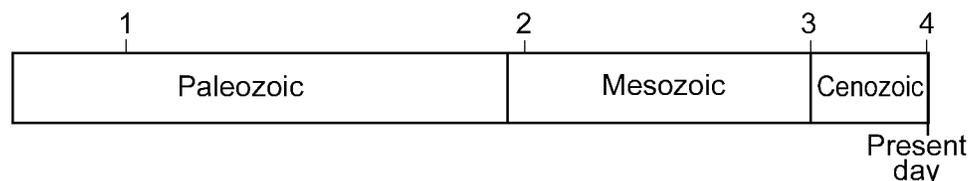


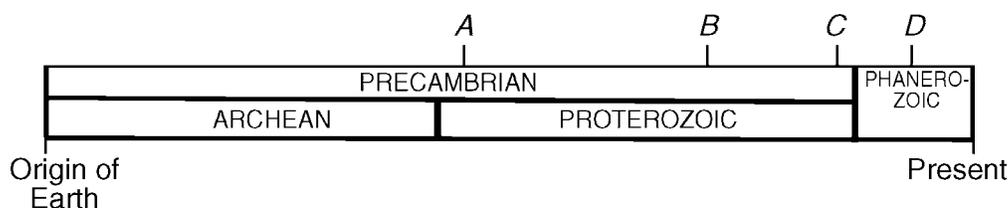
Name: _____

- 1) The geologic time line below represents the three most recent geologic eras. The numbers represent events in Earth's history.



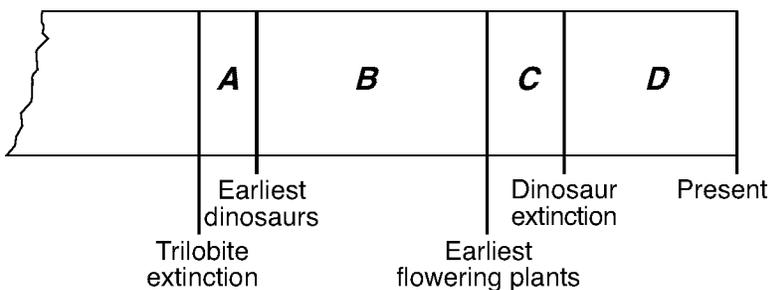
Which number *best* represents when humans are inferred to have first appeared on Earth?

- A) 1 B) 2 C) 3 D) 4
- 2) A timeline from the origin of Earth until the present is shown below.



At which letter on the timeline did the Ediacaran fauna exist?

- A) *A* B) *B* C) *C* D) *D*
- 3) The diagram below is a portion of a geologic timeline. Letters *A* through *D* represent the time intervals between the labeled events, as estimated by scientists.

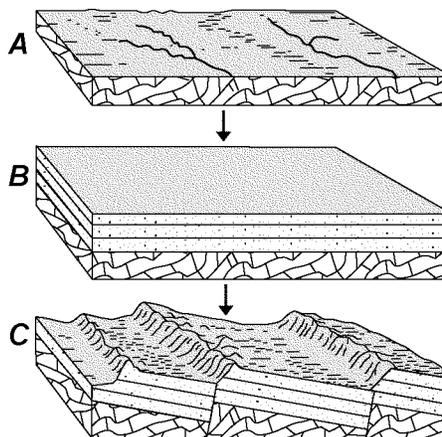


(not drawn to scale)

Fossil evidence indicates that the *earliest* birds developed during which time interval?

- A) *A* B) *B* C) *C* D) *D*
- 4) Which group of organisms has the *shortest* record of life on Earth?
- A) eurypterids C) graptolites
B) birds D) placoderm fish
- 5) Evidence indicates that 251 million years ago a mass extinction of many life-forms occurred on Earth. Which form of life became extinct at this time?
- A) trilobites C) mammoths
B) dinosaurs D) eurypterids

- 6) The sequence of block diagrams below shows stages of development of a landscape. The stages are labeled *A*, *B*, and *C*.

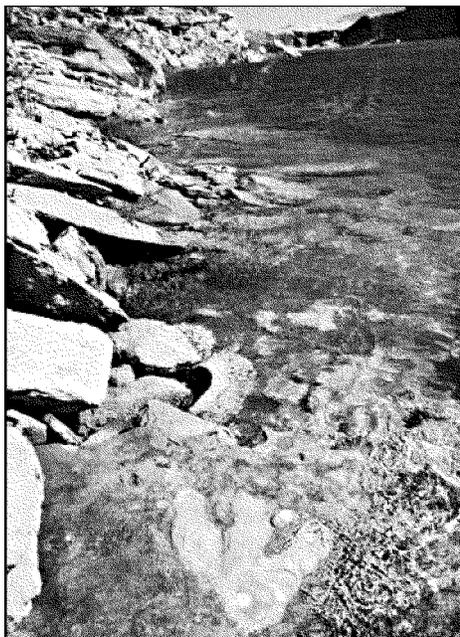


Which sequence of geologic processes *best* describes the events that created each stage shown?

- A) uplift and erosion , subsidence and erosion , folding
 B) erosion , subsidence and deposition , uplift and faulting
 C) metamorphism , erosion and deposition , volcanic eruptions
 D) uplift and deposition , flooding , folding and erosion
- 7) Which scientific principle states that younger rock layers are generally deposited on top of older rock layers?
- A) evolution
 B) inclusion
 C) original horizontality
 D) superposition
- 8) Thin layers of volcanic ash act as excellent time markers in the correlation of bedrock because volcanic ash
- A) is easily eroded and lasts only a short time on Earth's surface
 B) is deposited over millions of years
 C) falls to Earth over a large area in a short period of time
 D) stays in the atmosphere for millions of years

- 9) **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

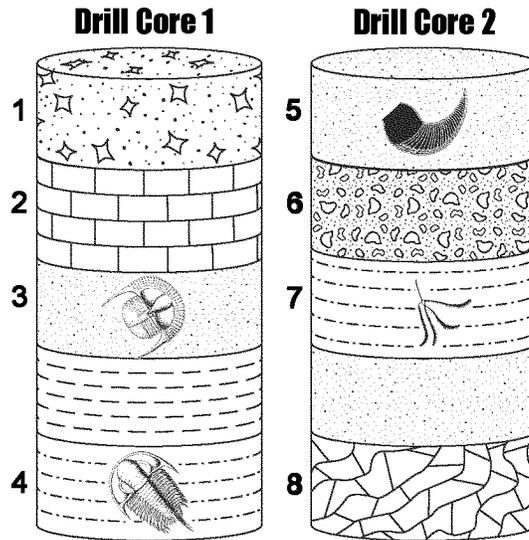
The events listed below led to the formation and exposure of the dinosaur tracks shown.

- 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?

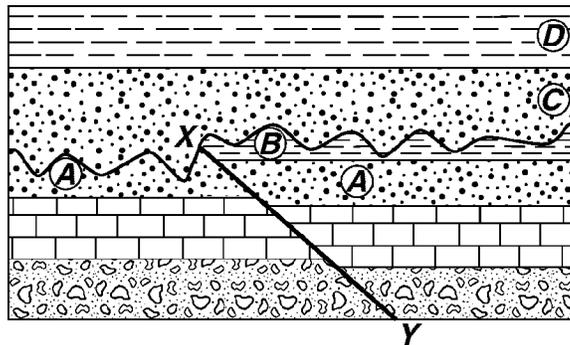
- A) B, C, A, E, D
- B) B, D, C, A, E
- C) E, C, B, D, A
- D) E, D, A, B, C

- 10) The drill-core samples below were taken from two locations 1,000 kilometers apart. Rock layers 1 through 8 have been labeled. Some index fossils are shown in the layers.



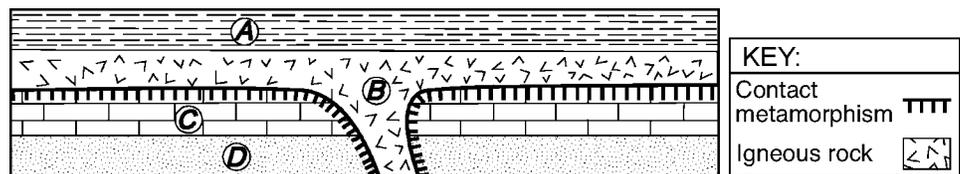
Which numbered layers most likely formed at the same time?

- A) 4 and 7 B) 2 and 8 C) 3 and 5 D) 1 and 6
- 11) The geologic cross section below shows bedrock layers A through D. Line XY is a fault.



The fault most likely occurred after

- A) layer B formed, but before layer C formed
 B) layer C formed, but before layer D formed
 C) layer A formed, but before layer B formed
 D) all bedrock layers were formed
- 12) The cross section below shows four rock units, A, B, C, and D.

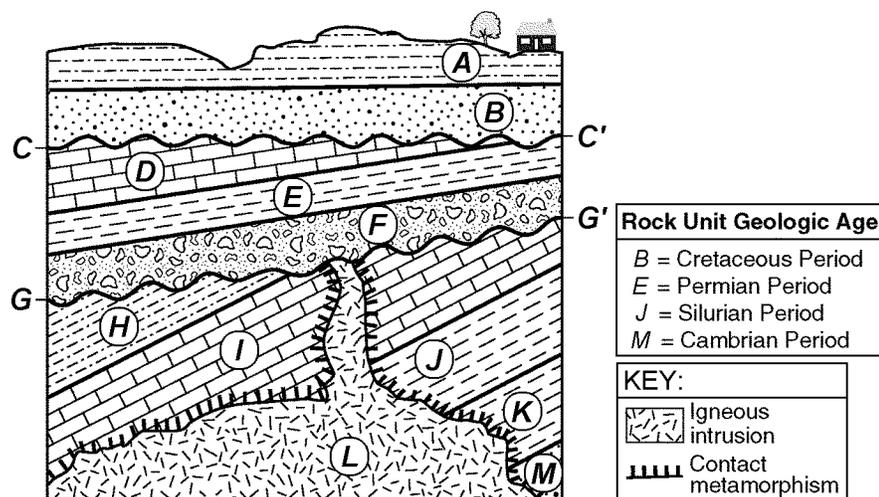


Which rock unit is *youngest* in age?

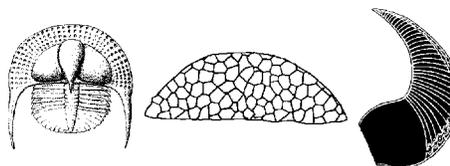
- A) A B) B C) C D) D

Questions 17 through 20 refer to the following:

The cross section below represents rock units that have not been overturned. Lines *CC1* and *GG2* represent unconformities. The geologic ages of some of the lettered rock units are shown to the right of the cross section.



- 17) Based on the given cross section, which rock unit was formed most recently?
 A) *L* B) *M* C) *A* D) *F*
- 18) Why is there *no* contact metamorphism indicated between rock unit *L* and rock unit *F* in the given cross section?
 A) The intrusion was not hot enough to metamorphose rock unit *F*.
 B) Conglomerate does not metamorphose.
 C) The contact metamorphism within rock unit *F* eroded away.
 D) Rock unit *F* was deposited after the intrusion of rock unit *L*.
- 19) Which inference about rock units *D*, *E*, and *H* can *best* be supported by evidence in the cross section?
 A) They contain mostly sand-sized sediment.
 B) They were deposited as horizontal layers and were later tilted.
 C) They contain both land and marine fossils.
 D) They were altered by contact metamorphism.
- 20) The diagrams below represent three index fossils found in one of the rock units in the cross section shown.



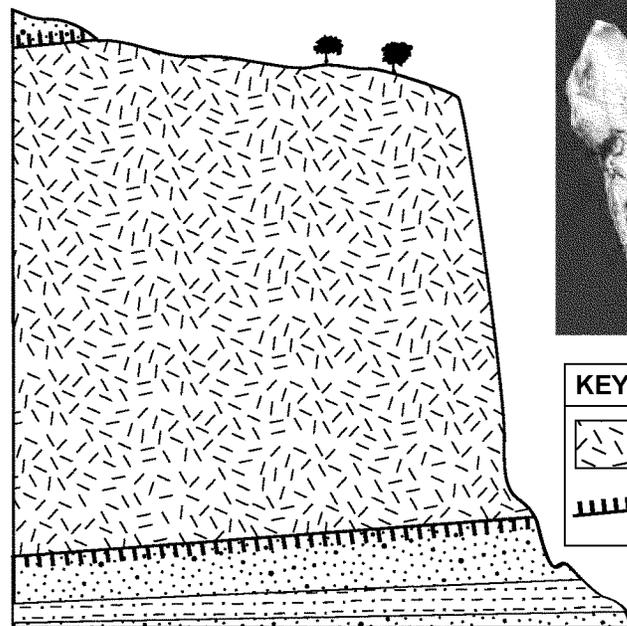
These fossils are most likely found in which rock unit?

- A) *M* B) *J* C) *K* D) *I*

Questions 21 through 23 refer to the following:

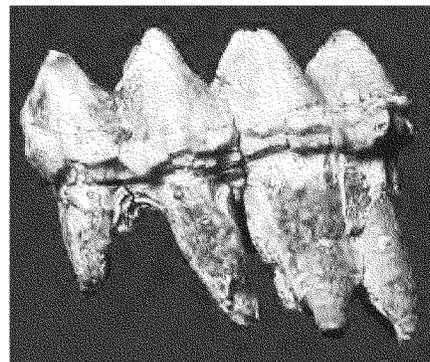
The cross section below represents the Palisades sill in southern New York State and the surrounding bedrock. Potassium-40 analysis determined the sill to be approximately 200,000,000 years old. The photograph shows a mastodont tooth found in glacial sediments nearby. Carbon-14 analysis determined this tooth to be approximately 11,400 years old.

Geologic Cross Section



(not drawn to scale)

Mastodont Tooth

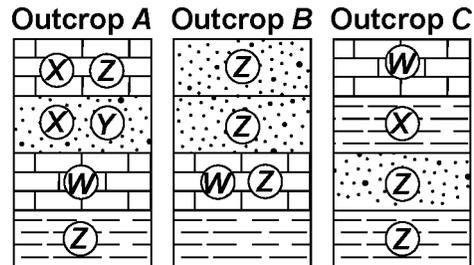


KEY:



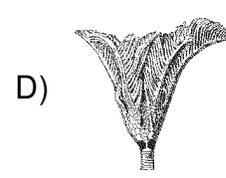
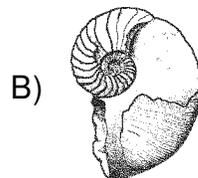
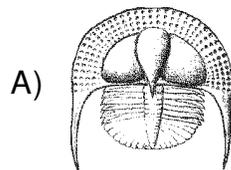
- 21) Which metamorphic rock was most likely produced in the contact zone between the Palisades sill and the sedimentary rock?
- A) schist
B) gneiss
C) slate
D) quartzite
- 22) Potassium-40 is useful for radioactive dating of the Palisades sill because the half-life of potassium-40
- A) was shortened by the high temperature of the magma that formed the sill
B) remained constant during the radioactive decay process
C) decreased as the amounts of ^{40}Ar and ^{40}Ca in the sill increased
D) increased as pressure from the overlying sedimentary rock increased
- 23) The mastodont tooth and the entire Palisades sill represented by the given diagrams are similar in that both
- A) can be used as time markers to date nearby geologic events
B) are fossils of animals that once lived in New York State
C) are Mesozoic in age
D) can be found in deposits left by the last continental ice sheet in New York State

- 24) Organisms that later became good index fossils lived over a
- limited geographic area and existed for a long geologic time
 - limited geographic area and existed for a short geologic time
 - wide geographic area and existed for a long geologic time
 - wide geographic area and existed for a short geologic time
- 25) The cross sections below represent three widely separated bedrock outcrops labeled A, B, and C. Letters W, X, Y, and Z represent fossils found in the rock layers.



Which fossil could best be used as an index fossil?

- Z
 - X
 - W
 - Y
- 26) What evidence suggests that a mass extinction of the dinosaurs occurred at the end of the Cretaceous Period?
- evolution of dinosaurs during the Late Cretaceous Epoch
 - an absence of dinosaur fossils in Paleocene bedrock
 - an abundance of dinosaur fossils in Early Cretaceous bedrock
 - drawings of dinosaurs made by humans in caves during the Paleocene Epoch
- 27) Which index fossil has been found in Ordovician-age bedrock?

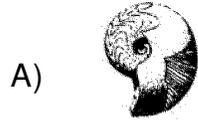


- 28) The index fossil shown below has been found in New York State sedimentary bedrock.



Phacops

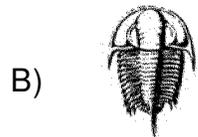
Which other index fossil could also be found in New York State bedrock of the same age?



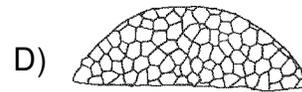
Manticoceras



Eospirifer

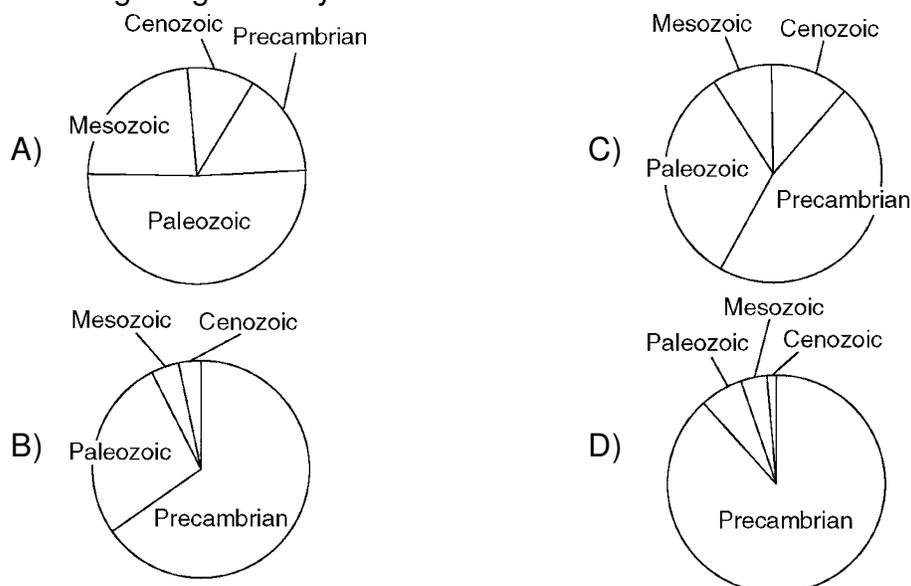


Elliptocephala



Lichenaria

- 37) Which pie graph *best* shows the relative length of time of the major intervals of Earth's geologic history?



- 38) Most scientists believe Earth's Early Archean atmosphere was formed primarily by gases released from
- A) chemical weathering C) volcanic eruptions
B) plant transpiration D) stream erosion
- 39) Approximately 2.2 billion years ago, which gas was first added in large amounts to Earth's atmosphere from life-forms that evolved in the oceans?
- A) nitrogen C) carbon dioxide
B) water vapor D) oxygen
- 40) What is inferred to be the *main* source of the free oxygen that first entered Earth's atmosphere?
- A) melting of glacial ice into hydrogen and oxygen
B) oxygen-producing organisms
C) radioactive decay of rocks containing oxygen
D) meteorite impacts releasing oxygen
- 41) Which geologic event is inferred to have occurred most recently?
- A) formation of the Queenston delta
B) metamorphism of the bedrock of the Hudson Highlands
C) initial opening of the Atlantic Ocean
D) collision between North America and Africa
- 42) During which period in geologic history did the uplifting of the Adirondack Mountains begin?
- A) Cambrian C) Triassic
B) Cretaceous D) Quaternary

- 43) Which geologic event occurred in New York State at the end of the Triassic Period?
- A) formation of the Catskill delta
 - B) intrusion of the Palisades sill
 - C) retreat of the last continental ice
 - D) domelike uplift of the Adirondack region
- 44) Which plate tectonic events occurred as the Iapetus Ocean closed?
- A) Alleghenian orogeny and Grenville orogeny
 - B) Taconian orogeny and Grenville orogeny
 - C) Taconian orogeny and Acadian orogeny
 - D) Alleghenian orogeny and Acadian orogeny
- 45) A 65.5-million-year-old impact crater in Mexico provides evidence for the cause of the
- A) Alleghenian orogeny
 - B) evolution of the earliest corals
 - C) breakup of Pangaea
 - D) extinction of ammonoids
- 46) Which geologic event occurred in New York State at about the same time as the extinction of dinosaurs and ammonoids?
- A) formation of the Queenston Delta
 - B) initial opening of the Atlantic Ocean
 - C) advance and retreat of the last continental ice sheet
 - D) deposition of the sands and clays underlying Long Island
- 47) When did the *earliest* humans appear on Earth?
- A) during the Pleistocene Epoch
 - B) before the earliest dinosaurs
 - C) during the Late Triassic Epoch
 - D) before the earliest flowering plants
- 48) What percentage of Earth's history represents human existence?
- A) 1.8%
 - B) 23.5%
 - C) more than 98.6%
 - D) less than 1.0%

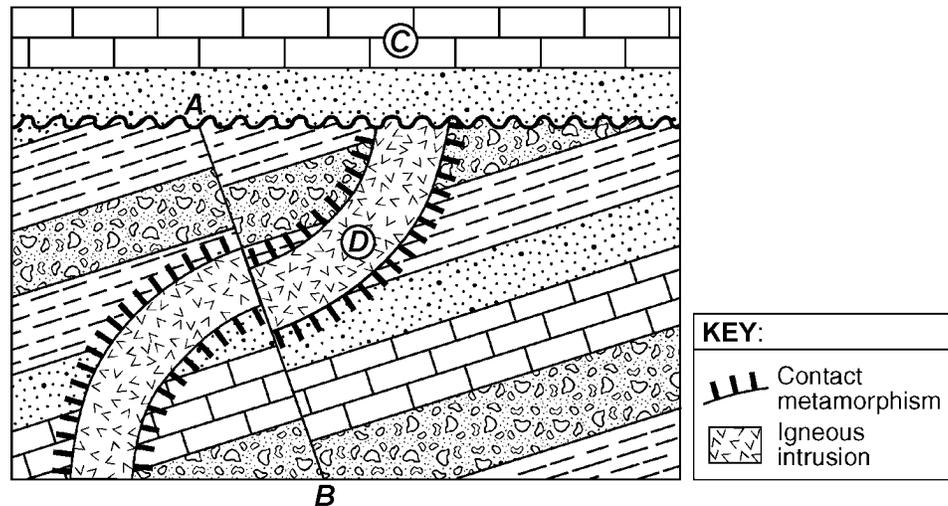
Questions 49 and 50 refer to the following:

ICE AGES:

Earth has undergone many ice ages, each lasting millions of years. Some scientists infer that most ice ages were caused by landmasses blocking the ocean currents between equatorial regions and the poles. Ice ages usually ended when the positions of continents allowed ocean currents to resume transporting equatorial heat to the poles.

During each ice age there were advances and retreats of glaciers. These cool glacial and warm interglacial climate intervals were caused mostly by changes in Earth's orbit and tilt. Earth is presently in a warm interglacial interval.

- 49) According to the given reading passage, Earth's warm interglacial intervals are due primarily to
- increases in elevation of North America
 - divergence at the Mid-Atlantic Ridge
 - changes in Earth's orbit and tilt
 - changes in Earth's period of rotation
- 50) Approximately 359 million years ago, the average intensity of insolation received in a year by the land area that is now eastern North America was likely
- less, because eastern North America was at a lower latitude
 - greater, because eastern North America was at a lower latitude
 - greater, because eastern North America was at a higher latitude
 - less, because eastern North America was at a higher latitude
- 51) Describe *one* characteristic of volcanic ash layers and index fossils that makes *both* of them good geologic time markers.
- 52) The cross section below represents several geologic structures. Line *AB* represents a fault. Letters *C* and *D* represent rock units.

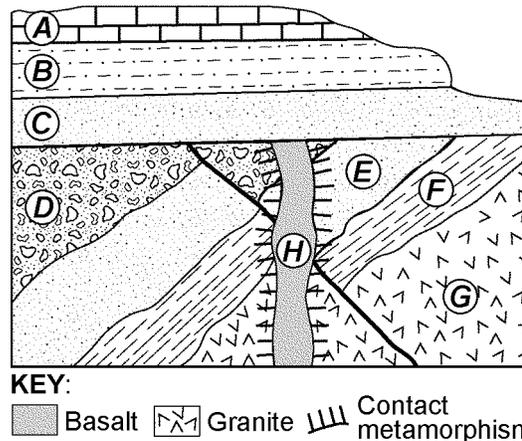


Indicate the proper sequence of the geologic events listed below by writing the number 1 before the first event, the number 2 before the second event, and the number 3 before the last event.

- ___ Deposition of rock unit *C*
- ___ Intrusion of rock unit *D*
- ___ Faulting along line *AB*

Questions 53 through 57 refer to the following:

On the cross section below, letters *A* through *H* represent rock units in which overturning has not occurred.

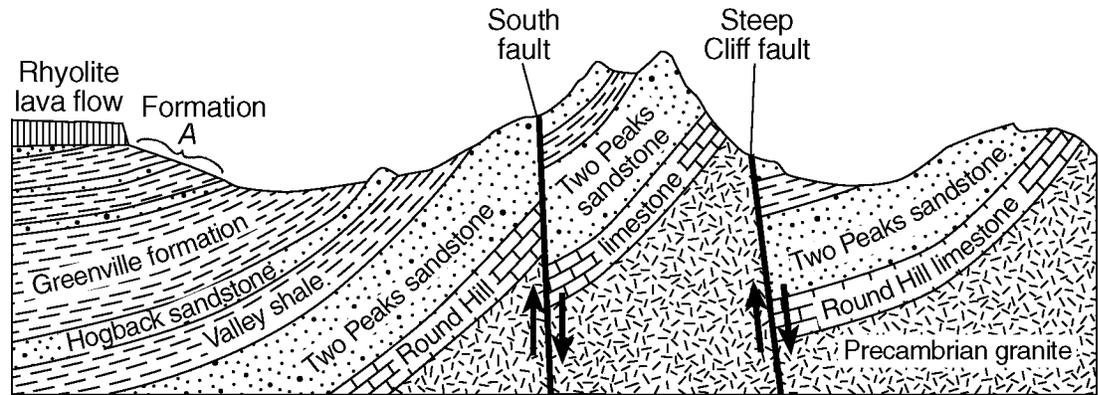


- 53) Identify *one* metamorphic rock that could have formed at the boundary between rock unit *E* and rock unit *H* on the given cross section.
- 54) Identify *two* processes that formed rock unit *D* on the given diagram from sediment.
- 55) State the diameter of a particle normally found in rock unit *B* on the given diagram.
- 56) Rock unit *B* on the given cross section contains fossils of *Centroceras* while rock unit *F* contains fossils of *Tetragraptus*. Identify *one* geologic time period when rock unit *D* could have formed.
- 57) Two inferences about the given cross section are listed below.
- Inference 1:** Rock unit *G* is older than the fault.
- Inference 2:** Rock unit *A* is younger than rock unit *C*.

Explain how each inference is supported by evidence in the cross section.

Questions 58 through 60 refer to the following:

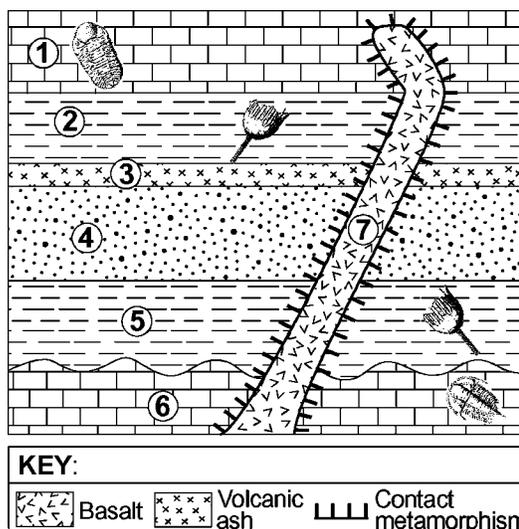
The cross section below represents rock formations that exist in the southwestern part of the United States. Names of the faults and rock units are indicated on the diagram.



- 58) In the given cross section, formation A consists of three thin sandstone layers interbedded with shale layers. Hornfels and quartzite are found at the top of formation A. Describe how the hornfels and quartzite formed.
- 59) Explain why the Two Peaks sandstone in the given cross section is *not* a continuous layer.
- 60) List *three* minerals that are likely present in the Precambrian granite rock shown in the cross section.

Questions 61 through 65 refer to the following:

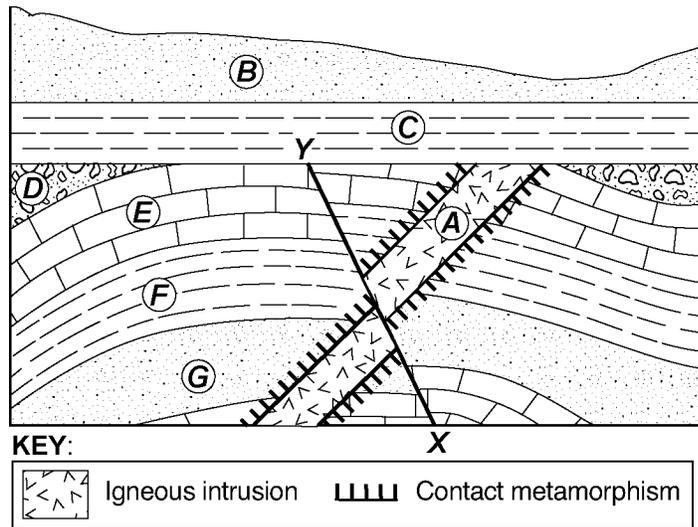
The geologic cross section below shows rock units 1 through 7 that have not been overturned. Some of the rock units contain New York State index fossils. An unconformity exists between rock units 5 and 6.



- 61) State the grain size of the sediment that was deposited to form rock unit 2 in the given cross section.
- 62) Identify *two* processes that produced the basalt in the given cross section.
- 63) Identify *one* metamorphic rock that could have been formed by the contact metamorphism within rock unit 1 in the given cross section.
- 64) What evidence shown in the cross section indicates that the basalt rock unit is the *youngest* rock unit?
- 65) Bedrock from which entire geologic time period is missing between rock units 5 and 6 in the given cross section?

Questions 66 through 69 refer to the following:

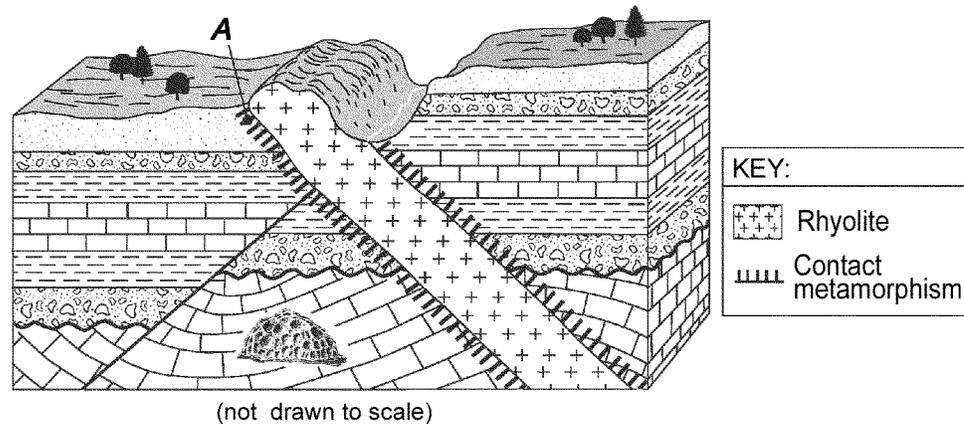
In the geologic cross section of bedrock below, letters A through G identify rock units and line XY represents a fault. The rocks have not been overturned.



- 66) Identify *one* metamorphic rock that would likely form in layer G along igneous intrusion A in the geologic cross section shown.
- 67) On the given cross section, draw a dark line () to indicate the most likely location of an unconformity.
- 68) What evidence indicates that the folded bedrock shown in the geologic cross section is *older* than fault line XY?
- 69) *Maclurites* fossils are found in rock unit F of the given geologic cross section. During which geologic time period were the sediments that formed rock unit F deposited?

Questions 70 through 74 refer to the following:

The block diagram below, which shows rock units that have not been overturned. Point A is located in the zone of contact metamorphism. A New York State index fossil is shown in one of the rock units.



- 70) Identify the crystal size of the minerals in rhyolite and explain what this size indicates about the rate of cooling of the magma from which it formed.
- 71) Identify the metamorphic rock that most likely formed at point A.
- 72) State the evidence shown by the block diagram that supports the inference that the fault is *older* than the rhyolite.
- 73) Identify the geologic time period when the index fossil shown in the block diagram was a living organism.
- 74) Describe *one* piece of evidence that would indicate that the valley shown on the surface of the block diagram had been eroded and deepened by a glacier.

Questions 75 through 78 refer to the following:

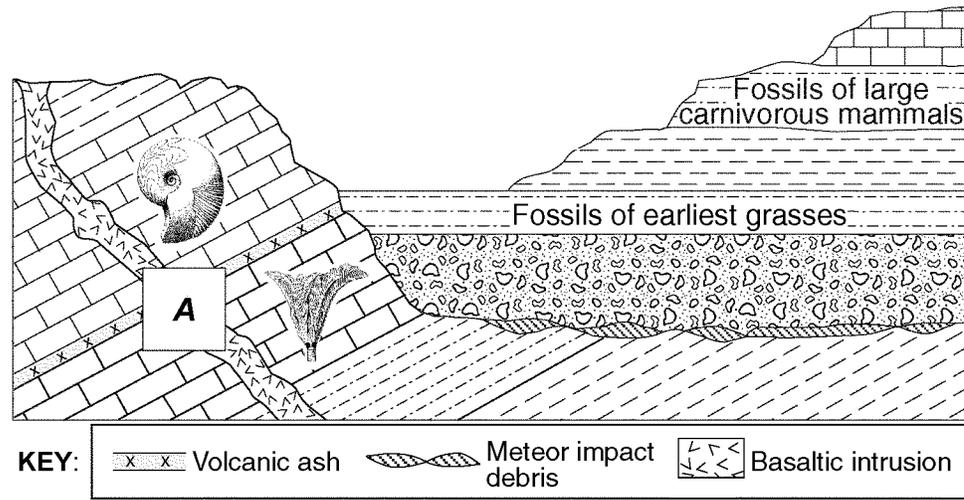
The cross sections below represent three bedrock outcrops, 1, 2, and 3, found several kilometers apart. The geologic time period when each sedimentary rock layer formed is shown. The symbols (☆, ○, X, □, and △) represent fossils of different types of organisms present in the rock layers.

Outcrop 1	Outcrop 2	Outcrop 3
Permian X	Devonian	Permian X
Pennsylvanian X △	Silurian	Pennsylvanian X
Mississippian X	Ordovician □	Devonian
Devonian ○	Cambrian ☆	Silurian

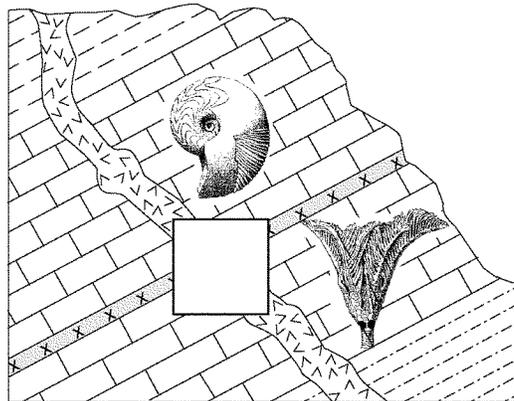
- 75) Draw the fossil symbol that represents the best index fossil. Describe *one* piece of evidence shown in the outcrops that indicates that this fossil has characteristics of a good index fossil.
- 76) Write the outcrop number of the cross section that could be found in New York State. Describe the evidence that supports your answer.
- 77) Explain why the index fossil *Coelophysis* is *not* preserved in any of the rock outcrops shown in the diagram.
- 78) Explain why the geologic age of the rock layers shown in the diagram could *not* be accurately dated using carbon-14.

Questions 79 through 81 refer to the following:

The geologic cross section below represents a portion of Earth's crust. Some rock units contain index fossils. Box *A* indicates a missing portion of the cross section.



- 79) In the blank box below that represents box *A* on the given cross section, draw *both* the volcanic ash layer and the basaltic intrusion to clearly show their relative age.



- 80) Describe *one* piece of evidence which indicates that the horizontal rock layers on the given diagram are *younger* than the tilted rock layers.
- 81) The meteor impact debris was deposited at the time trilobites became extinct. State the age, in million years, of this debris layer.

Questions 82 through 86 refer to the following:

The diagram below shows a rock sample containing fossils from a location in New York State at 42DN 78D 15' W. Fossils 1, 2, 3, and 4 are labeled. Table A lists the names and rock types of the New York State rock units from the Middle and Late Devonian in this area. The presence of fossil 1, 2, 3, or 4 in a rock unit is indicated by an **X** in the fossils column in the table. Table B identifies typical rocks formed within different marine (ocean) environments.

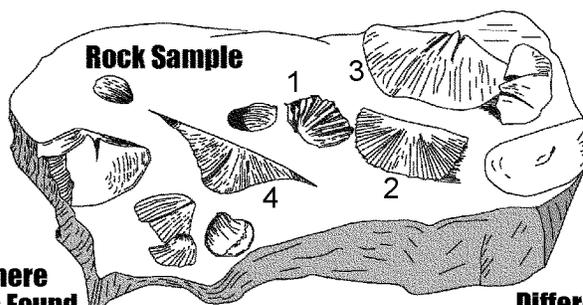


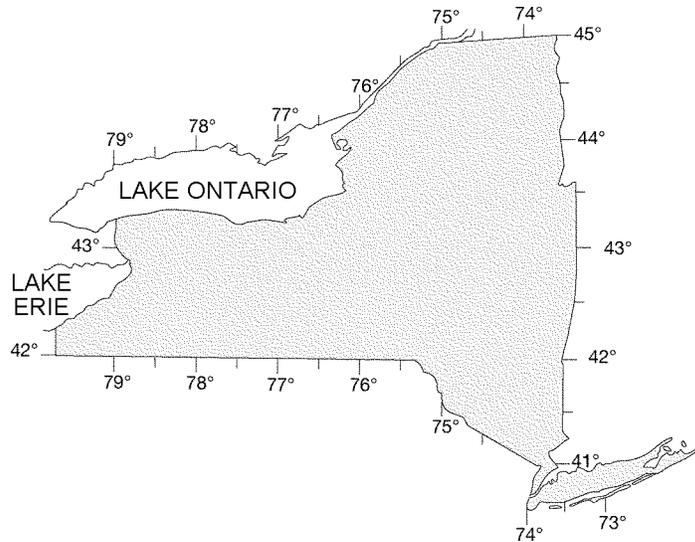
TABLE A: New York Rock Units in Area Where the Rock Sample was Found

TABLE B: Sedimentary Rock Types Formed in Different Marine Environments

Geologic Age: Devonian	Name of Rock Unit	Type of Rock Found in Unit	Fossils				Sedimentary Rocks	Marine Environment
			1	2	3	4		
Late	Conewango	shales and sandstones	X	X		X	limestones	clear, shallow water
Late	Conneaut	shales and sandstones	X	X		X	gray shales	muddy, oxygen rich
Late	Canadaway	shales and sandstones	X	X	X	X	black shales	muddy, oxygen poor
Late	West Falls	shales and sandstones	X	X	X		siltstones and sandstones	silty to sandy bottom
Late	Sonyea	shale	X	X	X		evaporites	very salty, shallow seas
Late/Middle	Genesee	shale	X	X			coarse-grained sandstones and conglomerates	tidal shores and deltas
Middle	Tully	limestone	X	X				
Middle	Hamilton	limestone	X	X				
Middle	Onondaga	limestone (includes volcanic ash bed)		X				

- 82) Based on the fossils present, the rock sample shown in the diagram came from which rock unit listed in table A?
- 83) Identify the New York State index fossil group that includes fossil 4 in the given rock sample.

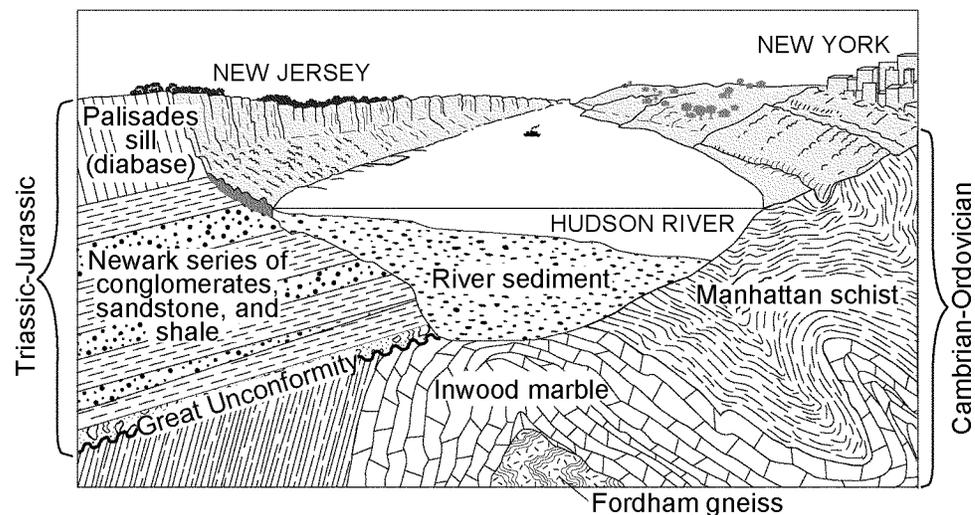
- 84) On the map below, place an **X** at the location where the given rock sample was collected.



- 85) Identify the landmass that collided with the eastern coast of North America to create the Acadian mountain range and the basin for the deposition of the Devonian rock units in table A.
- 86) According to the given tables, in which marine environment was the Tully rock unit deposited?

Questions 87 through 89 refer to the following:

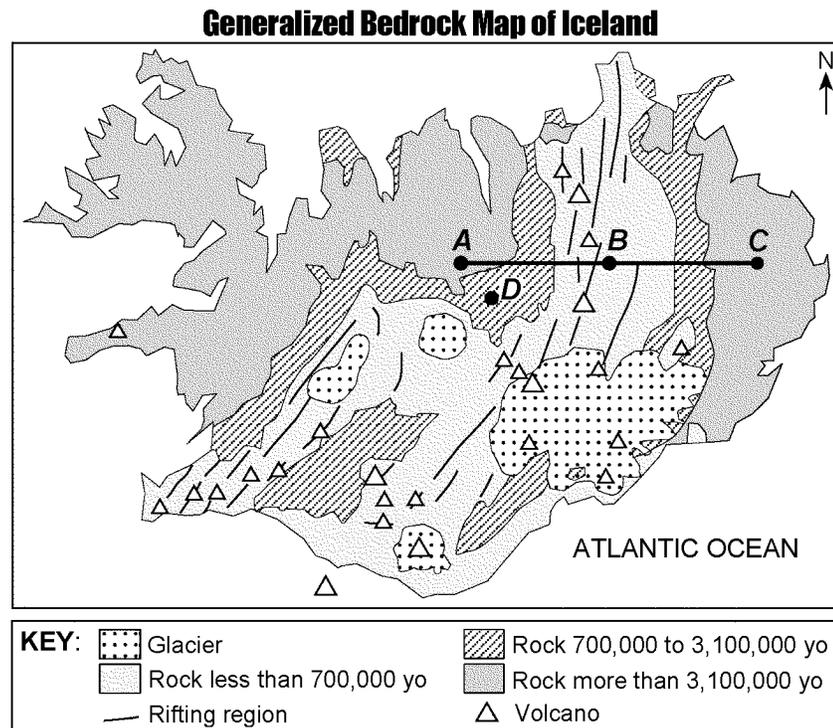
The cross section below shows the underlying bedrock of New York and New Jersey along the Hudson River.



- 87) Identify the *oldest* bedrock shown in the given diagram.
- 88) Describe *one* piece of evidence shown in the given cross section that indicates that the Inwood marble was formed by regional metamorphism.
- 89) Identify *two* processes that led directly to the development of the Great Unconformity beneath the Newark series in the given cross section.

Questions 90 and 91 refer to the following:

The map below shows the generalized surface bedrock geology of Iceland, an island located on the Mid-Atlantic Ridge. Points *A*, *B*, *C*, and *D* are locations on surface bedrock which is igneous in origin. Glaciers cover some surface bedrock.



- 90) State the change in the relative ages of the surface bedrock along the line from *A* to *B* to *C* on the given map.
- 91) During which geologic era did the surface bedrock at location *D* on the given map form?

Questions 92 through 94 refer to the following:

FROZEN MAMMOTH:

A woolly mammoth was found in 1999 buried in the frozen soil of the Siberian tundra. Carbon-14 dating indicated that it had died about 20,000 years ago. Many fossils represent only the partial remains of organisms. However, a complete mammoth with bones, skin, hair, and internal organs intact represented a unique opportunity for scientists to investigate the lifestyle of this animal and the environment in which it lived.

- 92) Identify *both* the period and epoch of geologic time during which the woolly mammoth mentioned in the reading passage lived.
- 93) Identify *one* New York State index fossil of an organism that lived during the same time as the woolly mammoth mentioned in the reading passage.
- 94) The low permeability of the tundra soil helped to preserve the mammoth mentioned in the reading passage. Explain why the tundra soil has a low permeability.

Questions 95 through 99 refer to the following:

DINOSAUR SKULL OFFERS HINTS ABOUT AFRICA'S PAST:

A fossil skull was found in Africa among many dinosaur bones from the Late Cretaceous Epoch. This skull came from a dinosaur named *Rugops primus*, or "first wrinkle face." This meat eater, believed to have been about 30 feet long and to have lived 95 million years ago, belonged to a group of dinosaurs called abelisaurids.

This fossil skull, unearthed in the Sahara Desert in 2000, provides new evidence that Africa split from other southern continents at a later time than previously thought. Before this discovery, abelisaurids from that period had been found only in South America, Madagascar, and India, but not in Africa. This new fossil, *Rugops primus*, found only in Africa, indicates that Africa was still connected to the other southern landmasses, at least by a land bridge, 100 million years ago.

- 95) Based on the reading passage, during which geologic era is *Rugops primus* inferred to have lived?
- 96) What evidence in the reading passage suggests that Africa was still attached to South America 100 million years ago?
- 97) Based on the reading passage, state the type of rock in which *Rugops primus* was most likely preserved.

- 98) *Rugops primus* described in the reading passage is *not* a good index fossil. Describe one characteristic of a good index fossil.
- 99) Identify the type of tectonic plate movement that caused Africa to separate from South America.