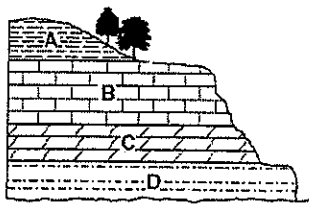
NAME: Richter - Key *

WEATHERING, EROSION, AND DEPOSITION NOTES

Log onto YouTube and search for **jocrisci** channel.

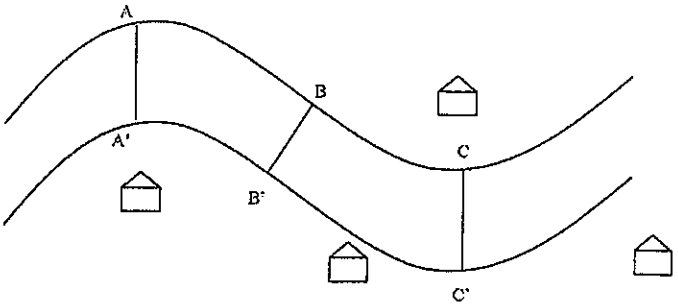
WEATHERING (Videos 4.1 & 4.2)

1. Why are streets and highways damaged so much more in the winter months than in the summer months in most of the United States?
2. Sandstones cemented by calcite usually weather much more rapidly than those cemented by quartz. Why?
3. With specific reference to weathering, explain why Egypt is a good location for a monument such as Cleopatra's Needle, and why New York City is a poor location.
4. The Earth is 4.6 billion years old. For most of its history, the forces of weathering and erosion have been attacking its surface. Why then do mountains still exist? Shouldn't the continents have been worn down flat by now?
5. On the diagram to the right, which layer is most resistant to weathering? How can you tell? The least?
6. What are the two major materials of which soil is composed?



EROSION (Video 4.3, 4.4, 4.5, 4.6, 4.7 ESRT 6c)

1. How are landscapes eroded by a glacier different from the landscapes eroded by a stream?
2. Why does one gram of finely ground up salt dissolve quicker than one gram of coarsely ground salt?
3. What two factors does the velocity of a stream depend on?
4. Given the diagram of a meandering stream to the right, you should be able to identify the points of maximum and minimum velocity, where erosion and deposition are greatest, and how the water depth varies at different points across the stream.
5. What effect does stream velocity have on the size of the sediments that can be transported? (As……)
6. You should be able to use the reference tables [page 1 (ruler) & 6 (graph)] to determine if a particle is a cobble, boulder, etc.



DEPOSITION (Video 4.8)

1. How are sediments deposited by a glacier different from the sediments deposited by a stream? (Two differences)
2. What effect does particle size have on settling time? (As…..)
3. What effect does particle shape have on settling time? (As ….)
4. How will unsorted sediments look after being deposited in water?

Weathering, Eroison, & Deposition Facts

Videos 4.1 & 4.2

1. Physical weathering is the / breaking down of rocks into smaller pieces (sediments)
2. Frost action occurs as / water seeps in crack, freezes and expands
3. Abrasion occurs when / rocks rub and become smaller and rounder in a stream or wind
4. Chemical weathering / changes the chemical composition of the rock, best example is rust also cave formation and acid rain
5. Moist and warm climates favor / chemical weathering
6. Moist and cold climates favor / physical weathering (good for frost action)
7. As particle size decreases / surface area increases and the rate of weathering increases
8. Resistant layers of rock / stick out and forms cliffs or escarpments
9. Soils develop as a result of / weathering and biological activity

Videos 4.3 – 4.7 ESRT 6c

10. Erosion is the / movement of sediment
11. The five agents of erosion are / water, glaciers, wave action, wind, and mass movements
12. The primary **force** that drives the agents of erosion is / gravity
13. The primary **agent** of erosion is / water
14. Streams valleys are / V-shaped
15. Stream velocity depends on / gradient (steepness or slope) and volume (amount) of water
16. The outside of a meander bend is / fast and erodes (elbow)
17. The inside of a meander bend is / slow and deposits (dent)
18. The size of the particles that can be transported / increases as stream velocity increases
19. Evidence of gravity erosion is / unsorted and angular (sharp) rocks at base of cliff.
20. Longshore drift moves / sand along the beach in the direction of the ocean current
21. Glacial landscapes show / U-shaped valleys, erratics (large boulders), kettle lakes, moraines drumlins, & scratched bedrock (striations)
22. Outwash plains form as / a glacier melts and rivers carry small sediments (sorted) away from the glacier
23. Glaciers advance from the / north, they formed Long Island, left sand and gravel (moraines)
24. Wind erosion creates / sand dunes, the windward side of a sand dune has a gentle slope

Video 4.8

25. Deposition / is the dropping or stopping of sediments after erosion
26. Water and wind deposits are / sorted by size and layered
27. Gravity and glacial deposits are / unsorted and not layered
28. When a river enters the ocean / it slows down, deposits & called a **delta** (horizontal sorting)
29. The particles that settle out first are / larger, most dense, and roundest
30. Watershed is a / geographic area where all the rainwater flows into a river

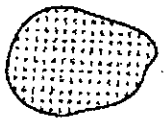
Fact(s) to memorize: 1 - 6

Weathering, Erosion and Deposition

Weathering: the breaking down of rocks through contact with the Earth's atmosphere, hydrosphere & biosphere

Types of Weathering: Physical and chemical

Physical Weathering

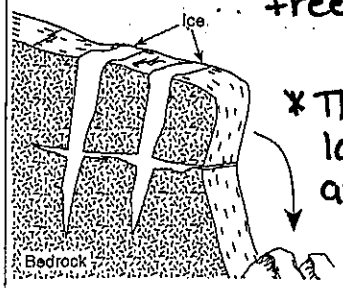


The breaking down of rocks into smaller pieces (sediments). Smaller pieces equals greater surface area equals greater rate of weathering.

Favored by cold and moist climates

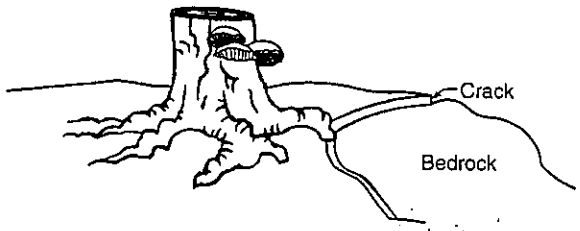
Types of Physical Weathering:

Frost Wedging → water seeps into cracks in rocks, freezes and expands.



This is how a lot of pot holes are formed

Root Action → roots of plants create cracks in rocks.



Abrasion → Rocks rub against each other and become smaller & rounder in streams or by wind.

*Roundest sediments = long time in a stream

Exfoliation → Rocks weather by peeling off in sheets rather than grain by grain.

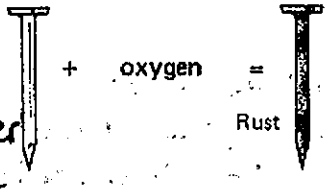
Fact(s) to memorize: 1 - 6

Chemical Weathering

Changes the chemical composition of the rock
(Best Examples: rusting & cave formations)
* most favorable in warm & moist climates *

Types of Chemical Weathering:

Oxidation

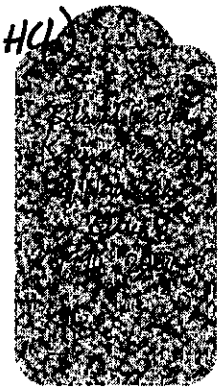


Iron rich rocks & other objects are exposed to oxygen producing rust.

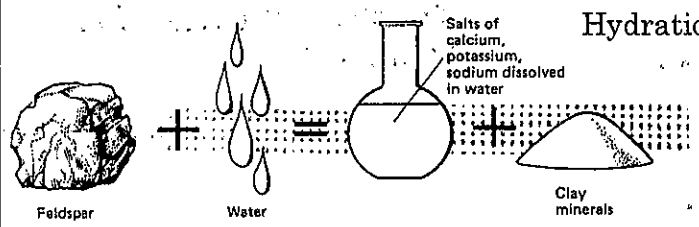
Carbonation

Acid Rain (containing HCl) comes in contact with marble & Limestone (containing calcite) breaking down the rock

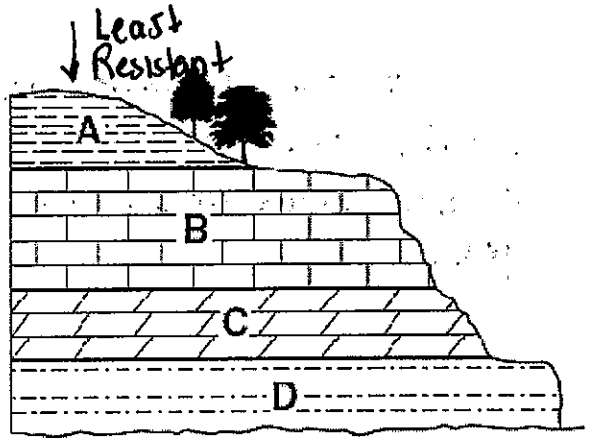
* Common - is old tombstones *



Hydration → water is absorbed by minerals in rocks.



Chemical weathering of feldspar by water.



↑ most resistant

Composition of the Rocks

What the rocks are made up of determine how resistant to weathering the rocks are.

More resistant rock layers stick out farthest on a cliff.

Fact(s) to memorize: 7 & 8

Factors that Effect Weathering

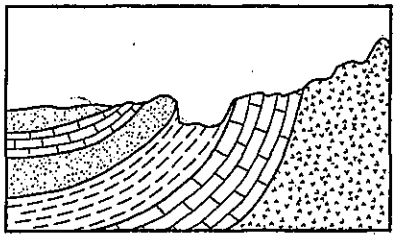
Factor	Physical Weathering	Chemical Weathering
Climate	cold & moist	warm & moist
Exposure	· Atmosphere · Hydrosphere · Biosphere	· atmosphere (oxygen) · Hydrosphere (H_2O)
Composition	- Varies	- Iron rich rocks - Calcite rich rocks

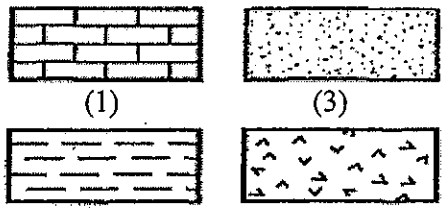
1. In which type of climate would the rate of chemical weathering be the greatest?
   (1) warm and dry (2) cold and dry (3) warm and moist (4) cold and moist

2. In which climate does physical weathering by frost action most easily occur?
   (1) dry and hot (2) dry and cold (3) moist and hot (4) moist and cold

3. Chemical weathering will occur most rapidly when rocks are exposed to the
   (1) hydrosphere and lithosphere
   (2) mesosphere and thermosphere
   (3) hydrosphere and atmosphere
   (4) lithosphere and atmosphere

4. The diagram below represents a geologic cross section. Which rock layer is least resistant to weathering?





5. Why will a rock weather more rapidly if it is broken into smaller particles?
   (1) the mineral structure of the rock has changed
   (2) the smaller particles are less dense
   (3) the total mass of the rock and the particles is reduced
   (4) there is more surface area exposed

Soil

Fact(s) to memorize: 9

Soils develop as a result of weathering and biological activity (burrowing animals, worms, etc.).

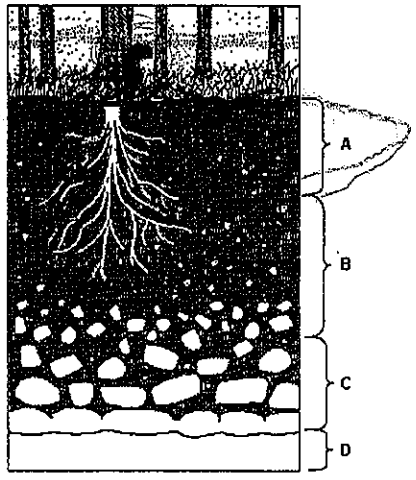
Residual Soil → Soil made up of the same composition as the underlying bedrock.
"Resides" (lives) there

Transported Soil → Soil that has been moved and deposited which has a different composition than the underlying bedrock.

1. Particles of soil often differ greatly from the underlying bedrock in color, mineral composition, and organic content. Which conclusion about these soil particles is best made from this evidence?
   A. They are residual sediments.
   (B) They are transported sediments.
   C. They are uniformly large-grained.
   D. They are soluble in water.

2. Which factors most directly control the development of soils?
   A. soil particle sizes and method of deposition
   (B) bedrock composition and climate characteristics
   C. direction of prevailing winds and storm tracks
   D. earthquake intensity and volcanic activity

3. The diagram to the right shows a soil profile formed in an area of granite bedrock. Four different soil horizons, *A, B, C*, and *D*, are shown. Which soil horizon contains the greatest amount of material formed by biological material?
   (A) *A*
   B. *B*
   C. *C*
   D. *D*



4. The formation of soil is primarily the result of
   A. stream erosion and mass movement
   B. stream deposition and runoff
   C. precipitation and wind erosion
   (D) weathering and biological activity

5. Soil that contains large quantities of calcium was most likely formed by the weathering of
   A. rock salt
   B. quartzite
   (C) coal
   D. limestone

Erosion

Fact(s) to memorize: 10 - 13

Erosion: the movement of sediments

Agents of Erosion: Water, wind, waves
Glaciers + Mass movement (gravity)
* Primary agent of erosion = water *

Force of Erosion: Gravity drives all agents of erosion

1. The composition of sediments on Earth's surface usually is quite different from the composition of the underlying bedrock. This observation suggests that most
   (1) bedrock is formed from sediments
   (2) sediments are residual
   (3) bedrock is resistant to weathering
   (4) sediments have been transported

2. On Earth's surface, transported materials are more common than residual materials. This condition is mainly the result of
   (1) recrystallization (2) erosion (3) folding (4) subduction

3. Most of the surface materials in New York State can be classified as
   (1) igneous rock
   (2) coastal plain deposits
   (3) metamorphic rocks
   (4) transported soils

4. Granite pebbles are found on the surface in a certain area where only sandstone bedrock is exposed. Which is the most likely explanation for the presence of these pebbles?
   (1) The granite pebbles were transported to the area from a different region.
   (2) Some of the sandstone has been changed into granite.
   (3) The granite pebbles were formed by weathering of the exposed sandstone bedrock.
   (4) Ground water tends to form granite pebbles within layers of sandstone rock.

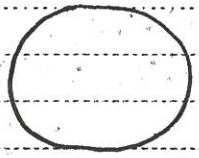
5. By which processes are rocks broken up and moved to different locations?
   (1) evaporation and condensation
   (2) weathering and erosion
   (3) burial and cementation
   (4) compaction and transportation

6. Transported rock materials are more common than residual rock materials in the soils of New York State. Which statement best explains this observation?
   (1) Solid rock must be transported to break.
   (2) Weathering changes transported rock materials more easily than residual rock materials.
   (3) Most rock materials are moved by some agent of erosion at some time in their history.
   (4) Residual rock materials form only from bedrock that is difficult to change into soil.

Fact(s) to memorize: 14 - 18

Water Erosion

- Sediments are transported by moving water.
- Rounded rocks & smooth (from abrasion)



Round & smooth

The sediments rub/brush against the stream bottom making the rocks round and smooth.
* This is called abrasion *

Streams

Stream: any body of water with a current

Includes: brooks, creeks, tributaries & rivers

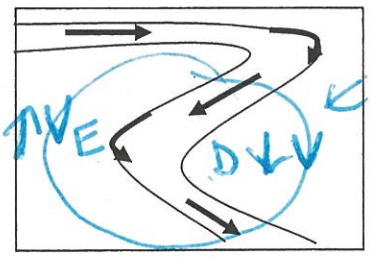
Velocity of a stream is influence by the following:

(1) Gradient : slope of the land
(steeper slope = greater velocity)

(2) Volume: amount of water
(greater amount of water = greater)

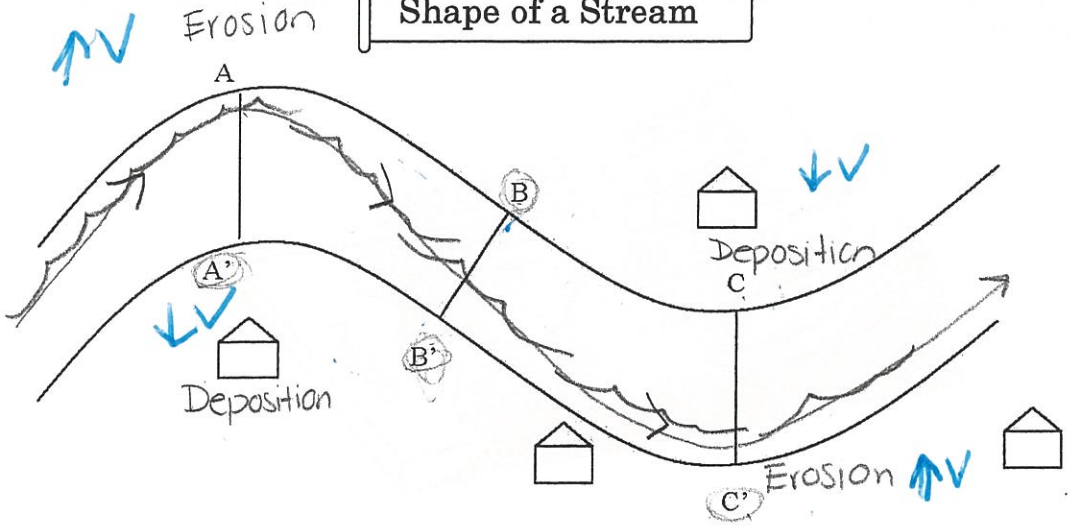
- discharge: volume of water passing through a specific point.

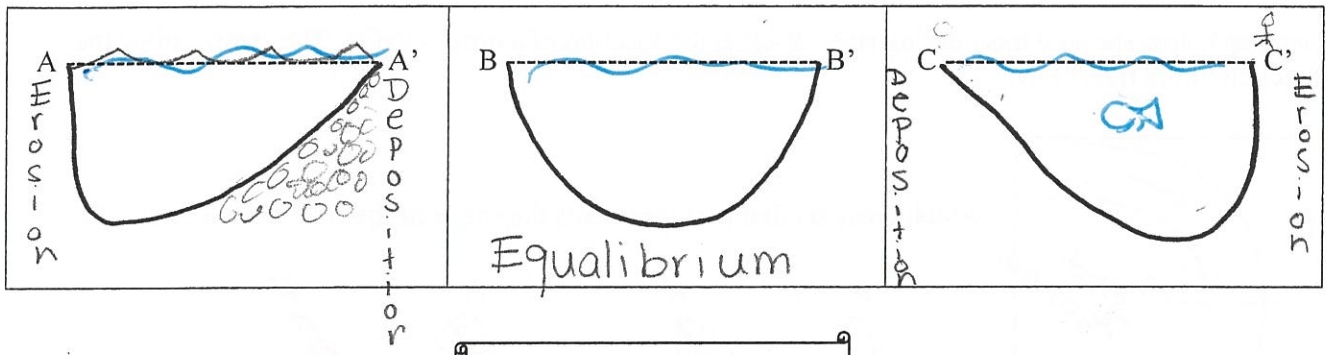
Oxbow Lake: meander joins together and separates from the river.



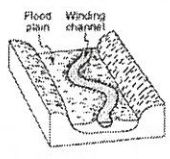
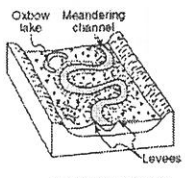
Meander – bend in the river
outside = fast + erodes
inside = slow + deposits

Shape of a Stream

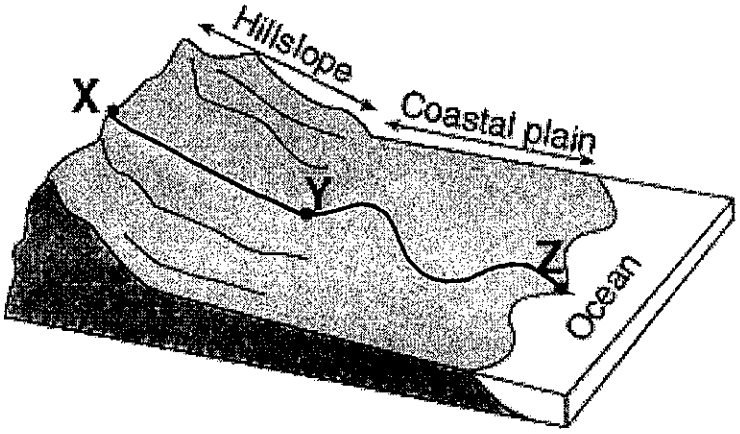




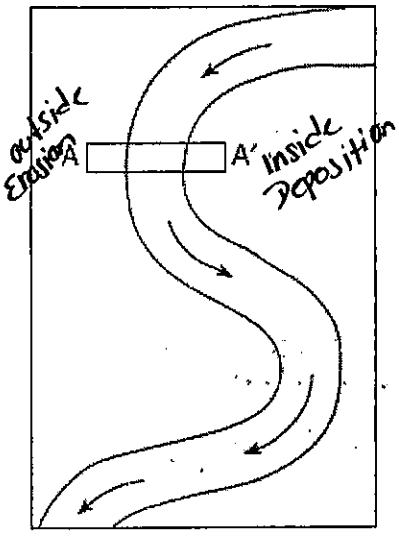
Life of a Stream

Beg.	Youth 	• high energy • fast moving • steep gradient / slope • a lot of erosion • river creates a narrow "v" shaped valley.
Middle	Mature 	• gentler gradient • slower moving water • side walls of the "v" shaped valleys collapse. • meanders develop • valley becomes wider than river channel. • flood plains develop
End	Old Age 	• land is almost flat • levees form a place around a stream where deposition over time, deposits a mound of sediments. • oxbow lake; a cut off meander, forms from deposition.

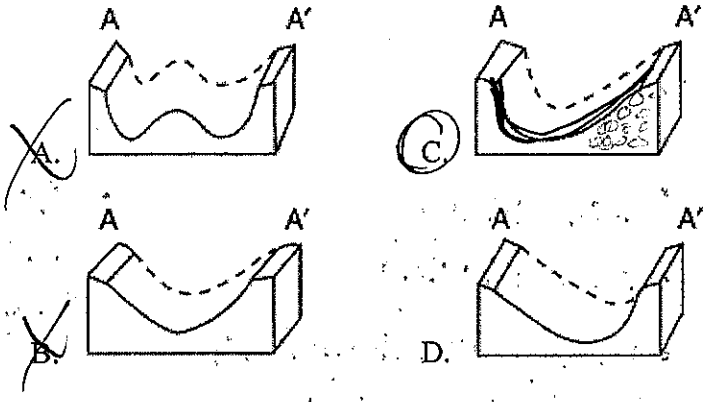
1. Based on what you just learned about stream shape and age draw in the shape of the stream from X to Y then Y to Z in the diagram below.



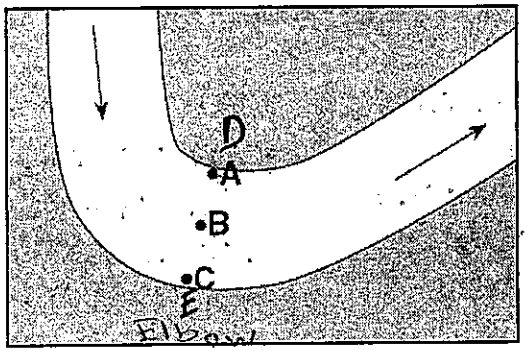
2. The map below shows a meandering river. *A–A'* is the location of a cross section. The arrows show the direction of the river flow.



Which cross section best represents the shape of the river bottom at *A–A'*?

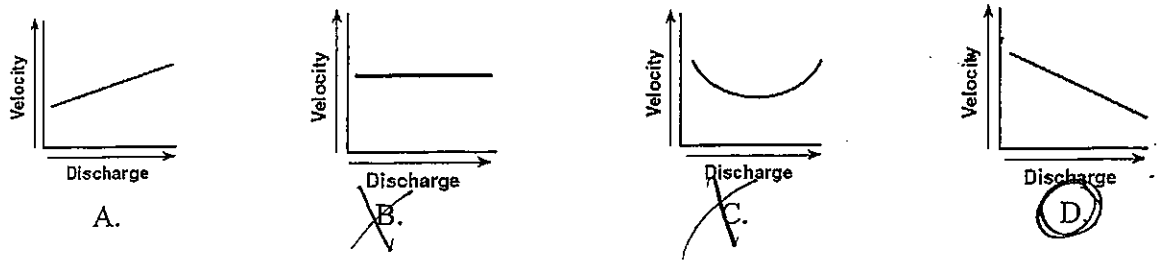


3. The map below shows the bend of a large meandering stream. The arrows show the direction of stream flow. Letters *A*, *B*, and *C* are positions on the streambed where erosion and deposition data were collected. Place a check mark in each of the correct the locations where erosion and deposition are dominant and where equilibrium exists between the two processes.



	Erosion	Equilibrium	Deposition
A			✓
B		✓	
C	✓		

4. Which graph best represents the relationship between the discharge of a stream and the velocity of stream flow?



5. Deposition within a meandering stream usually occurs on the inside of the curves because the

A. water velocity decreases
B. stream gradient increases
C. water is deeper
D. stream is narrower

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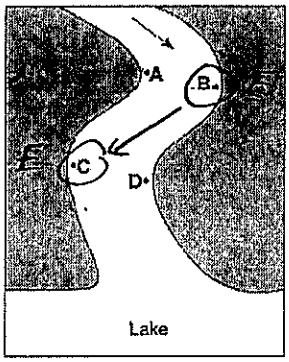
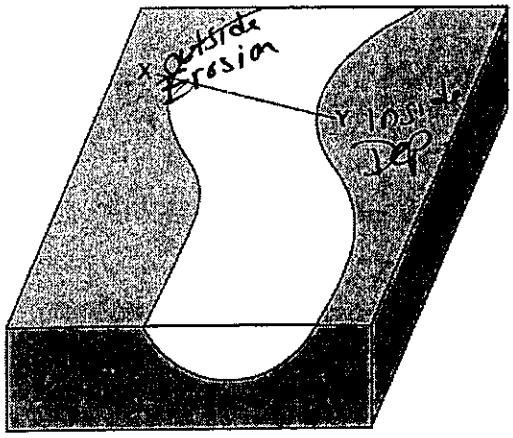
6. The map below shows a meandering stream as it enters a lake. The arrow shows the direction of stream flow. Points *A* through *D* represent locations on the surface of the stream.

The greatest stream velocities are found closest to points

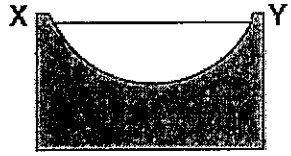
A. *A* and *B*
B. *B* and *C*
C. *C* and *D*
D. *D* and *A*

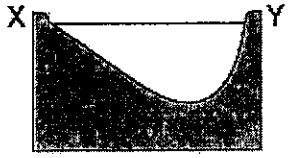


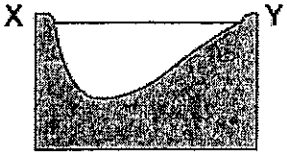
7. The block diagram below shows part of a meandering stream. Line *XY* shows the location of a stream cross section.

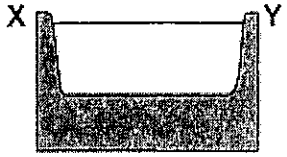


Which cross section best represents the shape of the stream channel at line *XY*?

A.


B.


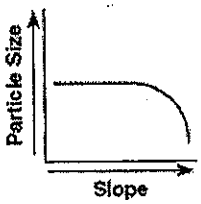
C.


D.


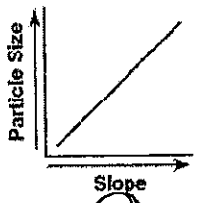
Stream Velocity Questions (ESRT Page 6)

1. Which graph best represents the relationship between the slope of a river and the particle size that can be transported by that river?

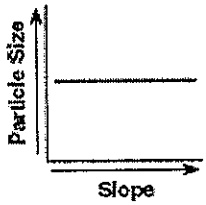
A.



B.



C.



D.

2. Which statement best describes the general relationship between stream velocity and the size of the sediment particles transported by the stream?
   A. As the stream velocity decreases, the diameter of the sediments transported increases.
   B. As the stream velocity decreases, the diameter of the sediments transported remains the same.
   C. As the stream velocity increases, the diameter of the sediments being transported decreases
   D. As the stream velocity increases, the diameter of the sediments being transported increases.

3. Heavy spring rains cause the velocity of a stream to increase from 10 cm/s to 100cm/s. As a result of the increase in runoff, the largest diameters of the sediment particles being transported could increase from
   A. 0.1 cm to 10 cm
   B. 0.2 cm to 2.3 cm
   C. 1.0 cm to 6.4 cm
   D. 6.4 cm to 25.6 cm

4. Which of the following particle diameters best represents largest particles that a stream flowing with a water velocity equal to 0.2 cm/s can transport?
   A. 0.0004 cm
   B. 0.003 cm
   C. 0.1 cm
   D. 1.3 cm

5. As the velocity of a stream transporting pebbles, sand, silt, and clay decreases from 30 cm/s to 0.1 cm/sec, some sediment deposition will occur. Which choice below best describes the sediments that will be deposited as a result of the decrease in stream velocity?
   A. pebbles, sand and some silt
   B. clay and some silt
   C. pebble, sand, silt, and most of the clay
   D. only some sand and clay

6. What is the minimum velocity that a stream must have in order to transport particles with diameters equal to 0.04 cm?

   A. 0.5 cm/s B. 1.0 cm/s C. 1.5 cm/s D. 2.0 cm/s

7. If the greatest velocity of a river was 10 centimeters per second, what was the approximate diameter of the largest particles that the river could have carried?

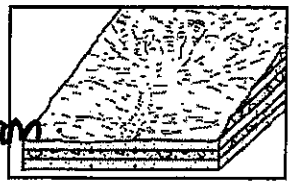
   A. 1.0 cm B. 2.0 cm C. 10.0 cm D. 0.2 cm

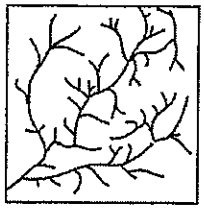
Drainage Patterns

Drainage patterns- determined by the topography of the surface and the underlying bedrock.

Dendritic:

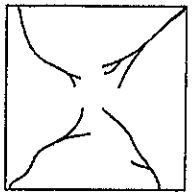
- most common stream pattern
- tributaries seem to flow in the same direction, creating a larger stream
- looks like branches on a tree.
- usually on undisturbed, horizontal rock layers





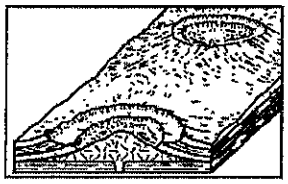
Radial:

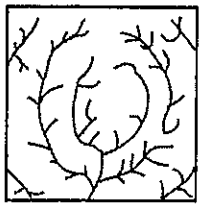
- occurs when the streams flow away from a high point.
- looks like spokes on a wheel
- develops over a smooth dome or volcanic cone



Annular:

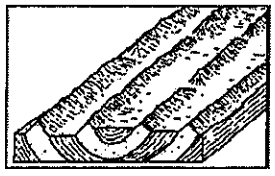
- occurs on a eroded dome
- appears to be a circular pattern with small tributaries going into each path/each circle.

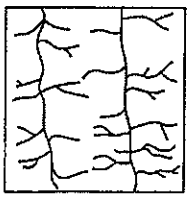


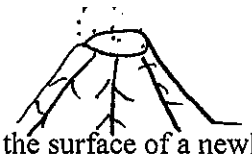


Rectangular:

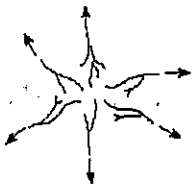
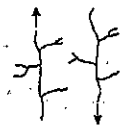
- occurs where drainage flows along folds and faults
- looks like parallel lines with tributaries going into each path.

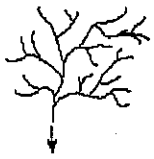






1. Which stream-drainage pattern most likely developed on the surface of a newly formed volcanic mountain?



A. B. C. D.

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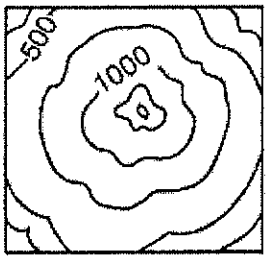
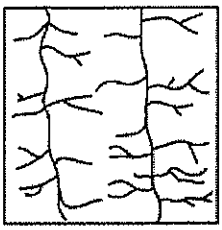
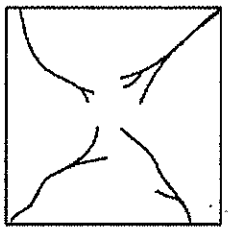
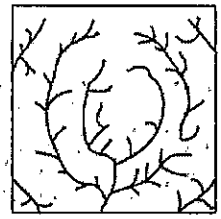
2. The topographic map below shows a particular landscape.



Which map best represents the stream drainage pattern for this landscape?



A. B. C. D.

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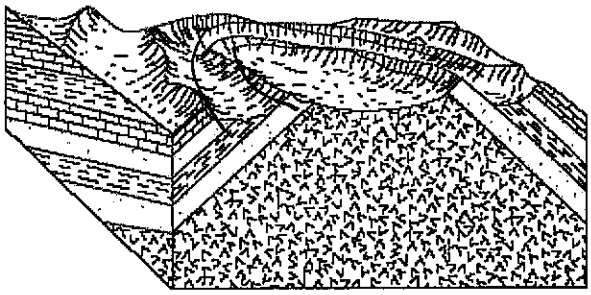
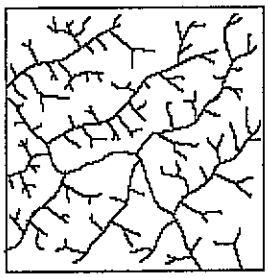
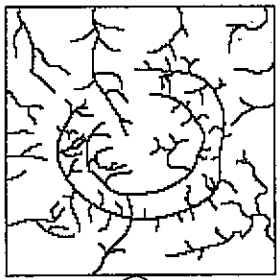
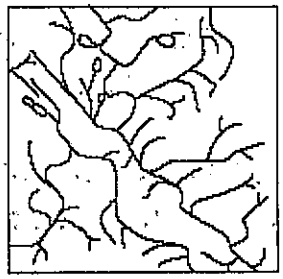
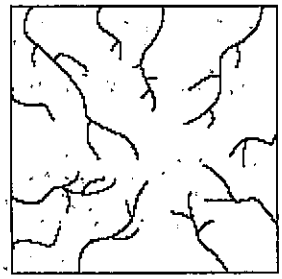
3. The block diagram below represents a deeply eroded dome.

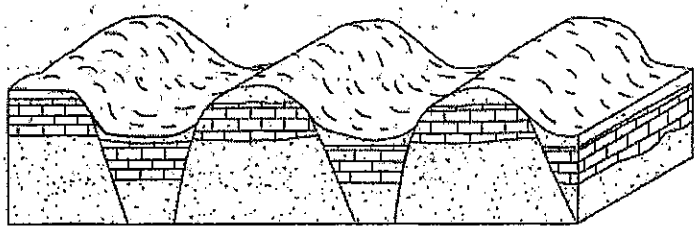


Which map shows the stream drainage pattern that would most likely develop on this deeply eroded dome?

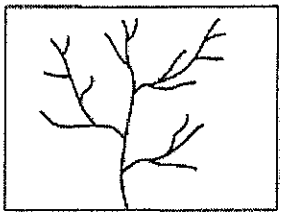





A. B. C. D.

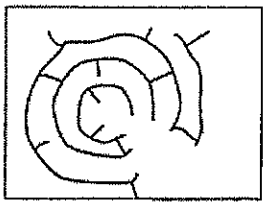
4. The block diagram below shows a region that has undergone faulting.



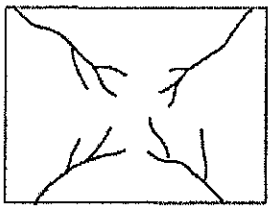
Which map shows the stream drainage pattern that would most likely develop on the surface of this region?



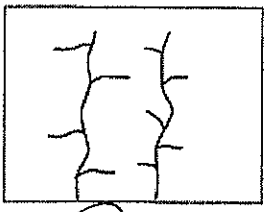
A.



B.



C.



D.

5. The maps below labeled *A*, *B*, and *C* show three different stream drainage patterns. Which factor is primarily responsible for causing these three different drainage patterns?

A

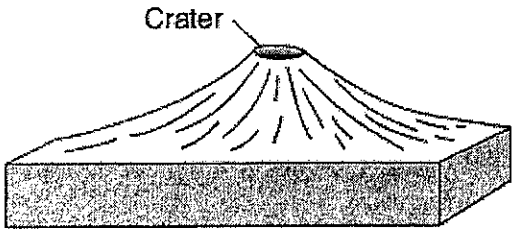
B

C

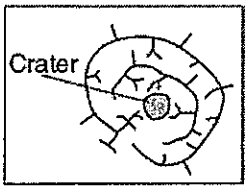
A. amount of precipitation
B. bedrock structure
C. stream discharge
D. prevailing winds

---

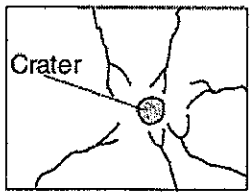
6. The block diagram below shows a volcano. Which map shows the stream drainage pattern that most likely formed on the surface of this volcano?



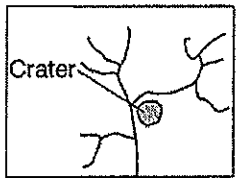
A.



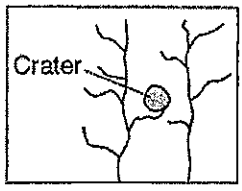
C.



B.



D.



Gravity Erosion

"mass movement"

- all agents of erosion are driven by gravity.
- examples of erosion by gravity alone include landslides dropping off cliffs and mass movement down steep slopes.
- without other erosional forces, rocks are jagged & rough. (unsorted)

Fact(s) to memorize: 19

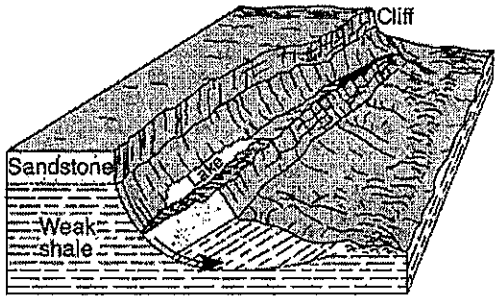
1. For which movement of earth materials is gravity *not* the main force?

   A. sediments flowing in a river
   B. boulders carried by a glacier
   C. snow tumbling in an avalanche
   D. moisture evaporating from an ocean

2. The block diagram below shows a displacement of rock layers.

   Which process describes the downward sliding of the rock material?

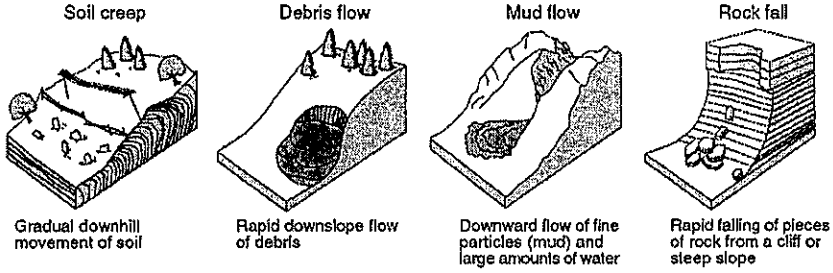
   A. tidal changes
   B. glacial erosion
   C. mass movement
   D. lava flow



3. The diagrams below represent four different examples of one process that transports sediments.

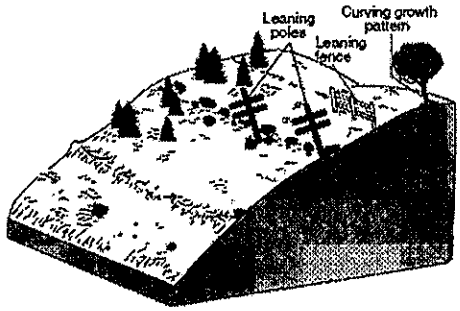
   Which process is shown in these diagrams?

   A. chemical weathering
   B. wind action
   C. mass movement
   D. rock abrasion



4. The diagram below shows the surface features of a landscape. Based on the features shown, which erosional agent had the greatest effect on tree growth and the structures that humans have built on this landscape?

   A. running water
   B. moving ice
   C. prevailing wind
   D. mass movement



5. A landslide is an example of

   A. river deposition
   B. glacial scouring
   C. mass movement
   D. chemical weathering

Fact(s) to memorize: 20

Wave Erosion

- wave action rounds sediments as a result of abrasion
- shores are protected by sand dunes and barrier islands.

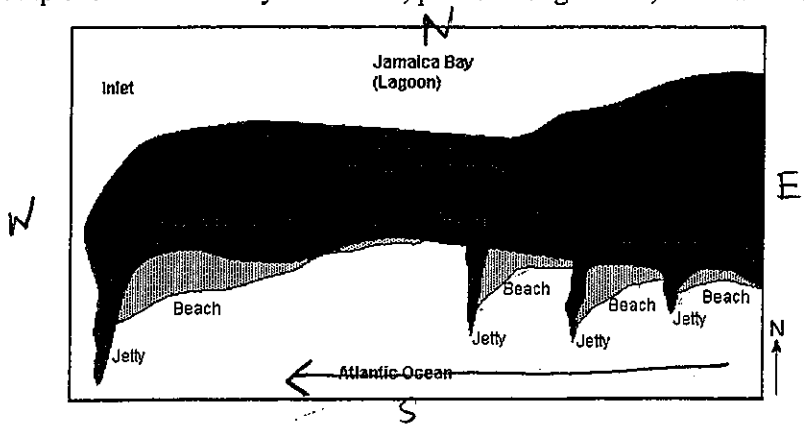
Creates beaches - formed from weathering & erosion of continental and oceanic rocks.

Barrier island- A long narrow island, running parallel to the main land, made of sand.
- built up by the action of waves, currents and winds that distribute sand.
- protects the coast from erosion.

Longshore Current - transportation of sediments (clay, silt, sand) along the coast at an angle to the shoreline.

Jetties and groins - interrupt the movement of sediment causing deposition.

1. The map shows Rockaway Peninsula, part of Long Island, New York's south shore.



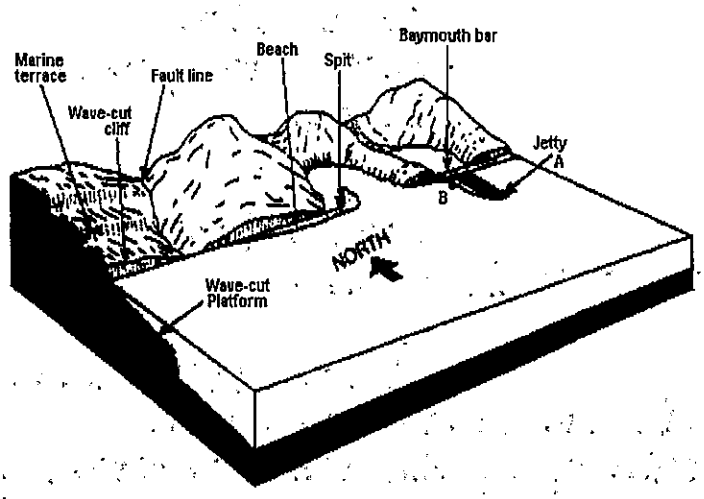
Toward which direction is sand being transported along the shoreline within the zone of breaking waves?

A. northeast
B. south
C. southeast
D. west

2. The diagram represents a shoreline along which several general features have been labeled.

What is the most likely source of the waves approaching this coastline?

A. variations in water temperature
B. density differences within the water
C. the rotation of Earth
D. surface winds



3. Refer to the diagram above. Which statement best describes the longshore current that is modifying this coastline?

A. The current is flowing northward at a right angle to the shoreline.
B. The current is flowing southward at a right angle away from the shoreline.
C. The current is flowing eastward parallel to the shoreline.
D. The current is flowing westward parallel to the shoreline.

---

4. The long, sandy islands along the south shore of Long Island are composed mostly of sand and rounded pebbles arranged in sorted layers. The agent of erosion that most likely shaped and sorted the sand and pebbles while transporting them to their island location was

A. glaciers
B. landslides
C. wind
D. ocean waves

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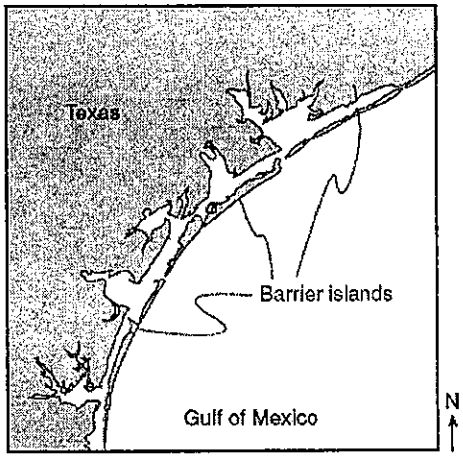
5. The map below shows barrier islands in the ocean along the coast of Texas.

Which agent of erosion most likely formed these barrier islands?

A. mass movement
B. wave action
C. streams
D. glaciers



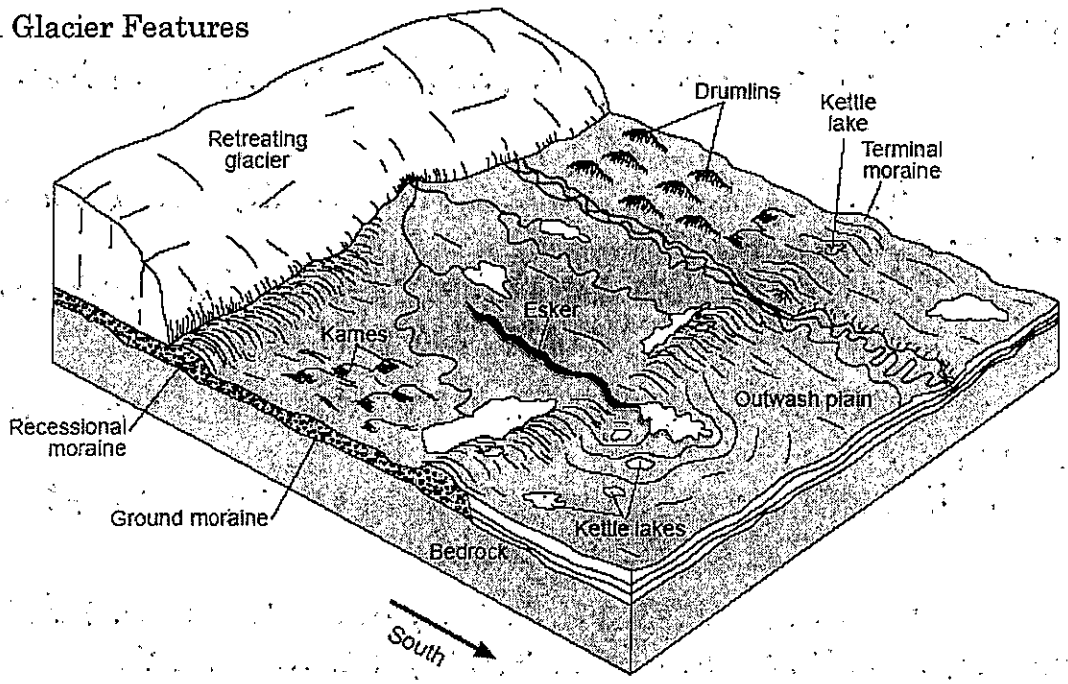
Fact(s) to memorize: 21 - 23

Glacial Erosion

- large, very slow moving ice.
- form in high latitudes and high elevations.
- form when more snow falls in the winter than can melt in the summer.
- gravity causes glaciers to flow down a valley or spread out over a continent.
- push, drag and carry sediment.
- can carry any size sediment, including boulders.
- deposition is unsorted.
- features include:
  - striations (scratches) on the rock parallel groves in the bedrock.
  - rocks may be partially rounded

** U-Shaped Valleys **

Continental Glacier Features



Esker Long narrow ridge of coarse gravel deposited by a stream flowing in a narrow ice tunnel under the glacier. (sorted sediment)

Till - unsorted sediment deposited by a glacier.

Erratic - rocks that do NOT match the size and type of other rocks in the same area.
- size can vary from pebbles to boulders.

Moraine - a large deposit of glacial till that forms when the glacier has stalled or retreated (melted)

Terminal Moraine - large ridge of glacial till marking the farthest advancement of the glacier.

Recessional moraine - mixture of sand, gravel and rock that is deposited as the ice front melts.

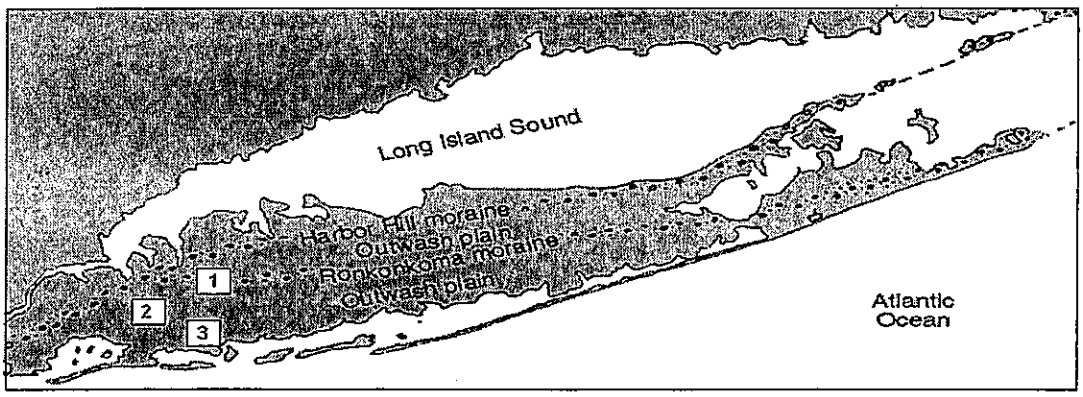
Outwash plain - horizontal layers of sorted glacial material in front of the glacier.
- formed by meltwater of the glacier.

Drumlins - Glacial hills that are shaped like a back of a spoon — by the ice
- indicates the direction of glacial movement (toward the gentle slope).

Kames - Irregularly shaped hills compased of sorted sand and gravel.
- directly formed from the meltwater of the glacier.

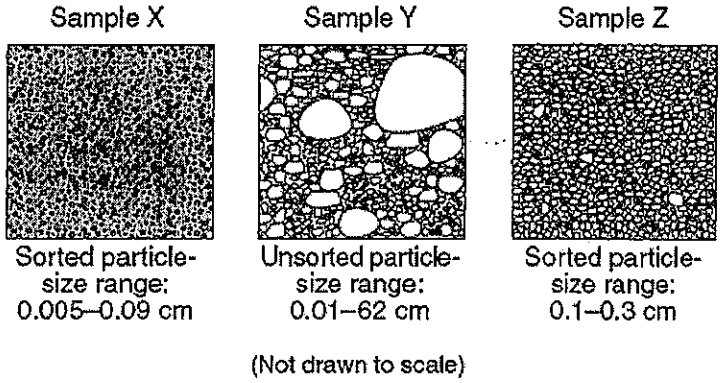
Kettle Lake - occurs when a large piece of a glacier drops off the front and becomes partially buried
- if the hole fills with water it becomes a Kettle Lake.

Map C



The diagrams below represent three sediment samples labeled *X*, *Y*, and *Z*.

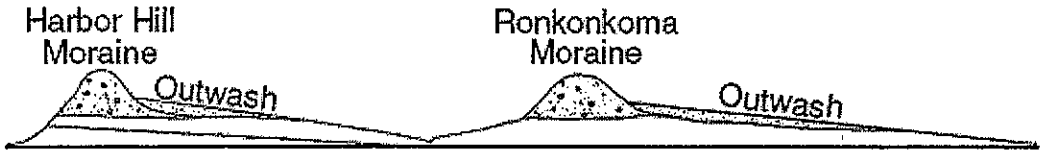
These samples were collected from the three numbered locations marked on the map *C*.



1. Which choice correctly indicates the location from which each sample was most likely collected?

   A. 1 = *Z*, 2 = *Y*, 3 = *X*
   B. 1 = *X*, 2 = *Z*, 3 = *Y*
   C. 1 = *Y*, 2 = *X*, 3 = *Z*
   D. 1 = *Y*, 2 = *Z*, 3 = *X*

2. The cross section below represents the sediments beneath the land surface along one of the reference lines shown on the map.



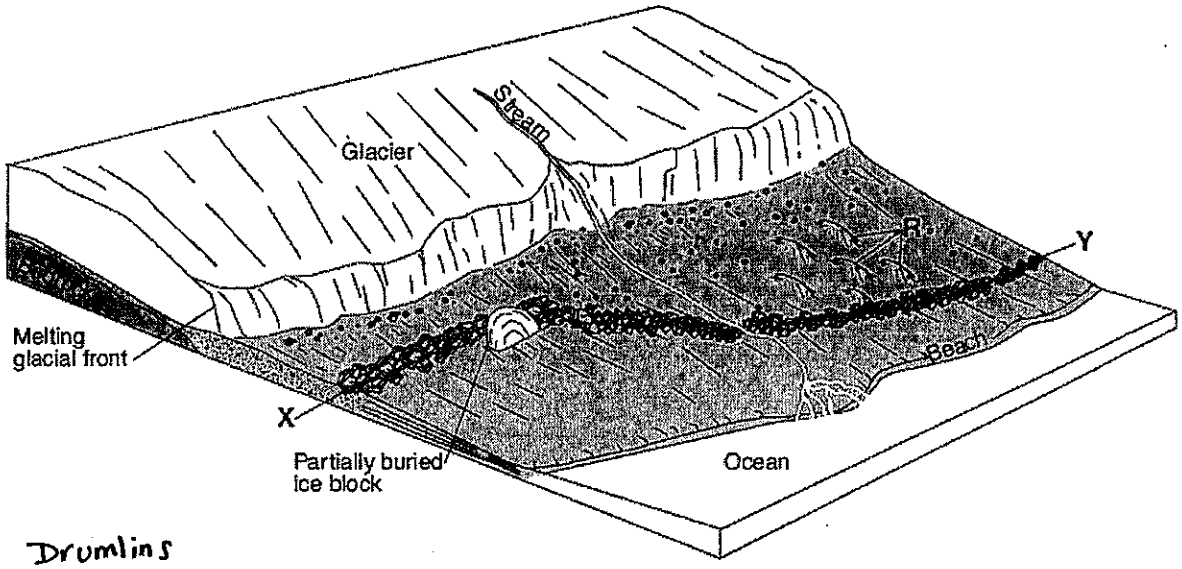
   Along which reference line was the cross section taken?

   A. *AB*
   B. *CD*
   C. *EF*
   D. *GH*

3. A major difference between sediments in the outwash and sediments in the moraines is that the sediments deposited in the outwash are

   A. larger
   B. sorted
   C. more angular
   D. older

Base your answer to the question on the diagram below, which shows the edge of a continental glacier that is receding. *R* indicates elongated hills. The ridge of sediments from *X* to *Y* represents a landscape feature.



Drumlins

4. The elongated hills labeled ***R*** are most useful in determining the
   A. age of the glacier
   B. direction the glacier has moved
   C. thickness of the glacier
   D. rate at which the glacier is melting

5. Which feature will most likely form when the partially buried ice block melts?
   A. drumlin
   B. moraine
   C. kettle lake
   D. finger lake

6. The ridge of sediments from *X* to *Y* can best be described as
   A. sorted and deposited by ice
   B. sorted and deposited by melt water
   C. unsorted and deposited by ice
   D. unsorted and deposited by melt water

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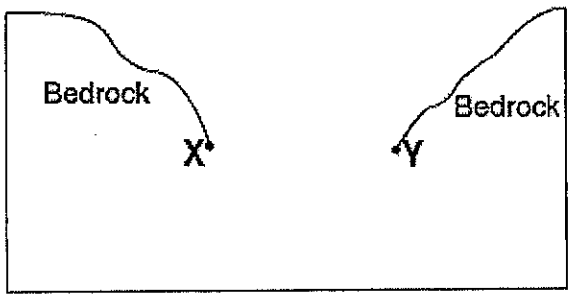
7. On this diagram, draw a line beginning at *X* and ending at *Y* to show the shape of this valley after it was eroded by glacial ice that flowed down the valley.

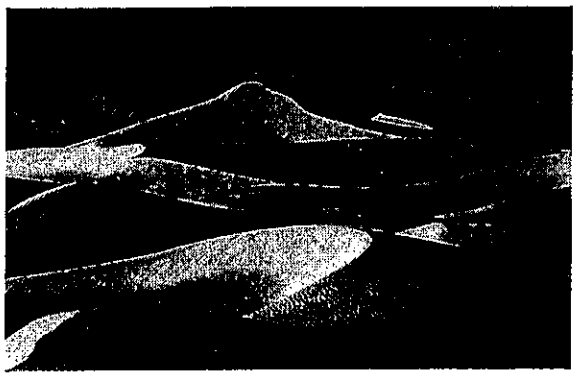


Fact(s) to memorize: 24

Wind Erosion

- most common in arid climates (dry)
- common in deserts and on beaches
- the faster the wind blows, the larger the sediment it can carry.
- usually can not move large sediments
- larger particles settle out first.
- weathering by abrasion
- features may be pitted flat faces and straight edges.
- surface features include dunes and sand blasted bedrock
- gravity causes wind

* cold air is more dense than warm air and is pulled down by gravity towards earths surface.



What direction was this agent moving? Explain

1. The particles in a sand dune deposit are small and very well-sorted and have surface pits that give them a frosted appearance. This deposit most likely was transported by

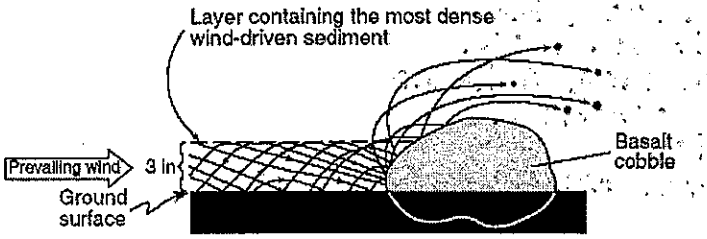
   A. ocean currents
   B. glacial ice
   C. gravit
   D. wind

2. The picture below shows a geological feature in the Kalahari Desert of southwestern Africa.

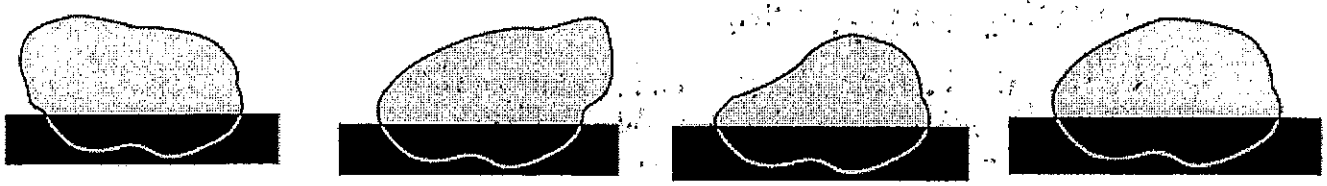
Which process most likely produced the present appearance of this feature?

   A. wind erosion
   B. volcanic eruption
   C. earthquake vibrations
   D. plate tectonics

3. 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.

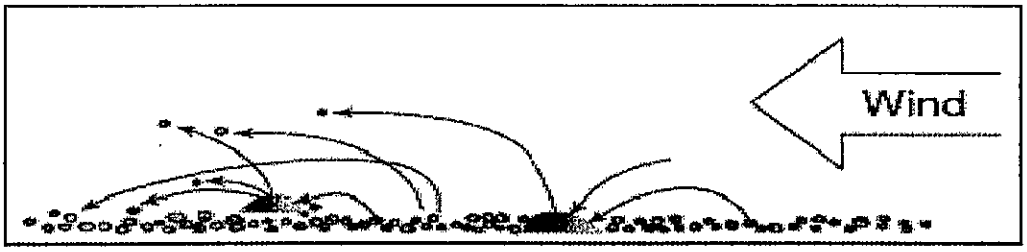


Which cross section best represents the appearance of this cobble after many years of exposure to the wind-driven sand?



A. B. C. D.

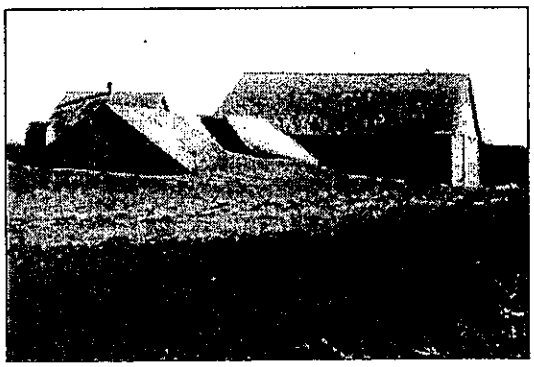
The diagram below shows sand particles being moved by wind.



4. At which Earth surface locations is this process most likely to be observed as a major type of erosion?

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

5. The photograph below shows farm buildings partially buried in silt.



Which erosional agent most likely piled the silt against these buildings?

A. glacial ice
B. ocean waves
C. wind
D. mass movement

Fact(s) to memorize: 25 - 29

Factors that Affect Deposition

Deposition - geologic process in which sediments are "added" or "deposited" to a landform / landmass.
dropping out of weathered rock materials

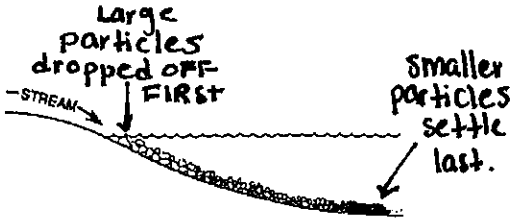
Shape - rounder particles settle faster than flatter particles
Size - larger particles settle faster than smaller particles.
Density - most dense particles settle faster than less dense.

Sorting of Sediments

- Sorted - when larger, more dense, rounder particles settle out first.
- Unsorted - when sediments are dropped out in no particular order (all mixed up).

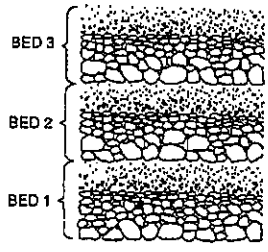
Horizontal sorting:

- occurs when a stream enters a large body of water
- velocity of stream slows down
- large particles settle out first.



Vertical sorting (Graded Bedding):

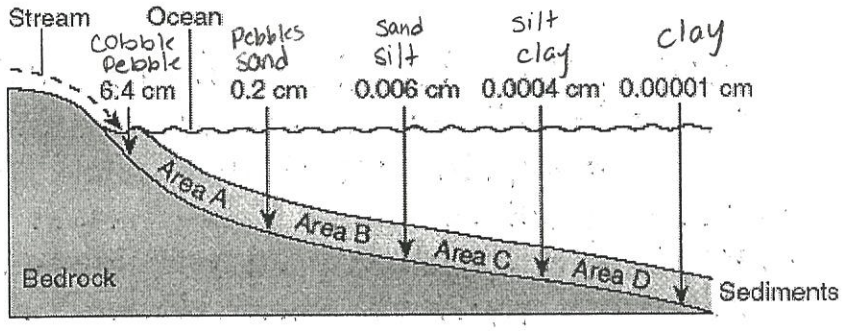
- sorting sediments from bottom to top.
- largest, roundest, most dense settle out first and are on the bottom.
- can occur after major event.
  ex: volcanic eruption, earthquakes and hurricanes.



Describe the relationship between settling rate and shape –

As the shape of the particle becomes more rounded, the faster it settles.

1. The profile below shows the average diameter of sediment that was sorted and deposited in specific areas *A, B, C,* and *D* by a stream entering an ocean.



As compaction and cementation of these sediments eventually occur, which area will become siltstone?

A. *A*
B. *B*
C. *C*
D. *D*

2. Explain why in the diagram above, the particles are deposited in size order after the stream enters the lake.

As the streams velocity decreases, the larger sediment drop first.

3. Which statement best describes sediments deposited by glaciers and rivers?

A. Glacial deposits and river deposits are both sorted.
B. Glacial deposits are sorted, and river deposits are unsorted.
C. Glacial deposits are unsorted, and river deposits are sorted.
D. Glacial deposits and river deposits are both unsorted.

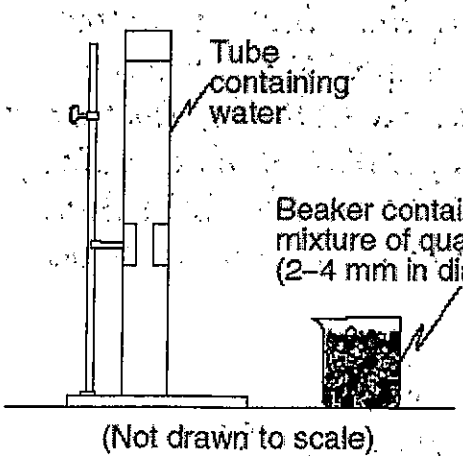
4. When the velocity of a stream suddenly *decreases*, the sediment being transported undergoes an increase in

A. particle density
B. erosion
C. deposition
D. mass movement

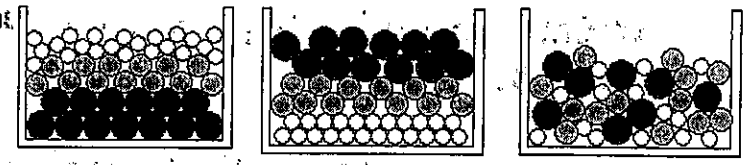
5. Which change at a particular location in a stream usually causes more sediment to be deposited at that location?

A. decrease in stream velocity
B. decrease in stream width
C. increase in stream slope
D. increase in stream discharge

6. Base your answer to the question on the diagram, which shows a clear plastic tube containing water and a beaker containing a mixture of rounded quartz grains of different sizes.

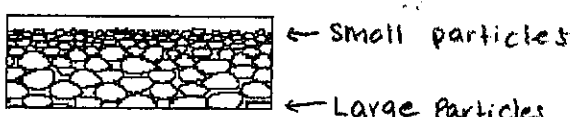


When the rounded quartz grains are poured all at once into the tube, the grains will settle to the bottom of the tube. Which cross section below best shows the approximate grain sizes and pattern of arrangement of the rounded quartz grains at the bottom of the tube?



7. The pattern of sediment size shown indicates that these sediments were most likely deposited within a

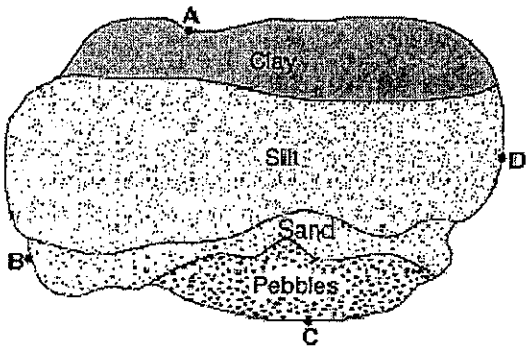
A. landslide
B. drumlin
C. moraine
D. delta



(Drawn to scale)

8. Each of the rock particles below has the same density and volume. Which particle will most likely settle at the fastest rate in moving water?

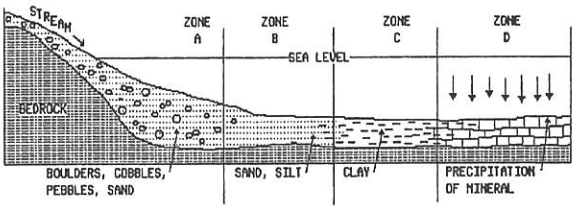
9. The map below shows an overhead view of sediments that have accumulated at the bottom of a lake. Points *A* through *D* represent locations on the shoreline of the lake.



A river most likely flows into the lake nearest to location

A. *A*
B. *B*
C. *C*
D. *D*

Fact(s) to memorize: 30



Formation of Deltas

-as a river empties into a larger body of water, deposition occurs.
-when deposition exceeds the amount of sediment moved by waves & tidal action, deltas form.

Drainage basin - the area where water from precipitation drains downhill into a body of water. Included streams and land areas

Watershed - an area where water flows from
- surface water (runoff) that feeds a river

Tributary - a creek or stream that flows into a larger body of water

New York State Stream Drainage
Using Page 3 of ESRT and Map 2 Next Page

Directions:

1. On the accompanying NYS river system map and using your ESRT page 3, **find and label** the following rivers/bodies of water

Hudson River	Susquehanna River	
Lake Ontario	St. Lawrence River	
Delaware River	Mohawk River	
Lake Champlain	Lake Erie	
Genesse River	Finger Lakes	

Alluvial Fan

2. **Use a blue pencil** to trace the Hudson River and all of the tributaries to it.

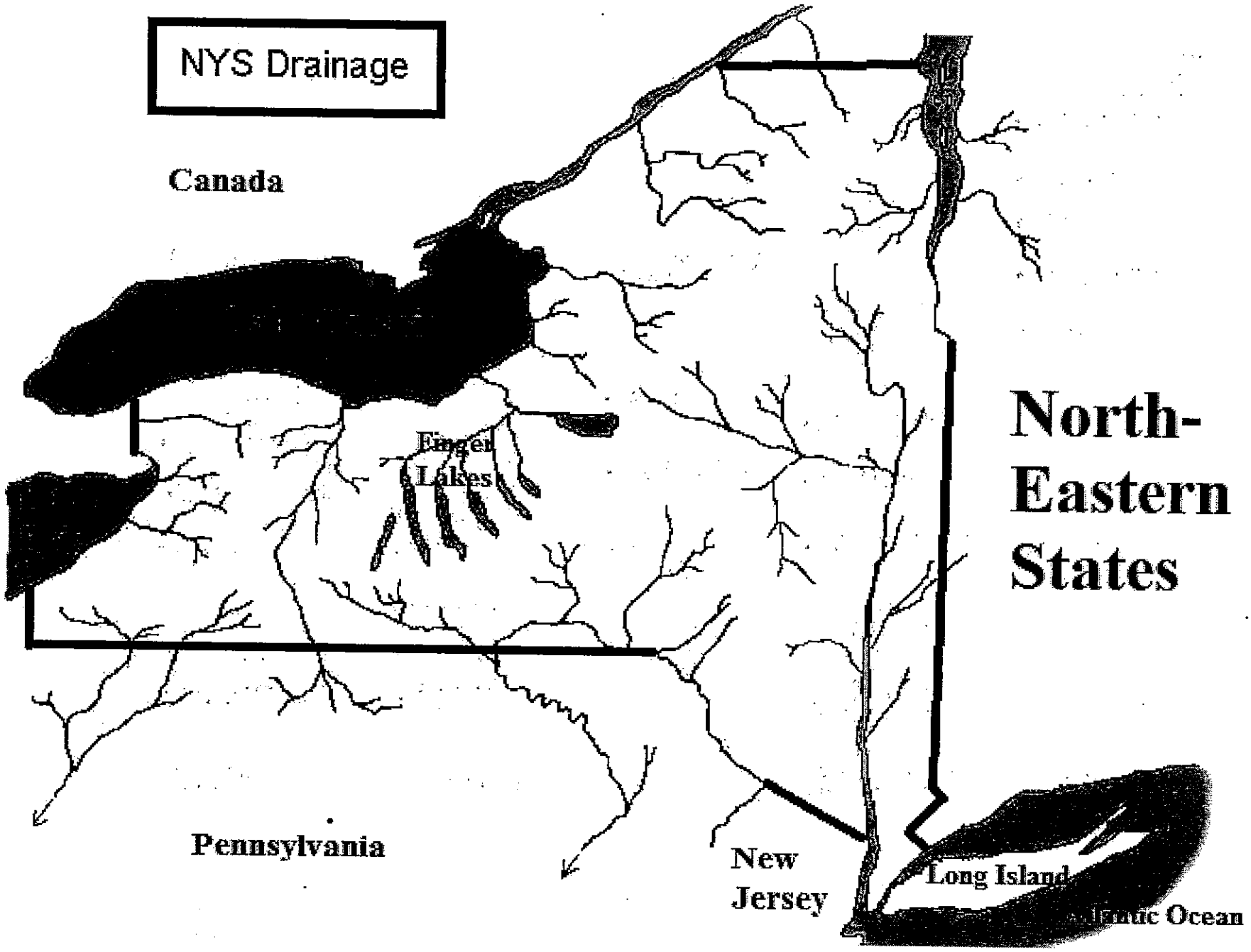
3. **Use green color** to trace all the rivers and tributaries that ultimately flow into the Great Lakes system (that is, Lake Erie, Lake Ontario, and the St. Lawrence). Using that same color, lightly shade in the area of the 2 Great Lakes

4. **Use a purple color to trace** the streams that drain into Lake Champlain. Using that same color, lightly shade in the area of Lake Champlain.

5. Finally, **use a yellow color to trace** the streams of the Delaware and Susquehanna system

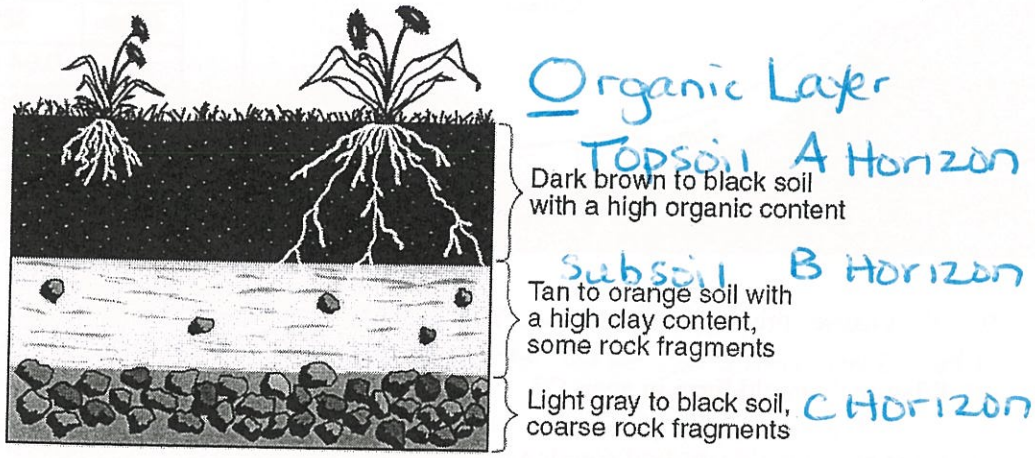
6. Use a **RED pencil** to **draw in the approximate position of the divide** of the major drainage systems in NYS. *(Hint: Trace the line between all the rivers which flow north versus the ones that flow south!)*

7. With a **black pencil** place an **X** where you think a delta would form on the map of NYS. Explain why you chose to put it where you did.


NYS Drainage
Canada
Finger Lakes
North-Eastern States
Pennsylvania
New Jersey
Long Island
Atlantic Ocean

	Water	Wind	Waves	Gravity	Glaciers
Particle Sorting	sorted	sorted	sorted	unsorted	unsorted
Sediments Appearance	- round - smooth	- round - smooth - pitted	- round - smooth	- angular - jagged	- angular - jagged
Erosional Landscape Features	• meanders • oxbow lake • V - shaped valleys	• sand blasting	• cliffs • sea caves • arches	• avalanches • landslides • mudslides	• Kettle Lakes • striations • U - shaped valleys
Depositional Features	meanders	dunes	- sand bars		• moraines • drumlins • till • erratics • outwash plains (sorted sediment)

Use the diagram below to answer questions 1-2.



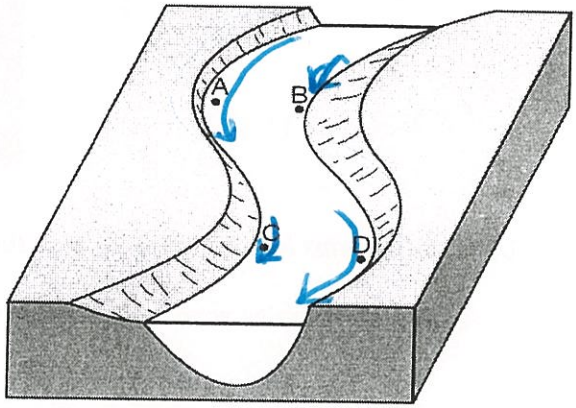
1. What climate conditions will cause the top layer to become thicker?

   Hot + Moist

2. What is the name given to the top layer of soil?

   Topsoil

Use the diagram below to answer questions 3-6.



3. Which locations is the water moving the fastest?

   A + D

4. Which locations will have the most deposition?

   B + C

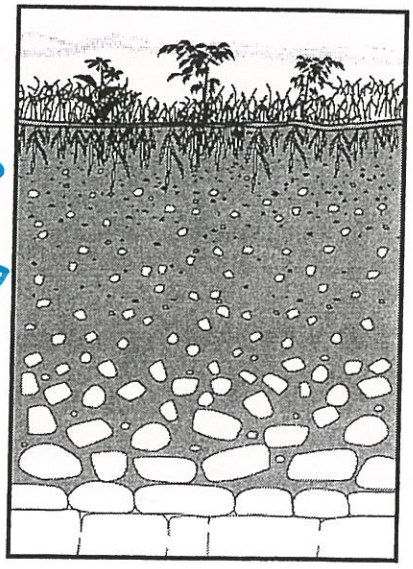
5. Label with a large arrow to show the fastest water.

6. Label with a small arrow the slowest water.

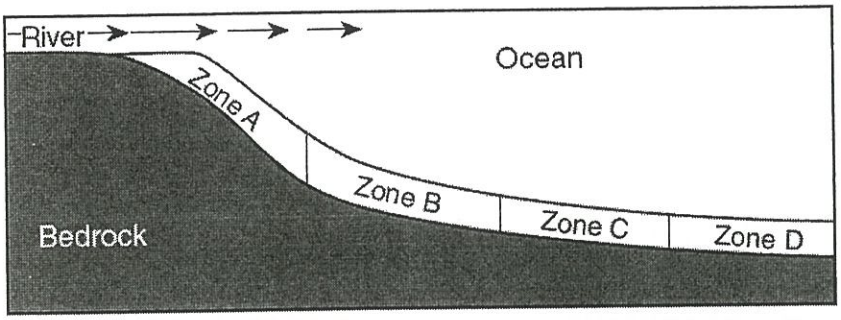
Use the diagram below to answer questions 7-8.

7. Label the area with the highest amount of organic material.

8. Label the area with the least amount of organic material.



Use the following diagram to answer questions 9-11.

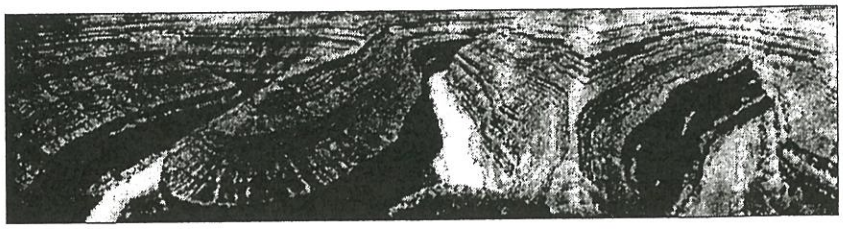


Data Table

Zone	Major Sediment Sizes
A	0.04 cm to 6 cm Pebbles
B	0.006 cm to 0.1 cm Sand
C	0.0004 cm to 0.006 cm Silt
D	Less than 0.0004 cm clay

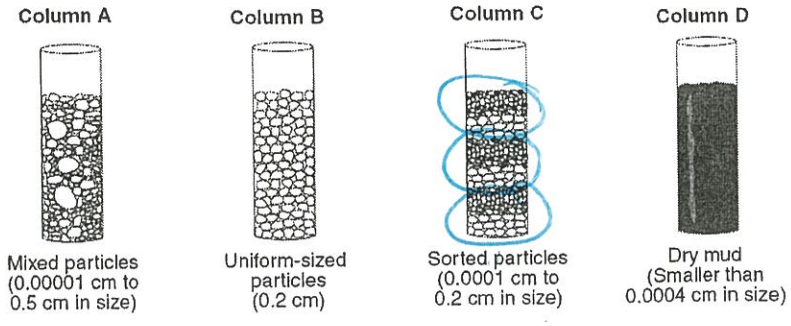
9. What causes this separation to occur? As the stream velocity decreases the amount and size of sediments it carries decreases.
10. What rock would form in zone C?
Siltstone
11. What zone would you find conglomerate rocks?
A
12. State at least two processes that formed this picture.

- Weathering
- Erosion



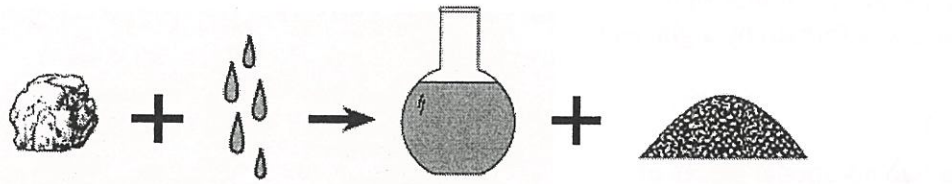
Use the diagrams below to answer questions 13-17.

13. Which samples were deposited by water?
B, d
14. Which sample was deposited by three separate river flooding events?
C
15. Which samples was deposited by a glacier?
A
16. Which sample will water travel through the slowest?



17. Which sample would create shale?
D
18. Which sample could form conglomerate rock?
A

Use the picture below to answer questions 19-21.



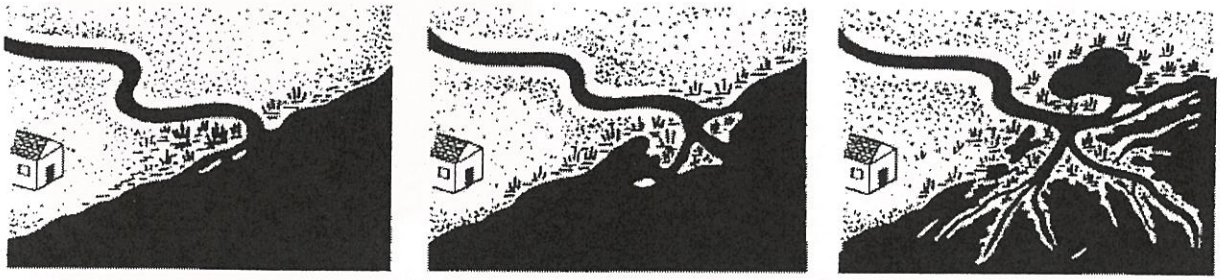
19. What process is occurring in this series of pictures? Hydration Chem weathering.

20. What sedimentary rock could be formed by the pile of clay minerals formed? shale

21. How does the surface area of the feldspar piece compare to the surface area of the pile of clay minerals? Clay minerals have greater surface area.

Use the picture below to answer questions 22-24.

The diagrams below show three stages of a river delta forming.

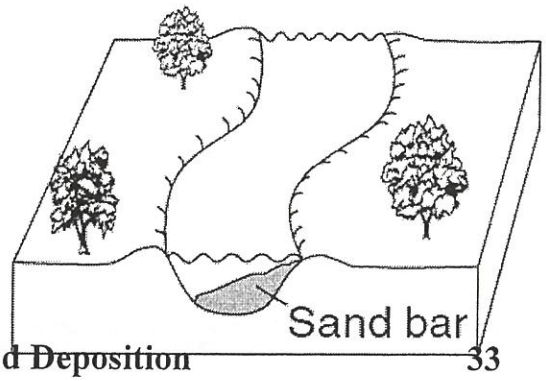


22. Which process is increasing between stage 1 and stage 3? Deposition

23. How does the size of the sediment change as you move from the shore line to the edge of the delta? It decreases.

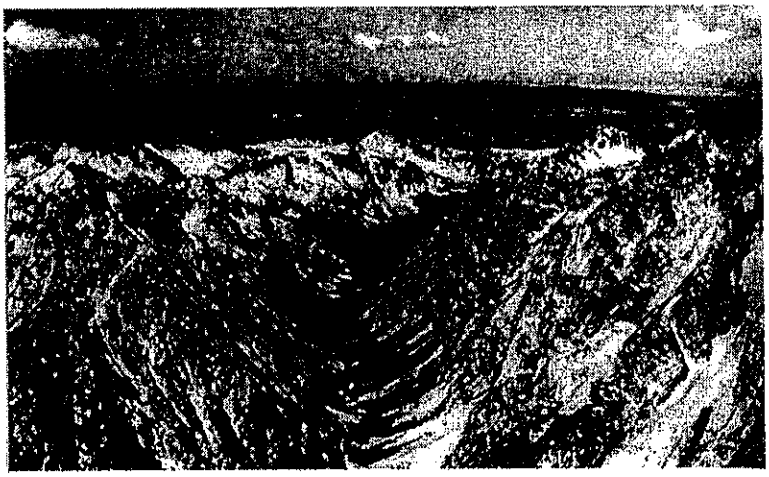
24. Why is the sand bar located in that position in the curve?

river velocity slower deposition occurs



Use the following picture to answer questions 25-27.

25. What characteristic of this valley Indicates it was formed by a glacier?



26. Describe two additional pieces of evidence that would be present in this valley to support your answer.

-
-

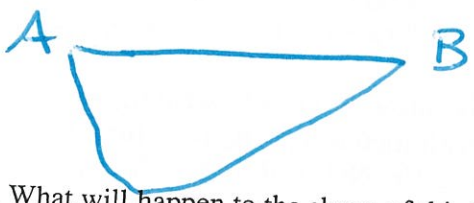
27. If this valley was in New York State, Which general direction would it run?

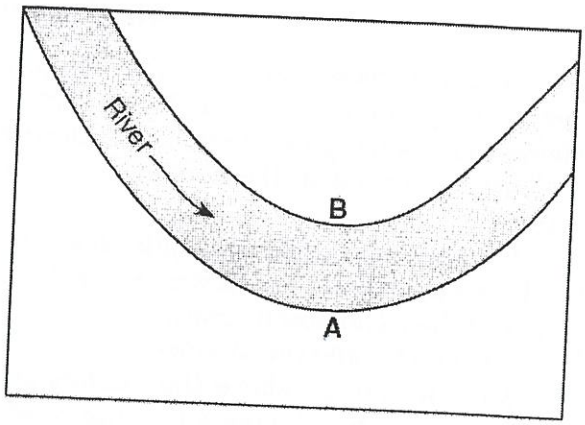
28. This structure is in the desert, what type of erosion could have formed this structure?

29. This structure is a deposit of sand, silt and clay. What type of deposition is this and where would it be found?

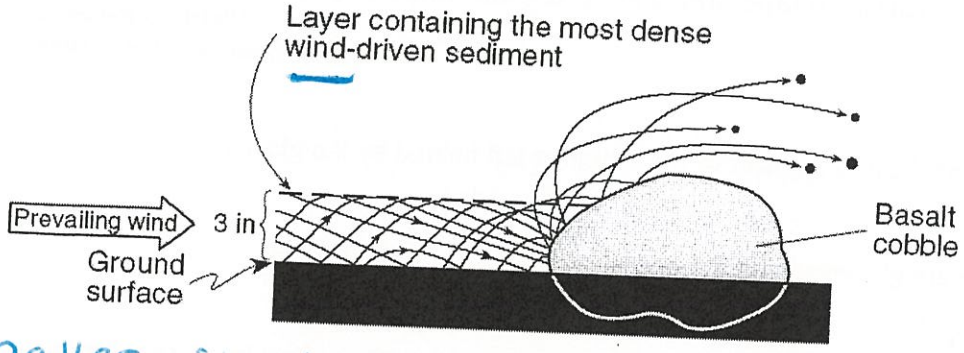
30. How does the speed of the river at location A compare to the speed at location B?

A is faster
B is slower





31. What will happen to the shape of this boulder over time under these conditions?

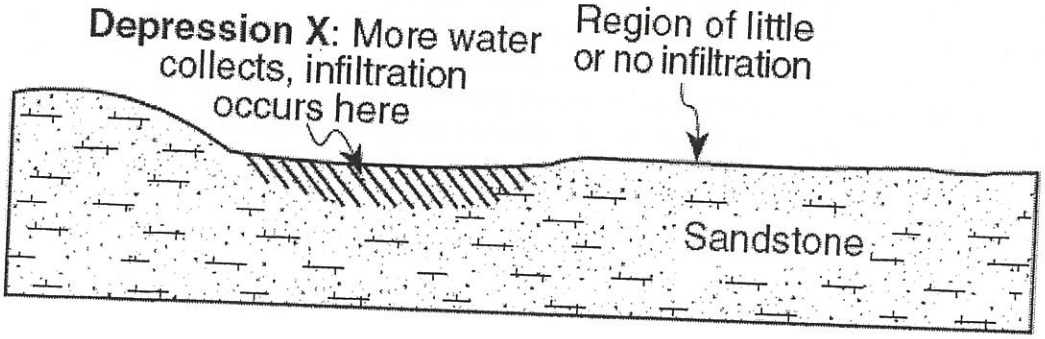


Smaller, smoother, rounder, Pitted

32. What will happen to the calcite cement holding the sandstone together if acidic rainwater infiltrates?

it will bubble (chem weath) carbonation.

Late Pleistocene, Wetter Climate



Read the following paragraph and answer questions 33 and 35.

Watching the Glaciers Go

Mountain glaciers and ice caps in tropical areas of the world are melting fast and may vanish altogether by the year 2020. That was the chilling news last year from Lonnie Thompson, a geologist at Ohio State University's Byrd Polar Research Center who has been studying icy areas near the equator in South America, Africa, and the Himalayas for two decades.

It doesn't take a glacier scientist to see the changes. In 1977, when Thompson visited the Quelccaya ice cap in Peru, it was impossible not to notice a schoolbus-size boulder stuck in its grip. When Thompson returned in 2000, the rock was still there but the ice wasn't — it had retreated far into the distance.

Most scientists believe the glaciers are melting because of global warming — the gradual temperature increase that has been observed with increasing urgency during the past decade. Last year a panel of the nation's top scientists, the National Research Council, set aside any lingering skepticism about the phenomenon, concluding definitively that average global surface temperatures are rising and will continue to do so.

"Watching the Glaciers Go,"
Popular Science, vol. #7, January 2002

33. Describe the arrangement of the sediment left behind by the glacier.

unsorted, Jagged

34. Where are glaciers usually found?

High altitudes, High latitudes

35. Some glaciers are found near the equator. What landform must be present for glaciers to occur?

mountains

Read the following paragraph and answer question 36.

Howe Caverns

Many scientists believe that the formation of the rocks in which Howe Caverns is now found began millions of years ago. At that time, an ocean covered the eastern region of New York State. Hundreds of feet of calcium carbonate ($CaCO_3$) sediments were deposited in layers along the edge of this ocean. These layers eventually formed the sedimentary rock limestone, which makes up the walls of today's Howe Caverns.

Much later, tectonic forces raised this region of New York State above sea level exposing the rock to weathering and erosion. These tectonic forces cracked the thick limestone, creating pathways for groundwater to infiltrate and gradually increase the size of the cracks. Eventually some of the larger cracks provided pathways for the underground stream, which carved the winding passages of Howe Caverns seen today.

36. Name one test you could use to determine if the walls of the cavern are limestone.

Putting acid on it.