

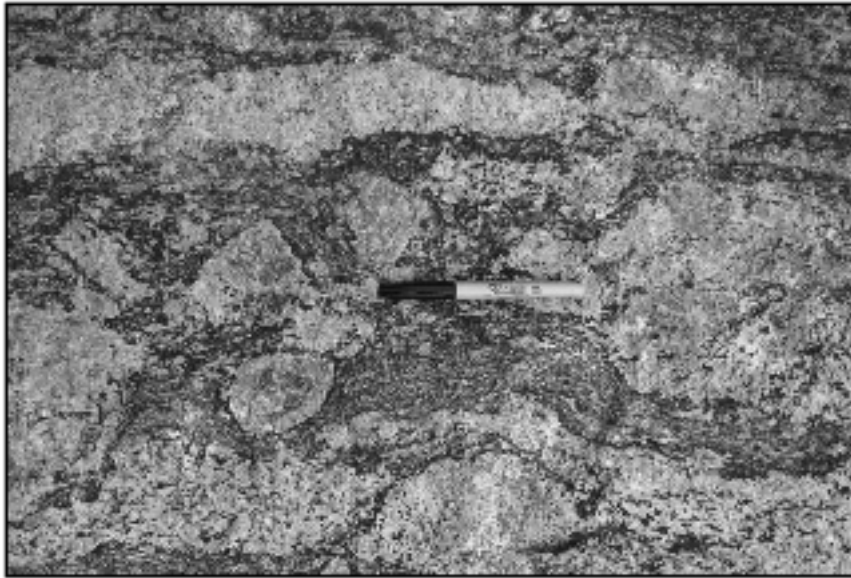
Rock Cycle In Earth Crust

- 1 The bedrock of the Adirondack Mountains was formed mainly by the
- (1) cementation of clastic sediments and precipitates from seawater
 - (2) compaction and recrystallization of volcanic material
 - (3) regional metamorphism of sedimentary and igneous rocks
 - (4) contact metamorphism of unconsolidated gravels

Base your answers to questions 2 on the passage and photograph below and on your knowledge of Earth science. The photograph shows anorthositic gneiss bedrock from Whiteface Mountain in New York State.

Whiteface Mountain

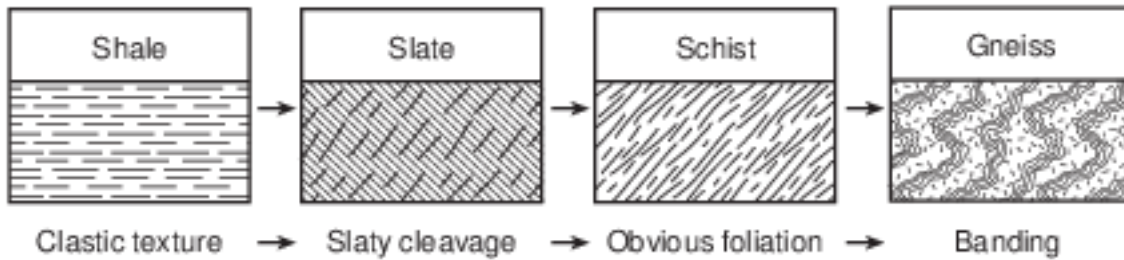
Whiteface Mountain, located in the Mount Marcy region, is one of New York State's highest mountain peaks. Most of the surface bedrock on Whiteface is anorthositic gneiss made up of large, light-colored plagioclase feldspar crystals and dark mineral bands composed of amphibole, pyroxene, and garnet. The foliated crystal alignment in the gneiss was produced during a major tectonic event called the Grenville orogeny. Landslides have exposed steep slopes of this white and gray bedrock on the sides of Whiteface Mountain.



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- 2 The texture of the gneiss indicates that the bedrock
- | | |
|-------------------------------------|--|
| (1) underwent contact metamorphism | (3) was bioclastic in origin |
| (2) underwent regional metamorphism | (4) was composed of compacted sediment |

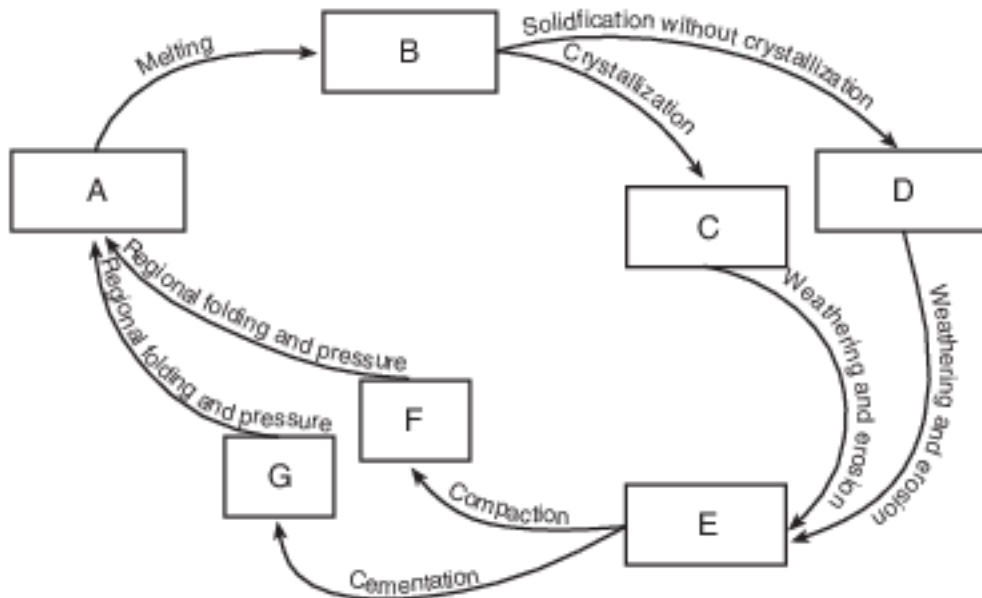
3 The diagram below indicates physical changes that accompany the conversion of shale to gneiss.



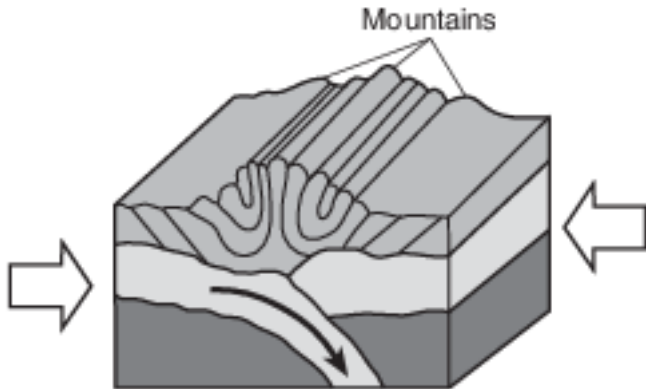
Which geologic process is occurring to cause this conversion?

- (1) sedimentary layering
- (2) intrusion of magma
- (3) metamorphism
- (4) weathering

Base your answers to questions 4 on the flowchart below and on your knowledge of Earth science. The boxes labeled A through G represent rocks and rock materials. Arrows represent the processes of the rock cycle.



4 The arrows in the block diagram below represent forces forming mountains in a region of Earth's lithosphere.



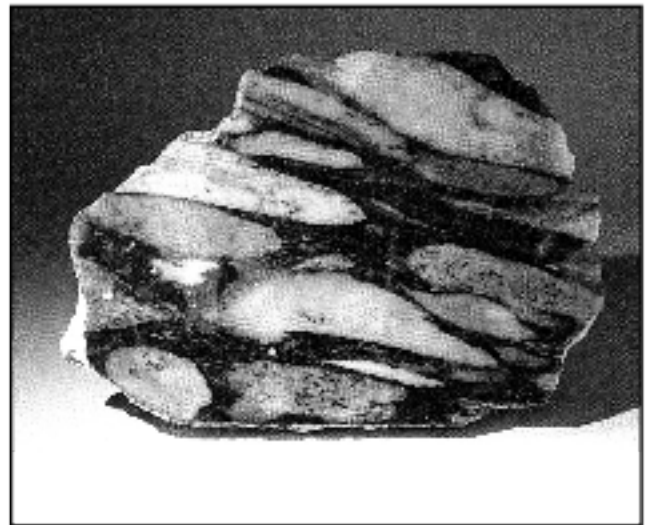
Metamorphic rocks that formed from these forces are represented by which lettered box in the flowchart?

- (1) A
- (2) B
- (3) E
- (4) F

5 The photographs below show samples of two different rocks, labeled A and B. The arrow represents the process by which a rock like rock A can change into a rock like rock B.



Rock A



Rock B

Which process does the arrow represent?

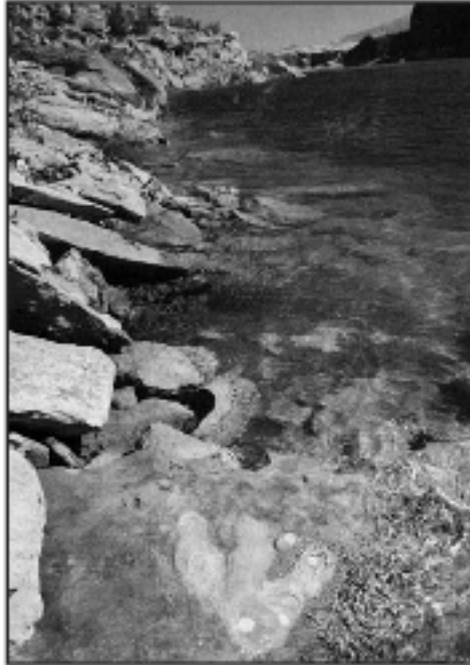
- (1) metamorphism
- (2) erosion
- (3) melting
- (4) cementation

Base your answers to questions 6 on the passage and photograph below.

Dinosaur Tracks Revealed After Years of Dry Weather

By April 2005, the surface of Lake Powell, a human-made lake in Utah and Arizona, had fallen 145 feet below its highest level. This revealed many traces of ancient life that had not been observed since this area had been covered with water. Among these traces, discovered in sandstone bedrock, were many dinosaur tracks, ranging in age between 170 and 200 million years old.

**Dinosaur Track on Shoreline
of Lake Powell**



Source: Andre Delgalvis, *Arizona Highways*,
February 2006

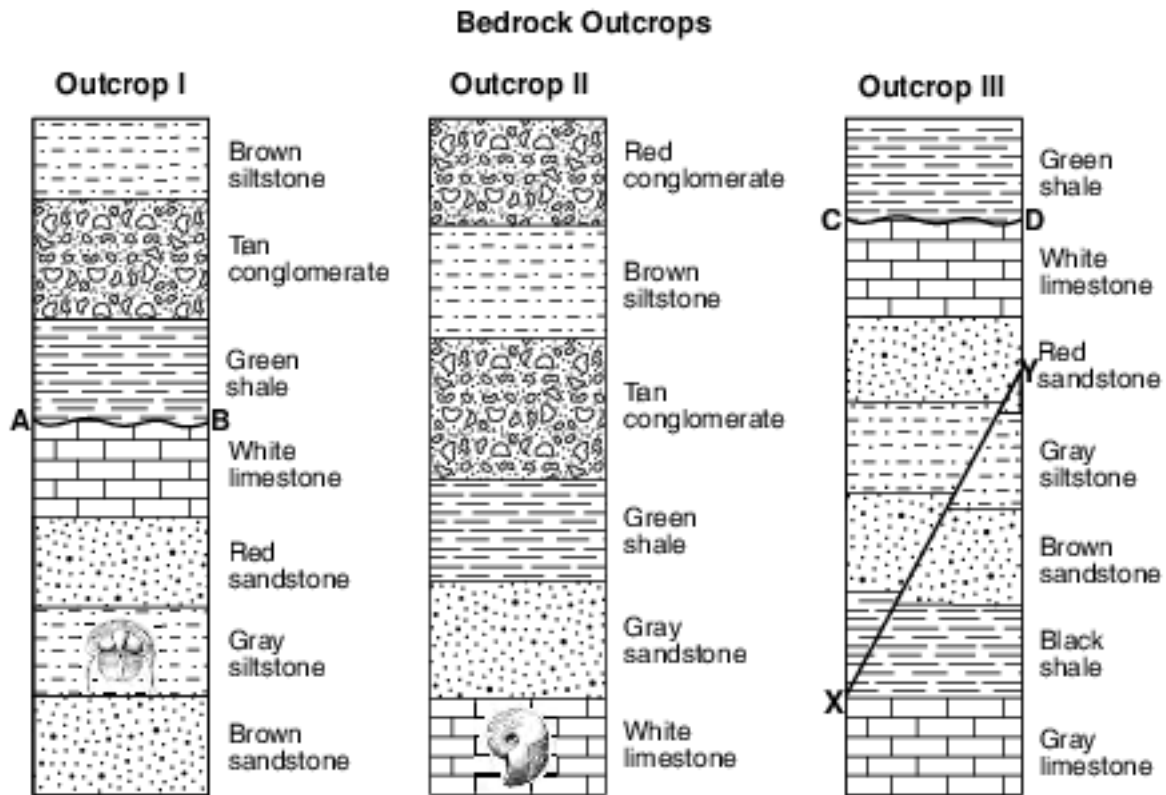
6 The events listed below led to the formation and exposure of these dinosaur tracks.

- A. Rock layers above the dinosaur tracks are eroded.
- B. Tracks are made in loose sand by dinosaurs.
- C. Sediments are compressed and cemented.
- D. Sedimentation buries tracks.
- E. The water level of Lake Powell drops.

What is the correct sequence of the events listed above that led to the formation and exposure of the dinosaur tracks in the surface bedrock along the shoreline of Lake Powell?

- (1) B → C → A → E → D
- (2) B → D → C → A → E
- (3) E → D → A → B → C
- (4) E → C → B → D → A

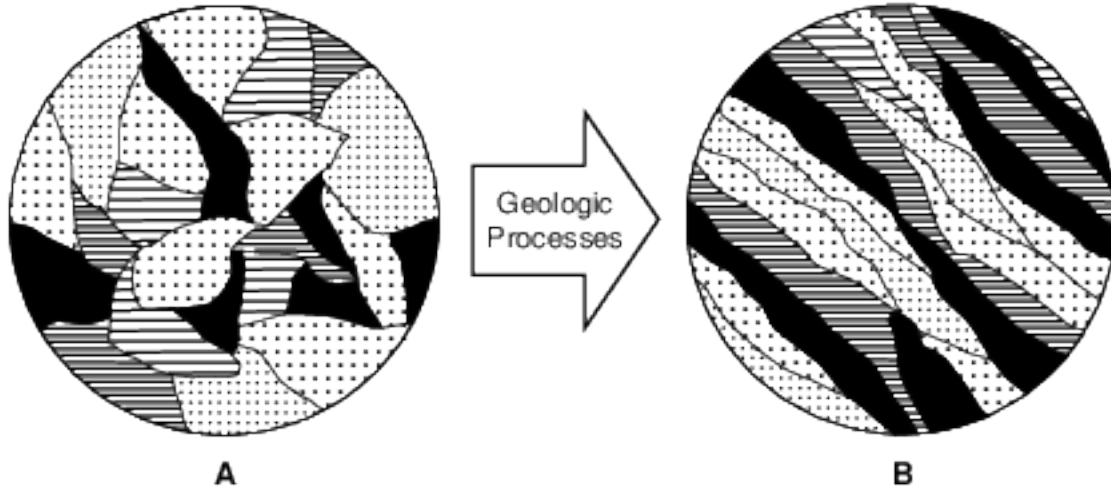
Base your answers to questions 7 on the three bedrock outcrops below and on your knowledge of Earth science. The outcrops, labeled I, II, and III, are located within 15 kilometers of each other. Lines AB and CD represent unconformities. Line XY represents a fault. No overturning of the layers has occurred.



7 Which processes produced the brown siltstone layer in outcrops I and II?

- (1) cooling and solidification of mafic lava at Earth's surface
- (2) cooling and solidification of felsic magma deep within Earth
- (3) compaction and cementation of rock fragments ranging in size from 0.006 to 0.2 centimeter in diameter
- (4) compaction and cementation of rock fragments ranging in size from 0.0004 to 0.006 centimeter in diameter

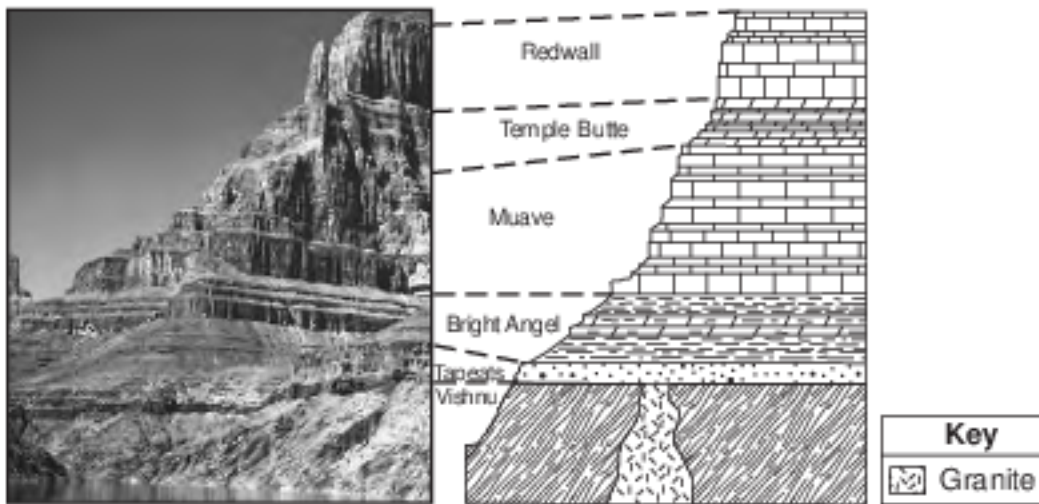
8 Diagrams A and B represent magnified views of the arrangement of mineral crystals in a rock before and after being subjected to geologic processes.



Which geologic processes are most likely responsible for the banding and alignment of mineral crystals represented in diagram B?

- (1) melting and solidification
- (2) heating and increasing pressure
- (3) compaction and cementation
- (4) weathering and erosion

Base your answers to questions 9 on the photograph and cross section below and on your knowledge of Earth science. The sequence of rock types found in the walls of the Grand Canyon are shown. The names of rock formations are shown and the upper and lower boundaries of each formation are indicated by dashed lines. The rock layers have not been overturned.



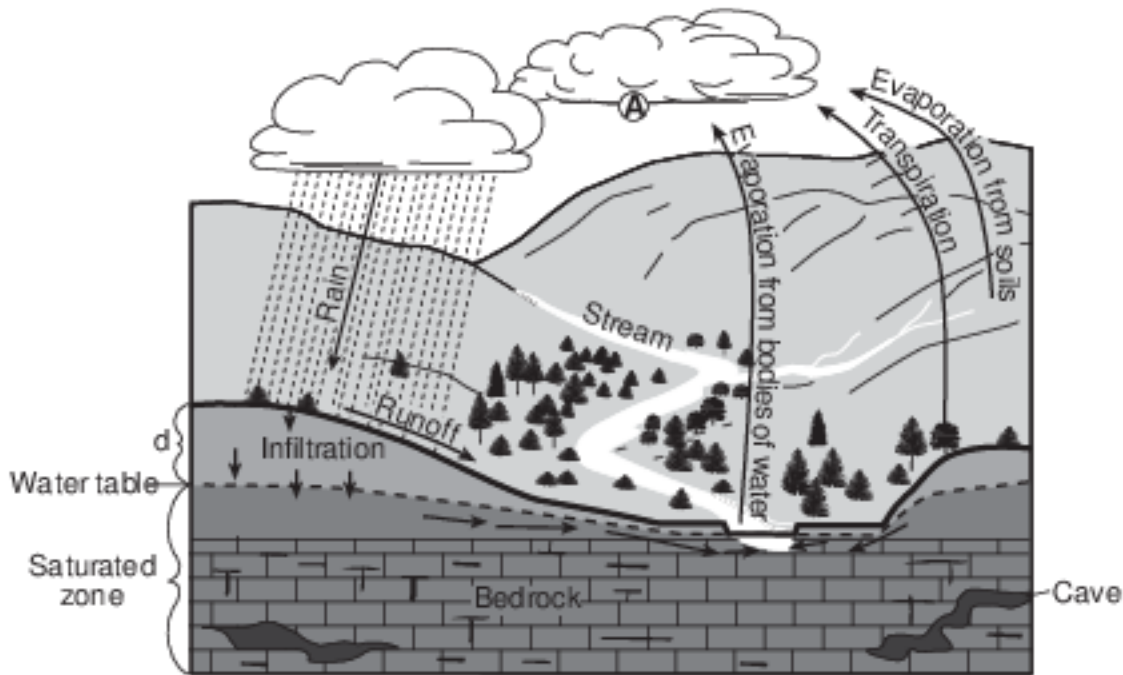
9 The granite formation was primarily formed by

- (1) metamorphism of layered sandstone
- (2) solidification of felsic magma
- (3) compaction of precipitated gypsum
- (4) cementation of clastic sediments

10 Which rock was subjected to intense heat and pressure but did not solidify from magma?

- | | |
|---------------|--------------|
| (1) sandstone | (3) gabbro |
| (2) schist | (4) rhyolite |

Base your answers to questions 11 on the diagram below and on your knowledge of Earth science. The diagram represents a portion of a stream and its surrounding bedrock. The arrows represent the movement of water molecules by the processes of the water cycle. The water table is indicated by a dashed line. Letter A represents a water cycle process occurring at a specific location. Letter d represents the distance between the water table and the land surface.

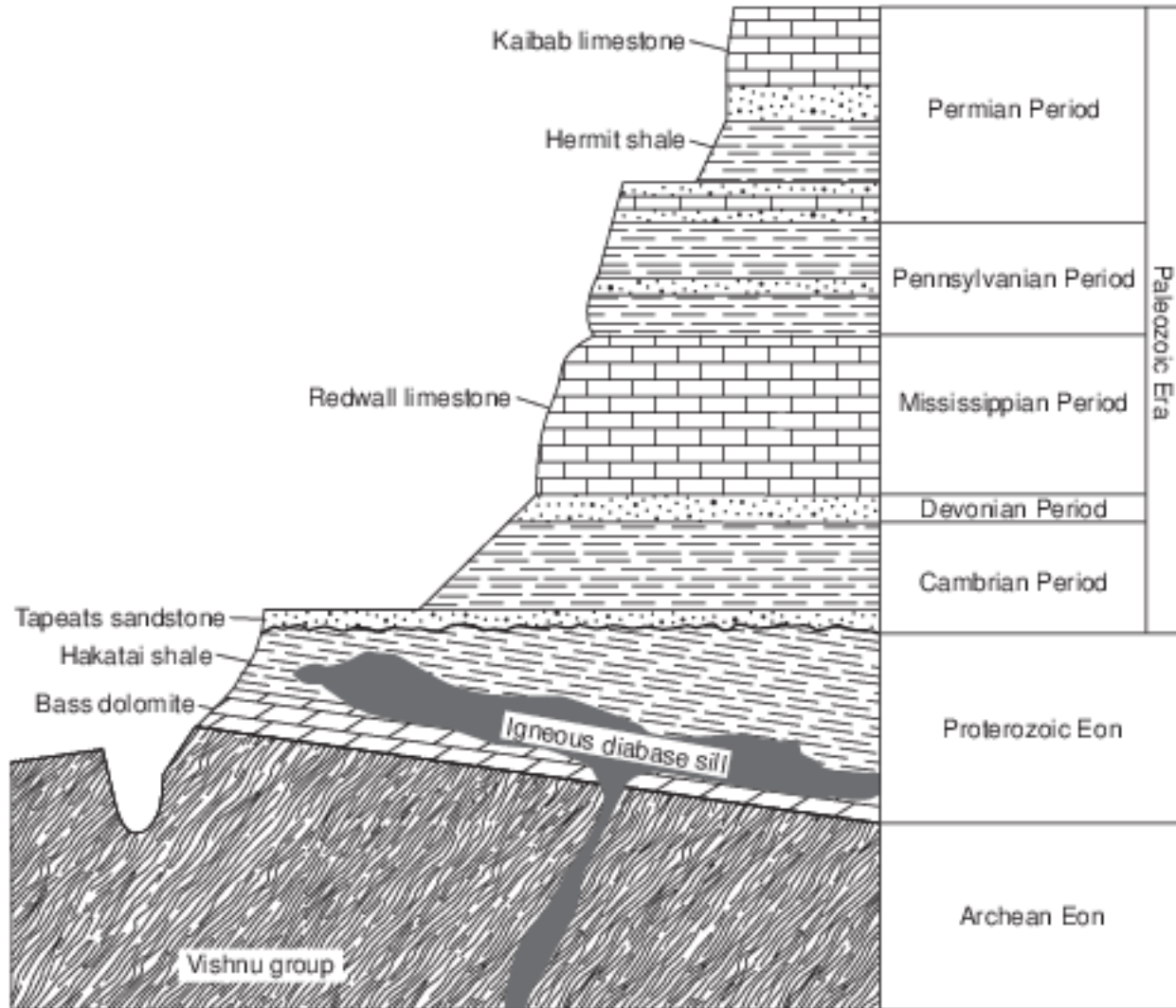


11 Slightly acidic groundwater has been seeping through cracks and openings in the limestone bedrock of this area, producing caves. State whether the type of weathering that produces these caves is mainly chemical or physical, and identify one characteristic of limestone that allows this type of weathering to occur. [1]

Type of weathering:

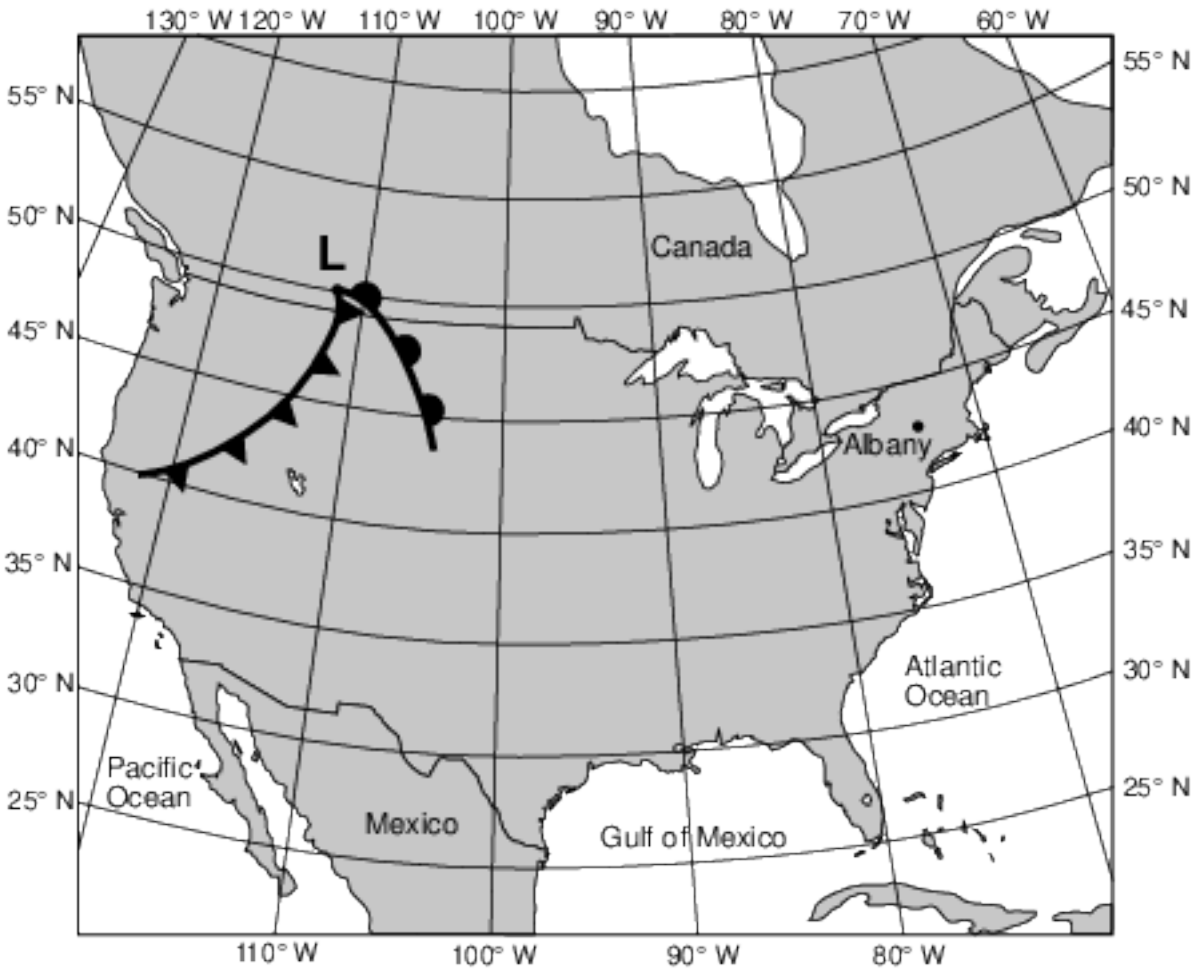
Characteristic of limestone:

Base your answers to questions 12 on the generalized cross section of the Grand Canyon represented below and on your knowledge of Earth science. Some rock layers have been labeled. The rock layers have not been overturned.



12 The Vishnu group is composed mostly of schist. Explain how this rock formed. [1]

Base your answers to questions 13 on the weather map below and on your knowledge of Earth science. The map shows the center of a low-pressure system (L). The location for Albany, New York, is shown.



13 Identify one process that causes clouds to form in the moist air rising along the frontal boundaries of the low-pressure system. [1]

Base your answers to questions 14 on the passage below and on your knowledge of Earth science. The passage describes unusual lava from a volcano in Africa.

Unusual Volcano

Nyiragongo, located at 2° S 29° E, is an active African volcano. It has the most fluid lava on Earth. The lava has a composition unlike any other lava in the world. The rare isotopes found in the lava are similar to those found in ancient asteroids. This fact leads scientists to infer that the lava may be as old as our solar system and that it comes from deep inside the mantle near Earth's outer core. Nyiragongo is one volcano in a ring of many volcanoes surrounding an area that is domed upward nearly a mile above sea level, causing scientists to infer that a new mantle hot spot is forming there.

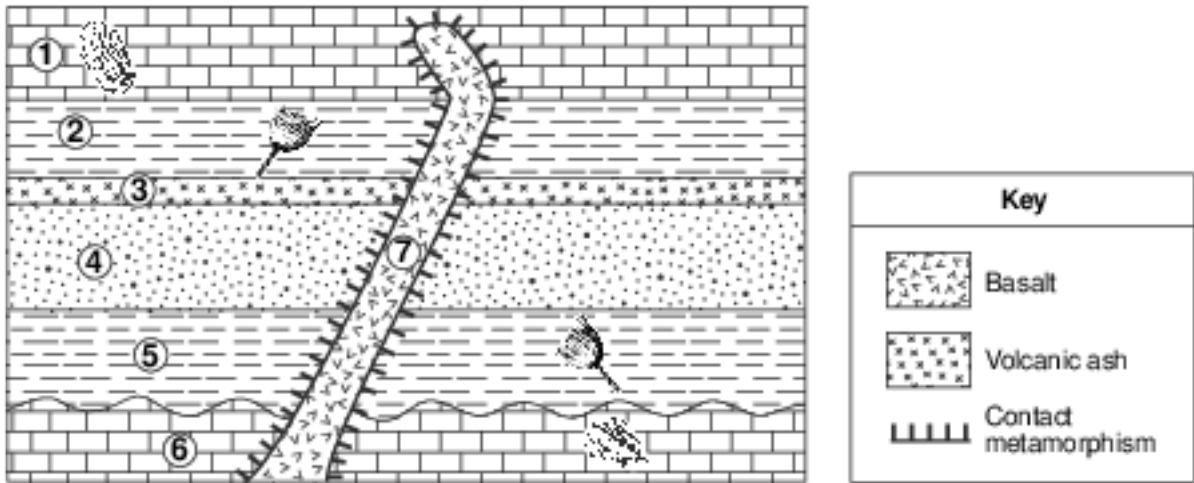
14 Two rocks, scoria and basalt, have formed from the cooled lava that erupted from Nyiragongo.

Describe the texture of each rock. [1]

Scoria: _____

Basalt: _____

Base your answers to questions 15 on the geologic cross section below, which shows rock units 1 through 7 that have not been overturned. Some of the rock units contain New York State index fossils. An unconformity exists between rock units 5 and 6.



15 Identify two processes that produced the basalt. [1]
and _____

Answer Keys

1 3

2 2

3 3

4 1

5 1

6 2

7 4

8 2

9 2

10 2

11 Allow 1 credit for chemical weathering and an acceptable characteristic of limestone. Acceptable characteristics include, but are not limited to:

- — Acid dissolves limestone.
- — The calcite in the limestone chemically reacts with acid.
- — Limestone is composed of calcite.

12 Allow 1 credit. Acceptable responses include, but are not limited to:

- — Heat and pressure metamorphosed early rocks.
- — Regional metamorphism distorted these rocks.
- — heat and pressure
- — metamorphism
- Note: Do not allow credit for “contact metamorphism” because schist forms from regional metamorphism.

13 Allow 1 credit. Acceptable responses include, but are not limited to:

- — condensation
- — cooling
- — expansion
- — deposition/phase change directly from water vapor to ice

14 Allow 1 credit for an acceptable response for both rocks. Acceptable responses include, but are not limited to:

- Scoria:
 - — noncrystalline
 - — glassy
 - — vesicular
- Basalt:
 - — fine
 - — nonvesicular

15 Allow 1 credit for two correct responses. Acceptable responses include, but are not limited to:

- — cooling
- — solidification
- — crystallization
- — melting
- — intrusion/intruding