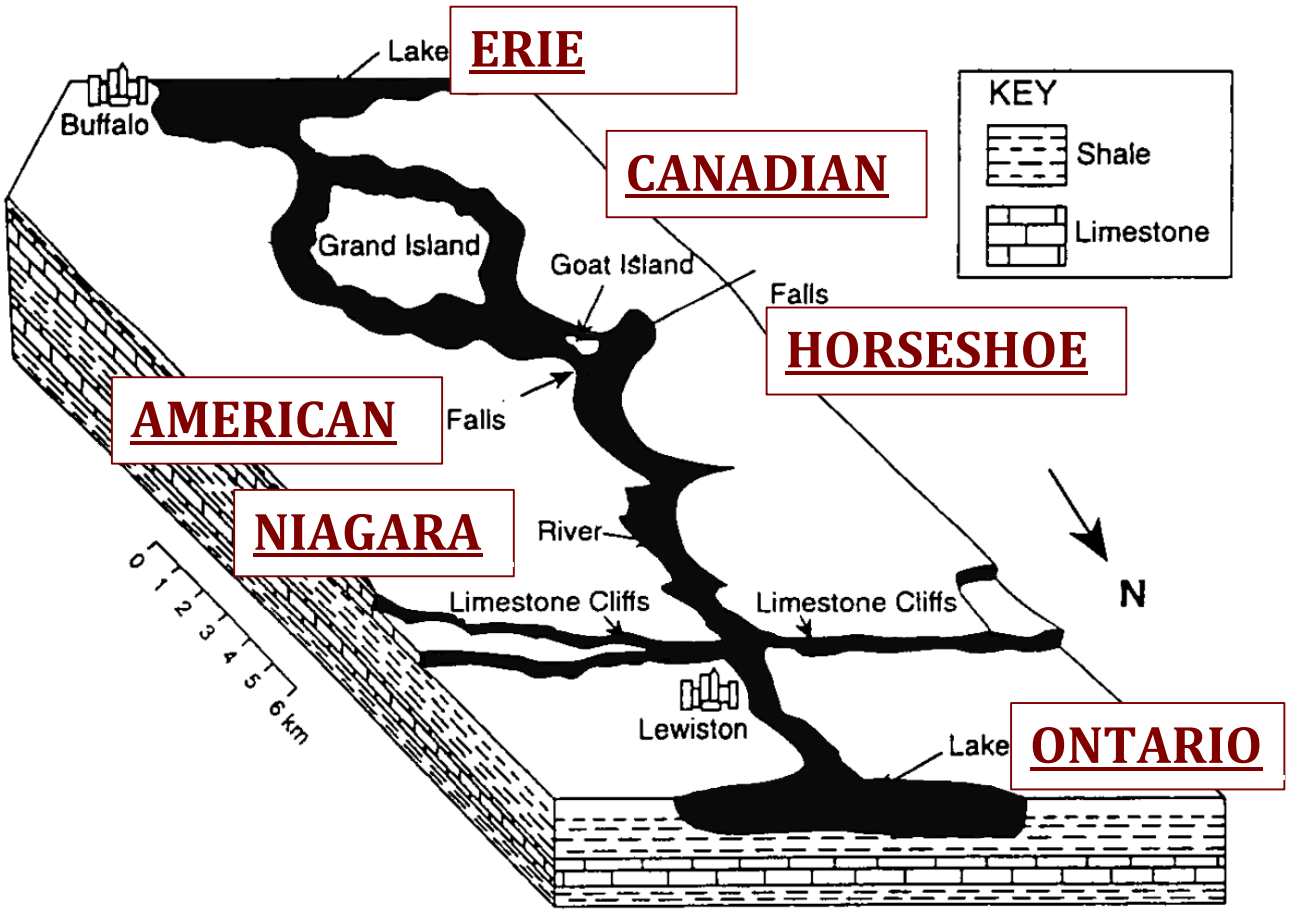


5. Landscape Features of Continental Glaciers

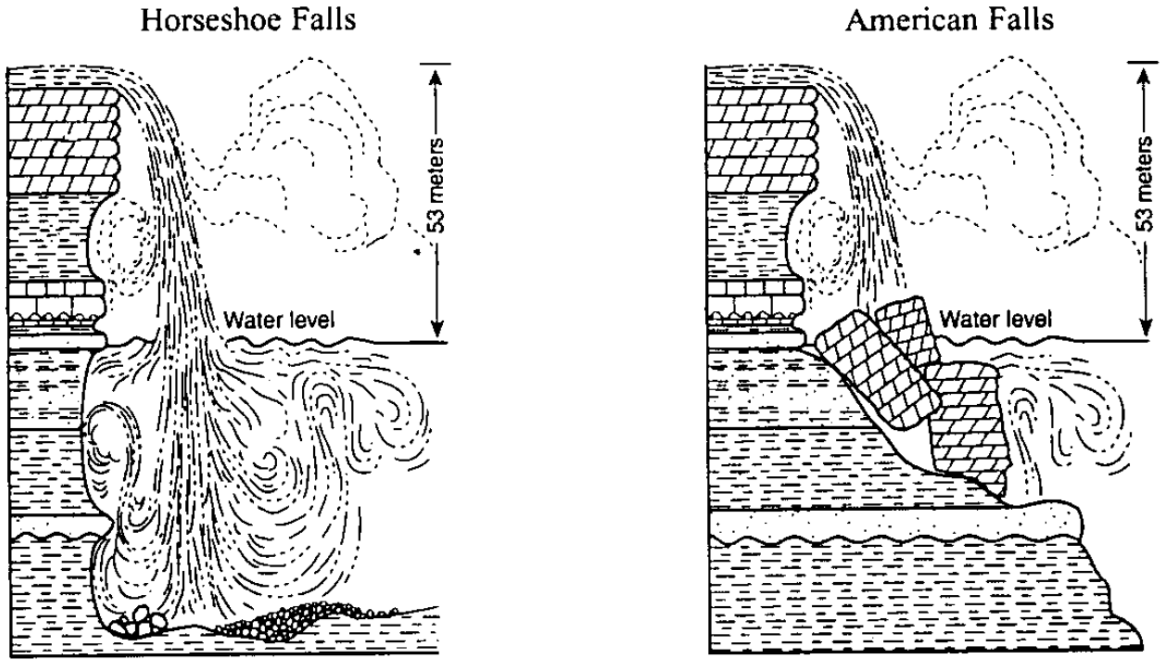


1. **KAME** – A cone-shaped hill made of sediment carried to the edge of a glacier by meltwater.
2. **DRUMLIN** – An oval-shaped hill of glacial moraine
3. **ERRATIC** – A large boulder deposited by ice
4. **KETTLE LAKE** – A lake formed when a block of glacial ice melts.
5. **BRAIDED STREAM** – A stream that is divided into an interlocking system of channels
6. **OUTWASH PLAIN** – Layers of sediment deposited by the meltwaters of glacial ice.
7. **TERMINAL MORAINE** – A mass of loose rock carried by a glacier and finally deposited in the form of a belt or ridge. It marks the farthest position reached by a glacier.
8. **GROUND MORAINE** – Glacial material deposited as the glacier retreats.
9. **ESKER** – A ridge-like hill of deposits resulting from a stream flowing in a tunnel under the glacier.

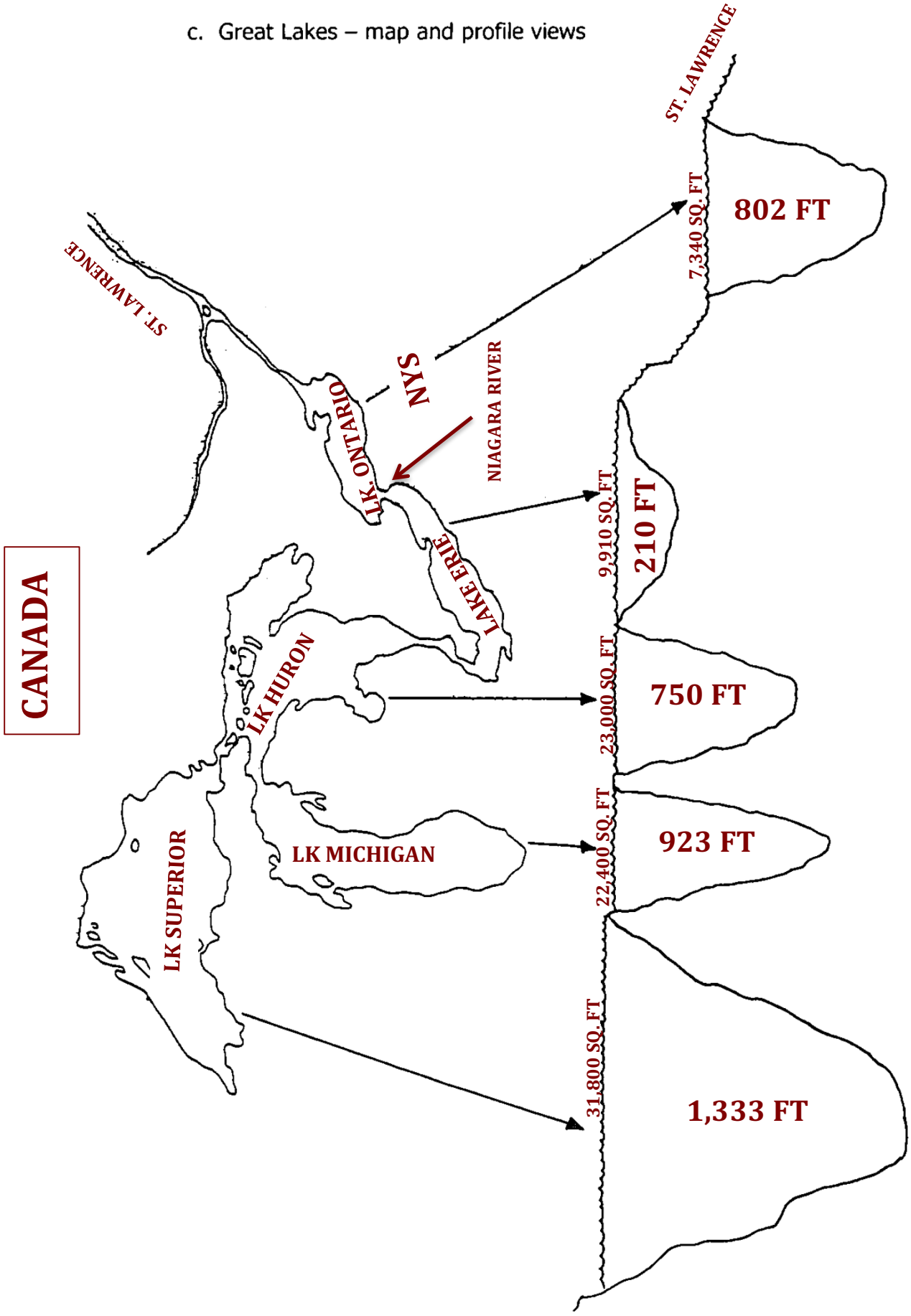
6. Other Landscape Features from the Last Ice Age
   a. Niagara Falls – the block diagram shows the generalized underlaying geology of an area in western New York State and Canada.



b. Profile of Niagara Falls



c. Great Lakes – map and profile views



UNIT 5 EXAM TOPICS

Weathering
- 3 ex. of physical
- 4 ex. of chemical
- resistance to weathering

Soil
- how it is made
- what it is made of

Waves
- beaches
- erosion
- deposition

Gravity
- mass movements
- erosion
- deposition

Wind
- erosion
- deposition

Landscapes
- plateau
- mountain
- plain
- how to identify
- climatic effects
- ESRT p. 2&3

Running Water
- slope
-discharge
-velocity
-erosion
- deposition
- meanders
- abrasion
- cross section
- V-shaped valley
- flood plain
- watershed
- drainage pattern
- horizontal sorting
- vertical sorting
- ESRT p.6

Glaciers
- Kettle lakes
- Finger lakes
- Striations
- Erosion
- Deposition
- Drumlin
- Moraine
- Outwash plain
- U-shaped valley

UNIT 5 VOCABULARY

Abrasion

Barrier Island

Chemical Weathering

Delta

Deposition

Drumlin

Erosion

Escarpment

Finger lake

Flood plain

Glacial Parallel Scratches

Glacier

Kettle Lake

Landscape

Landscape Region

Mass Movement

Meander

Moraine

Mountain

Outwash Plain

Physical Weathering

Plain

Plateau

Sand Dune

Sandbar

Sandblasting

Sediment

Sorted Sediment

Stream

Stream Abrasion

Stream Drainage Patter

Tributary

U-shaped Valley

Unsorted Sediment

Uplifting Forces

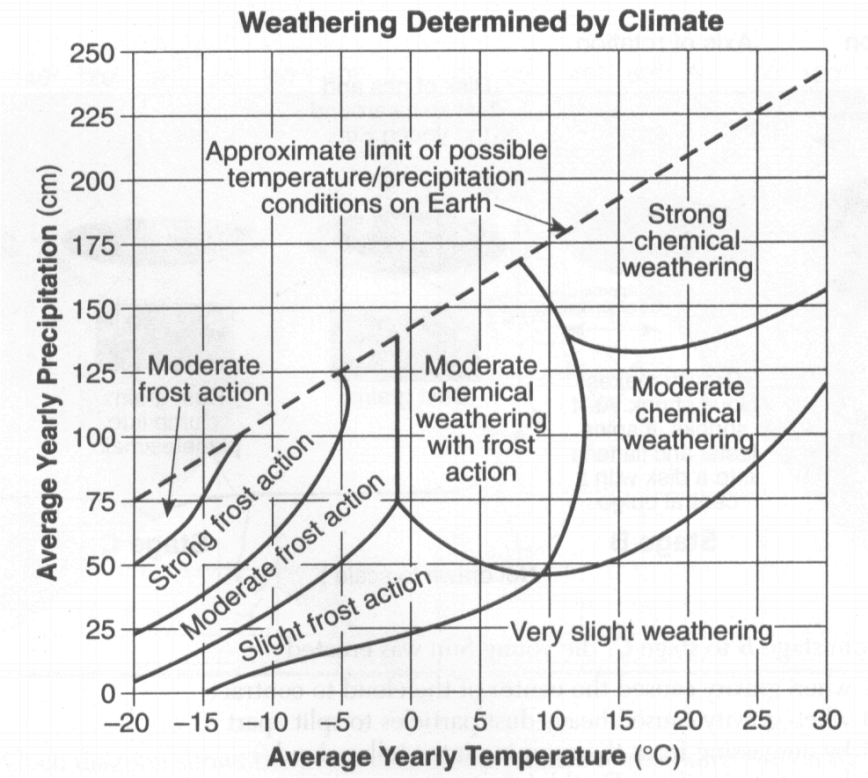
V-shaped Valley

Watershed

Weathering

UNIT 5 SAMPLE QUESTIONS

1. Base your answer to the following question on the graph below, which shows the effect that average yearly precipitation and temperature have on the type of weathering that will occur in a particular region.



Which type of weathering is most common where the average yearly temperature is 5°C and the average yearly precipitation is 45 cm?

A) moderate chemical weathering
B) very slight weathering
C) moderate chemical weathering with frost action
D) slight frost action

2. Which agent of erosion is most likely responsible for the deposition of sandbars along ocean shorelines?

A) glaciers B) mass movement
C) wave action D) wind action

3. By which processes are rocks broken up and moved to different locations?

A) evaporation and condensation
B) weathering and erosion
C) burial and cementation
D) compaction and transportation

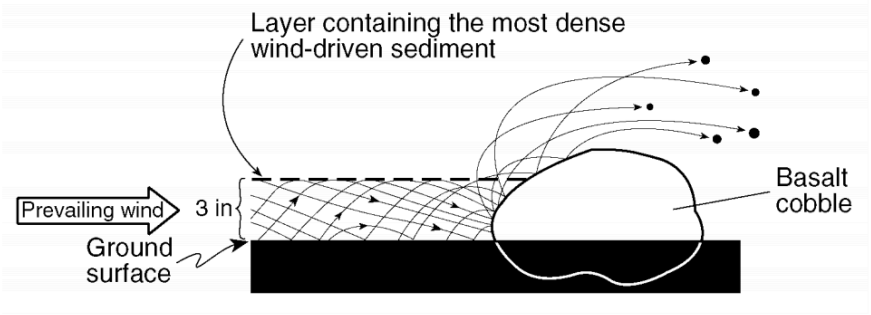
4. Which rock weathers most rapidly when exposed to acid rain?

A) quartzite B) granite
C) basalt **D) limestone**

5. Sediments found in glacial moraines are best described as

A) sorted and layered
B) sorted and not layered
C) unsorted and layered
D) unsorted and not layered

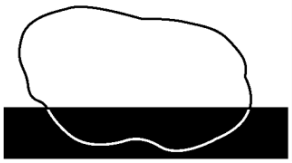
6. The cross section below shows the movement of wind-driven sand particles that strike a partly exposed basalt cobble located at the surface of a windy desert.

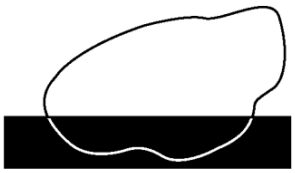


Which cross section best represents the appearance of this cobble after many years of exposure to the wind-driven sand?

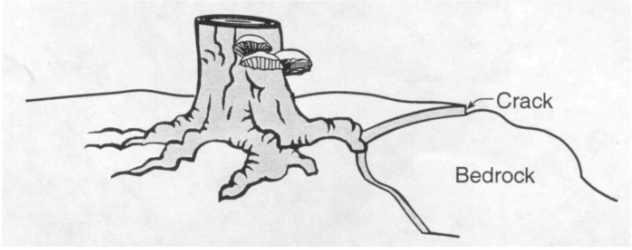
A)


B)


C)


D)


7. The diagram below shows the stump of a tree whose root grew into a small crack in bedrock and split the rock apart.



The action of the root splitting the bedrock is an example of

A) chemical weathering
B) deposition
C) erosion
D) physical weathering

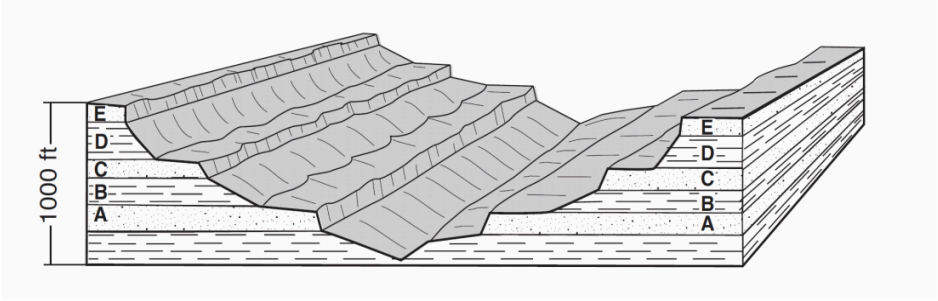
8. On the Earth's surface, transported materials are more common than residual materials. This condition is mainly the result of

A) subduction **B) erosion**
C) folding D) recrystallization

9. What occurs when a rock is crushed into a pile of fragments?

A) The total surface area decreases and chemical composition changes.
B) The total surface area decreases and chemical composition remains the same.
C) The total surface area increases and chemical composition changes.
D) The total surface area increases and chemical composition remains the same.

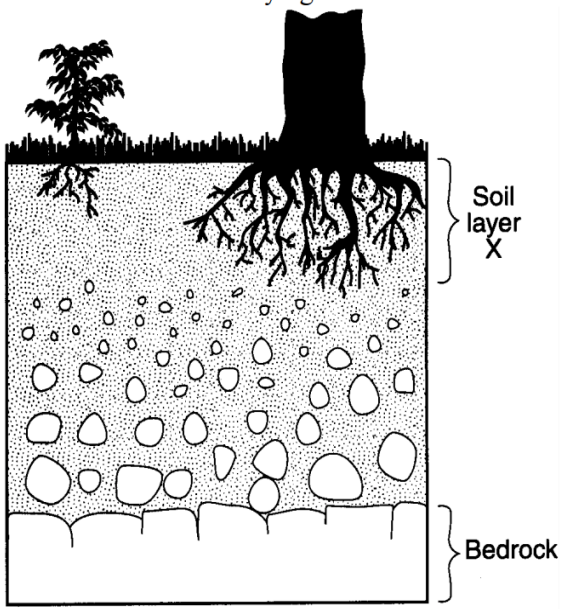
10. The block diagram below shows a cross section of a landscape. Letters *A*, *B*, *C*, *D*, and *E* represent different rock layers.



Which rock layers appear to be most resistant to weathering?

A) *A* and *B* B) *B* and *D* C) *C*, *D*, and *E* **D) *A*, *C*, and *E***

11. The cross section below shows soil layer *X*, which was formed from underlying bedrock.



Which change would most likely cause soil layer to increase in thickness?

A) a decrease in slope
B) a decrease in rainfall
C) an increase in biologic activity
D) an increase in air pressure

12. Sandstone, limestone, and conglomerate cobbles are found in a streambed in New York State where the surrounding bedrock is composed of shales and siltstones. The most likely explanation for the presence of these cobbles is that they were

A) weathered from the surrounding bedrock
B) formed when shale and siltstone bedrock were eroded
C) transported to this area from another region
D) metamorphosed from shale and siltstone

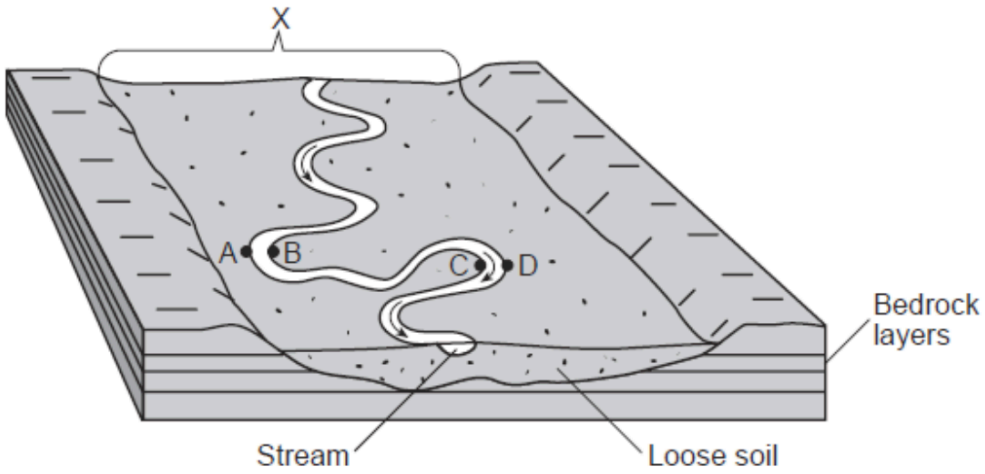
13. Pieces of bedrock material that are broken from a cliff and deposited by a landslide at the base of the cliff are best described as

A) rounded and sorted
B) rounded and unsorted
C) angular and sorted
D) angular and unsorted

14. What change will a pebble usually undergo when it is transported a great distance by streams?

A) It will become jagged and its mass will decrease.
B) It will become jagged and its volume will increase.
C) It will become rounded and its mass will increase.
D) It will become rounded and its volume will decrease.

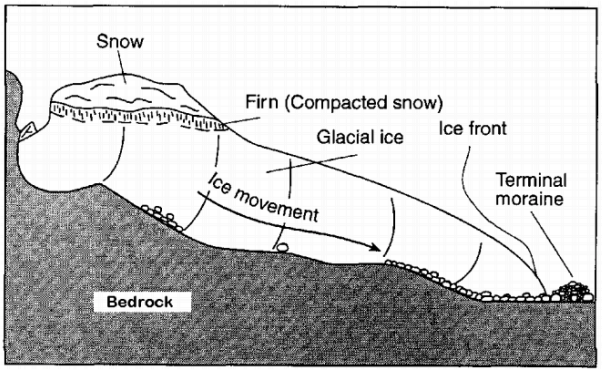
15. Base your answer to the following question on the block diagram below and on your knowledge of Earth science. The block diagram represents a landscape that was produced by a meandering stream. One landscape feature is labeled *X*. Letters *A*, *B*, *C*, and *D* represent locations on the stream banks.



Erosion is most likely greatest at locations

A) *A* and *B* B) *B* and *C* C) *C* and *D* **D) *D* and *A***

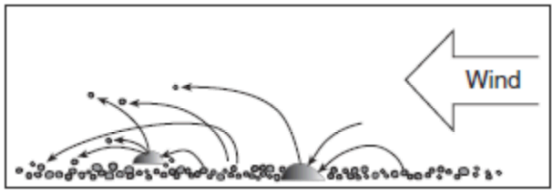
16. Base your answer to the following question on the diagram which represents a profile of a mountain glacier in the northern United States.



The downhill movement of mountain glaciers such as the one shown in the diagram is primarily caused by

A) evaporation of ice directly from the glacier
B) snow blowing across the top of the glacier
C) the force of gravity pulling on the glacier
D) water flowing over the glacier

17. The diagram below shows sand particles being moved by wind.



At which Earth surface locations is this process usually the most dominant type of erosion?

A) deserts and beaches
B) deltas and floodplains
C) glaciers and moraines
D) mountain peaks and escarpments

18. Base your answer to the following question on the reading passage below and on your knowledge of Earth science.

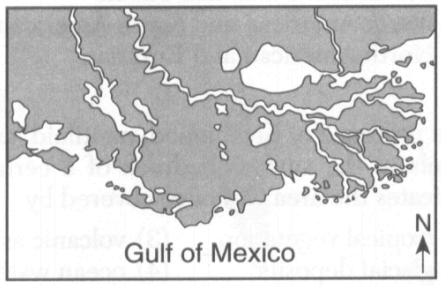
Roche Moutonée

A roche moutonée is a glacial landscape feature produced as an advancing glacier slides over a hill of surface bedrock. As the glacier advances up the side of the hill, the surface bedrock is abraded and smoothed by rock fragments carried within the base of the glacial ice, creating a more gentle hillslope. As the glacier advances down the opposite side of the hill, chunks of bedrock are broken off and removed by the ice, a process called glacial quarrying (plucking), making this side of the hill steeper. The resulting hill resembles a drumlin, except it is often smaller and is composed of solid rock.

The chunks of bedrock removed by glacial quarrying and transported by the glaciers most likely produce

A) terminal outwash plains
B) kettle lake depressions
C) V-shaped valleys
D) parallel scratches in surface bedrock

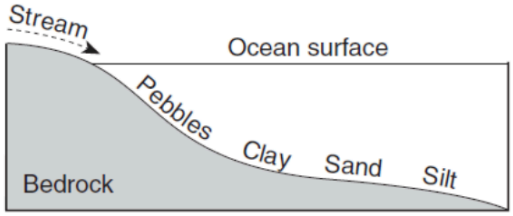
19. The map below shows the large delta that formed as the Mississippi River emptied into the Gulf of Mexico.

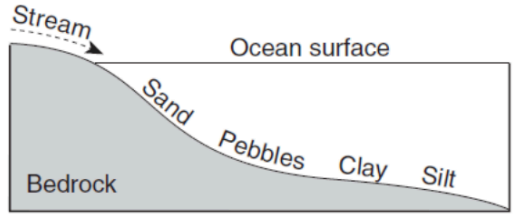


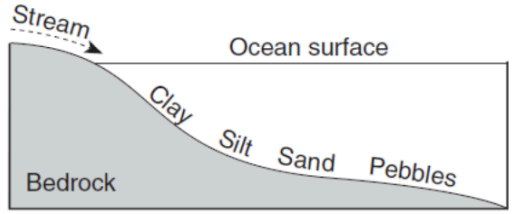
Which process was primarily responsible for the formation of the delta?

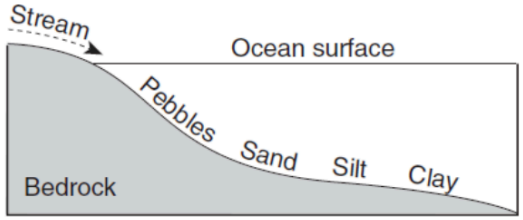
A) glacial erosion
B) cementation of sediment
C) deposition of sediment
D) mass movement

20. Which profile best shows the general depositional pattern that occurs when water from a stream enters the ocean?

A)


B)


C)


D)


Answer Key
Unit 5

1. **D**
2. **C**
3. **B**
4. **D**
5. **D**
6. **B**
7. **D**
8. **B**
9. **D**
10. **D**
11. **C**
12. **C**
13. **D**
14. **D**
15. **D**
16. **C**
17. **A**
18. **D**
19. **C**
20. **D**