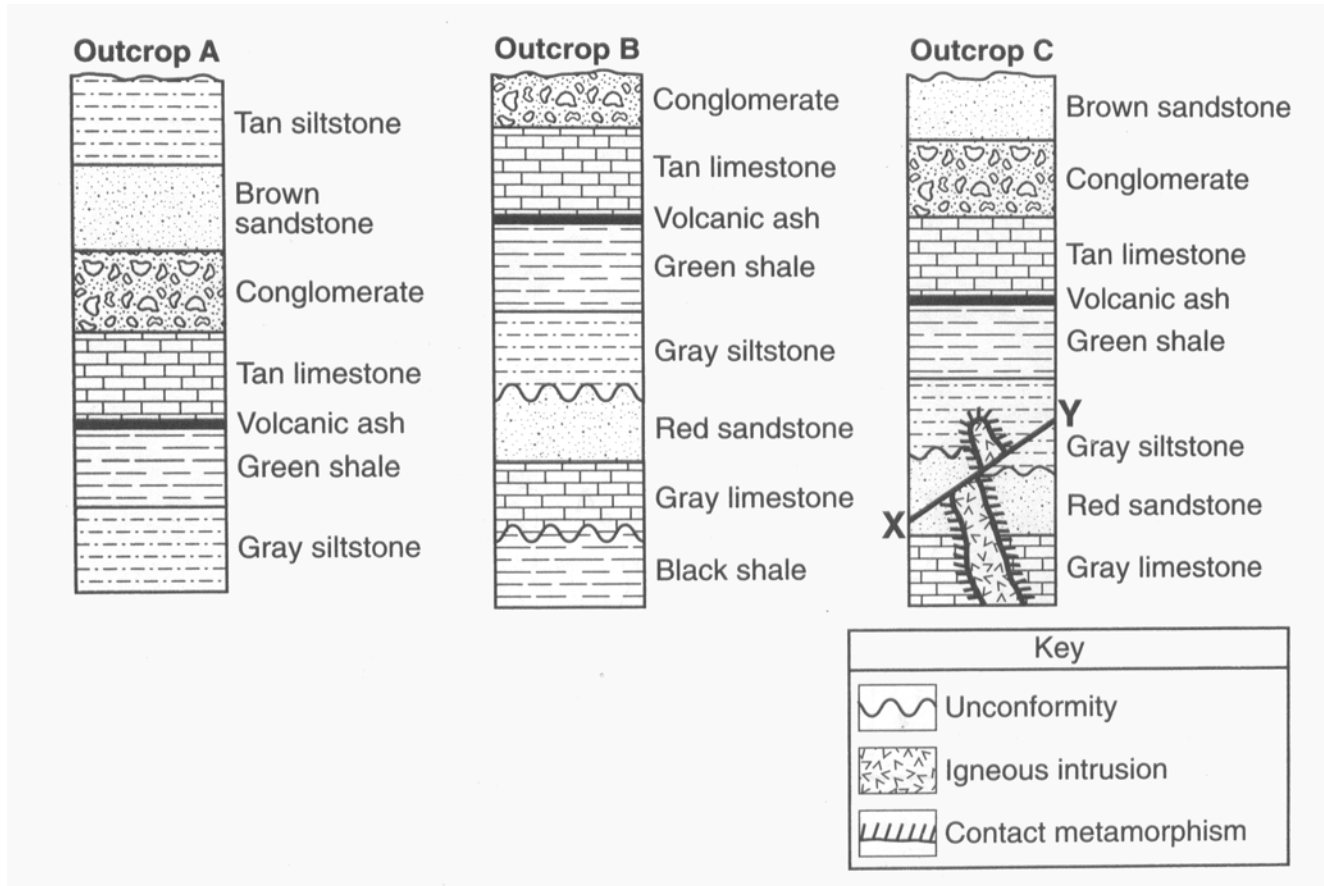
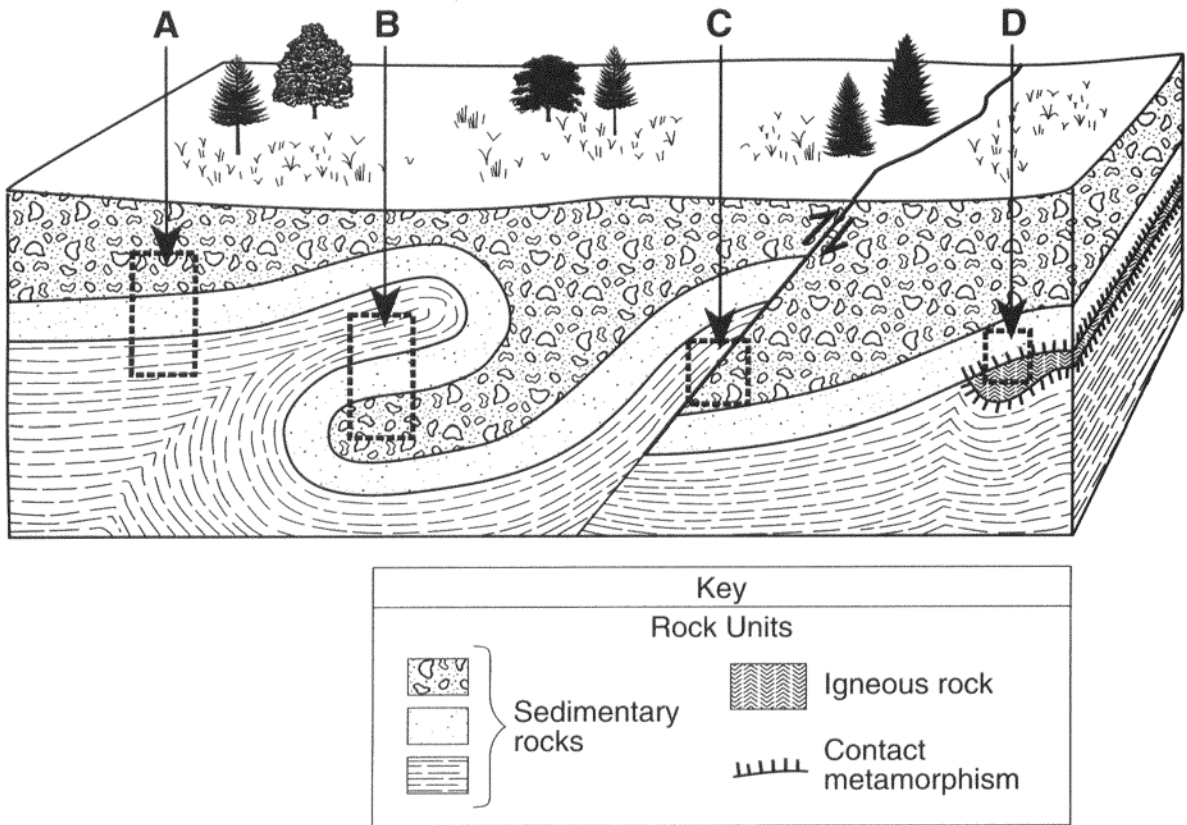


Base your answers to questions 1 and 2 on the cross sections of three rock outcrops, A, B, and C. Line XY represents a fault. Overturning has not occurred in the rock outcrops.



- What is the youngest geologic feature in the three bottom layers of outcrop C?
 - fault
 - igneous intrusion
 - unconformity
 - zone of contact metamorphism
- The volcanic ash layer is considered a good time marker for correlating rocks because the volcanic ash layer
 - has a dark color
 - can be dated using carbon-14
 - lacks fossils
 - was rapidly deposited over a wide area

3. The block diagram below of a portion of Earth's crust shows four zones labeled A, B, C, and D outlined with dashed lines.



In which zone is a younger rock unit on top of an older rock unit?

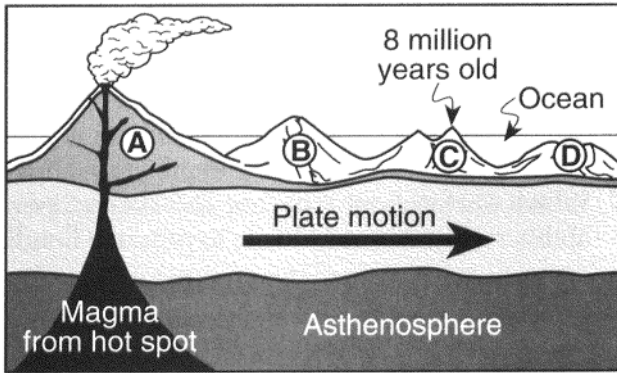
(1) A

(2) B

(3) C

(4) D

4. The cross section below shows the direction of movement of an oceanic plate over a mantle hot spot, resulting in the formation of a chain of volcanoes labeled A, B, C, and D. The geologic age of volcano C is shown.



What are the most likely geologic ages of volcanoes B and D?

- (1) B is 5 million years old and D is 12 million years old.
- (2) B is 2 million years old and D is 6 million years old.
- (3) B is 9 million years old and D is 9 million years old.
- (4) B is 10 million years old and D is 4 million years old.

Base your answers to questions 5 through 7 on the newspaper article shown below.

Fossilized Jellyfish Found in Wisconsin

Fossil hunters have unearthed the largest collection of fossilized jellyfish ever discovered, including the largest fossilized jellyfish ever found.

The remains of soft-bodied animals such as jellyfish are relatively rare because they don't have bones, fossil dealer Dan Damrow, James W. Hagadorn of the California Institute of Technology and Robert H. Dott Jr. of the University of Wisconsin at Madison noted in describing the find in the journal *Geology*.

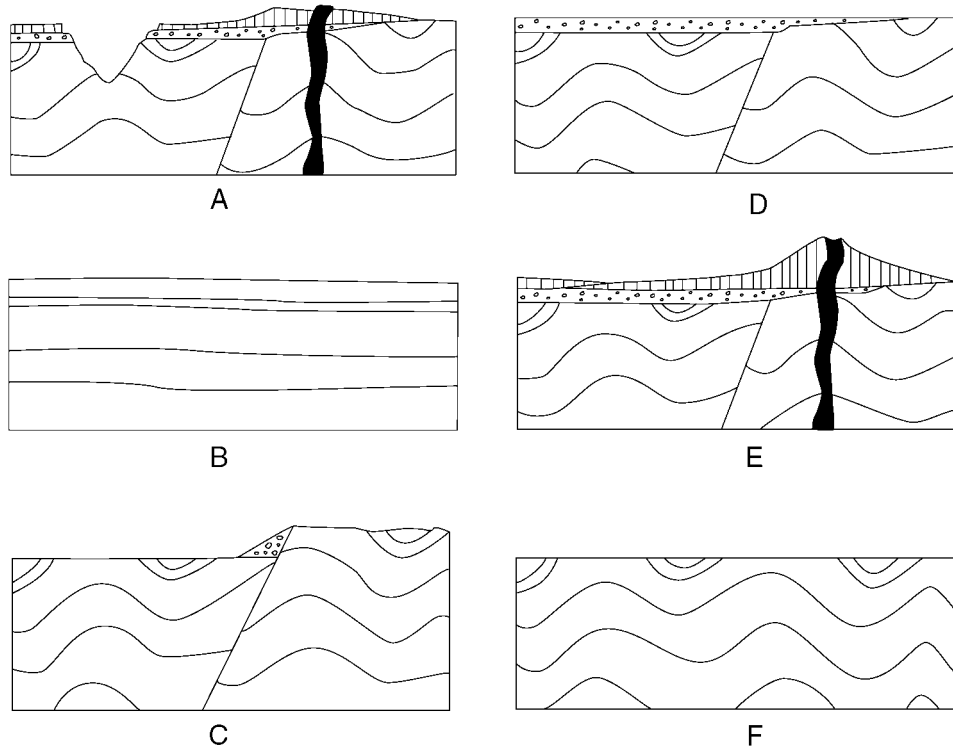
About a half-billion years ago, during the Cambrian period, the quarry in Mosinee, Wis., where the deposits were found was a small lagoon. The jellyfish apparently died when they were washed up by a freak tide or storm, the researchers said. The jellyfish remains were probably preserved because of a lack of erosion from sea water and wind, and a lack of scavengers, the researchers concluded.

"It is very rare to discover a deposit which contains an entire stranding event of jellyfish," Hagadorn said. "These jellyfish are not just large for the Cambrian, but are the largest jellyfish in the entire fossil record."

Washington Post, January 2002

5. Which two marine organisms most likely lived at the same time as these jellyfish?
- | | |
|----------------------------------|--------------------------------|
| (1) crinoids and dinosaurs | (3) brachiopods and gastropods |
| (2) ammonoids and placoderm fish | (4) amphibians and eurypterids |
6. Which evidence would lead scientists to suspect that a tide or storm had washed up these jellyfish on a beach?
- (1) Primitive life existed on land 500 million years ago.
 - (2) The rock containing the jellyfish fossils has distorted crystal structure.
 - (3) Treeroot fossils appear to have been pitted and folded.
 - (4) Large ripple marks were found in the fossil-containing rock layers.
7. These fossilized jellyfish were most likely discovered in which type of rock?
- | | | | |
|---------------|-------------|------------|-----------|
| (1) sandstone | (2) granite | (3) pumice | (4) slate |
|---------------|-------------|------------|-----------|
-

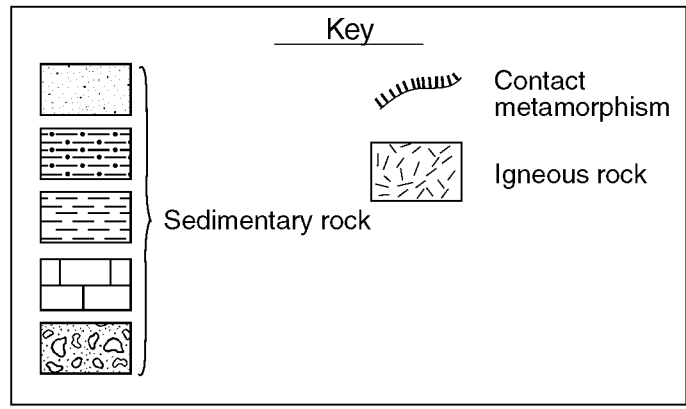
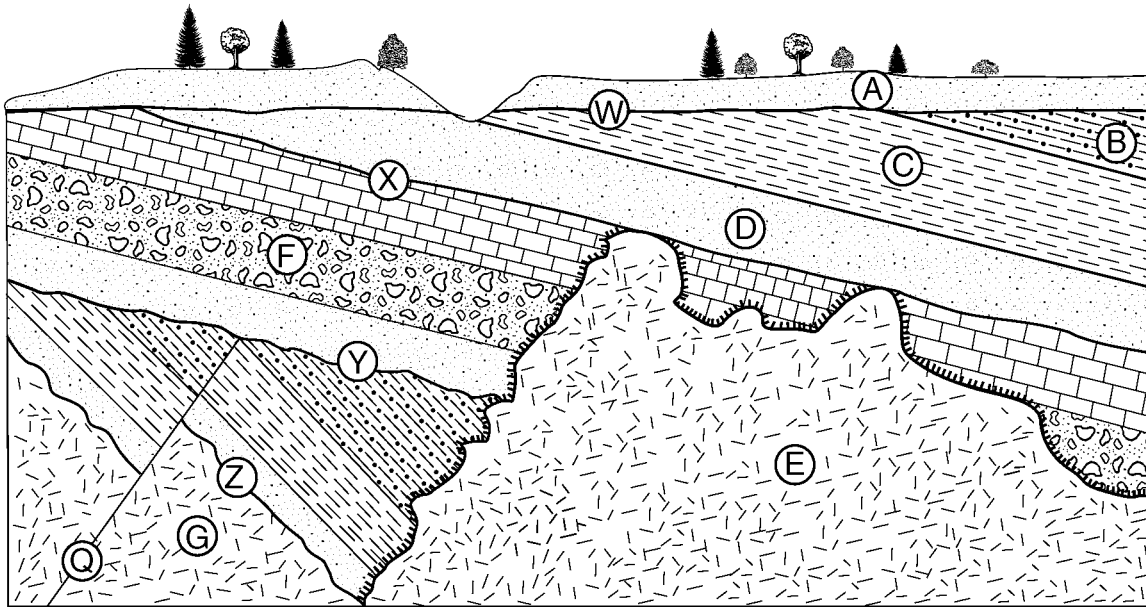
8. Geologic cross sections *A* through *F* shown below represent different stages in the development of one part of Earth's crust over a long period of geologic time.



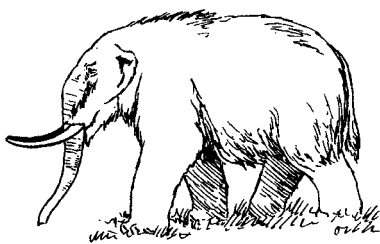
What is the correct order of development from the original (oldest) stage to the most recent (youngest) stage?

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

Base your answers to questions 9 and 10 on the geologic cross section of bedrock shown below. A through G identify rock layers and Q represents a fault. Lines W, X, Y, and Z are locations of unconformities. The rocks have not been overturned.



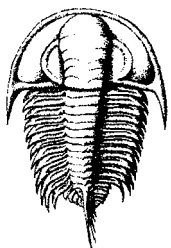
9. Rock layers B, C, and D formed during the Devonian Period. Which fossil might be found in these rock layers?



Mastodont
(1)



Phacops
(3)



Elliptocephala
(2)



Cystiphyllum
(4)

10. Which rock or feature is oldest?

(1) rock A

(2) rock G

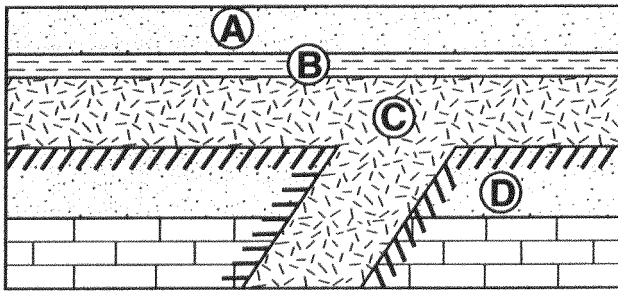
(3) fault Q

(4) unconformity Z

11. The diagram below shows a geologic cross section.

Letters A through D represent different rock units.

Surface



Key



Limestone



Shale



Sandstone



Igneous rock



Contact metamorphism

Which sequence correctly shows the age of the lettered rock units, from oldest to youngest?

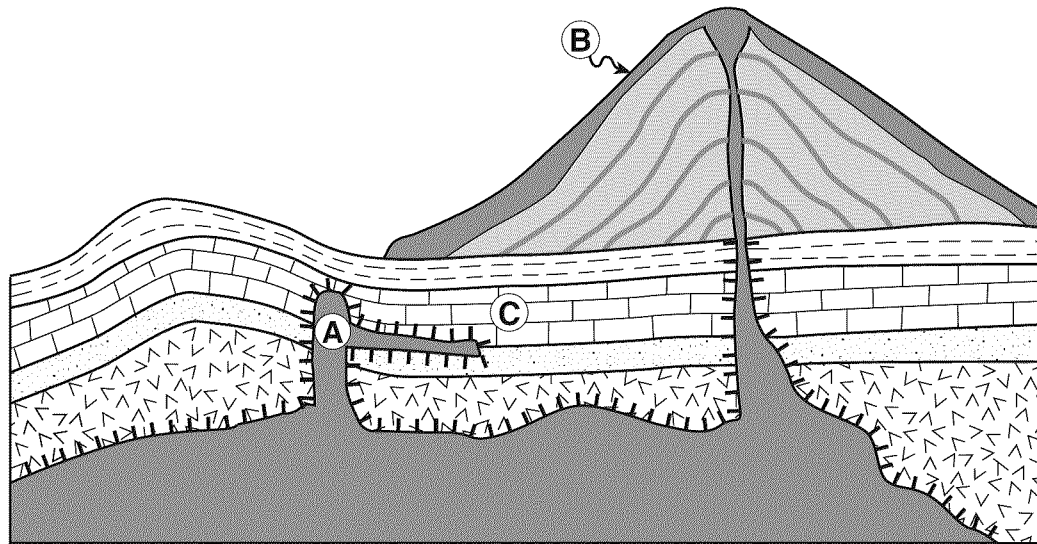
(1) A → B → C → D








(3) D → B → A → C

(2) C → D → A → B

(4) D → C → B → A

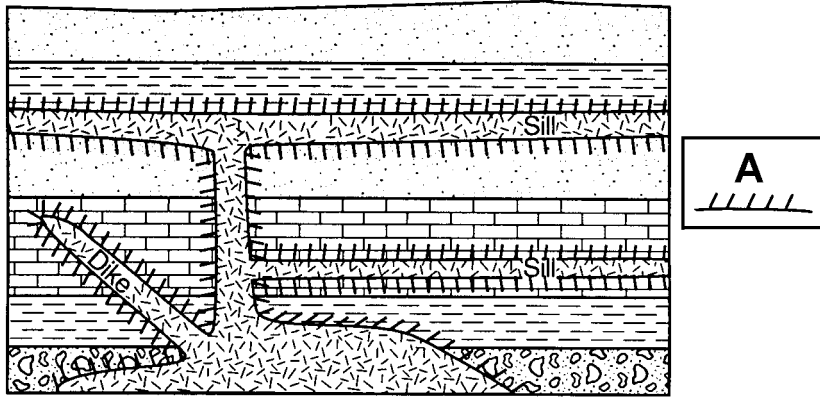
Base your answers to questions **12** and **13** on the geologic cross section below. The large cone-shaped mountain on Earth's surface is a volcano. Letters *A*, *B*, and *C* represent certain rocks.



Key			
	Igneous rock A and B		Sandstone
	Gabbro		Shale
	Limestone		Ash layers
	Contact metamorphism		

12. Rock *B* is most likely which type of igneous rock?
- (1) granite (2) peridotite (3) pegmatite (4) basalt
13. Which statement correctly describes the relative ages of rocks *A* and *C* and gives the best supporting evidence from the cross section?
- (1) *A* is younger than *C*, because *A* is a lower sedimentary rock layer.
- (2) *A* is younger than *C*, because the intrusion of *A* metamorphosed part of rock layer *C*.
- (3) *A* is older than *C*, because *A* has older index fossils.
- (4) *A* is older than *C*, because the intrusion of *A* cuts across rock layer *C*.

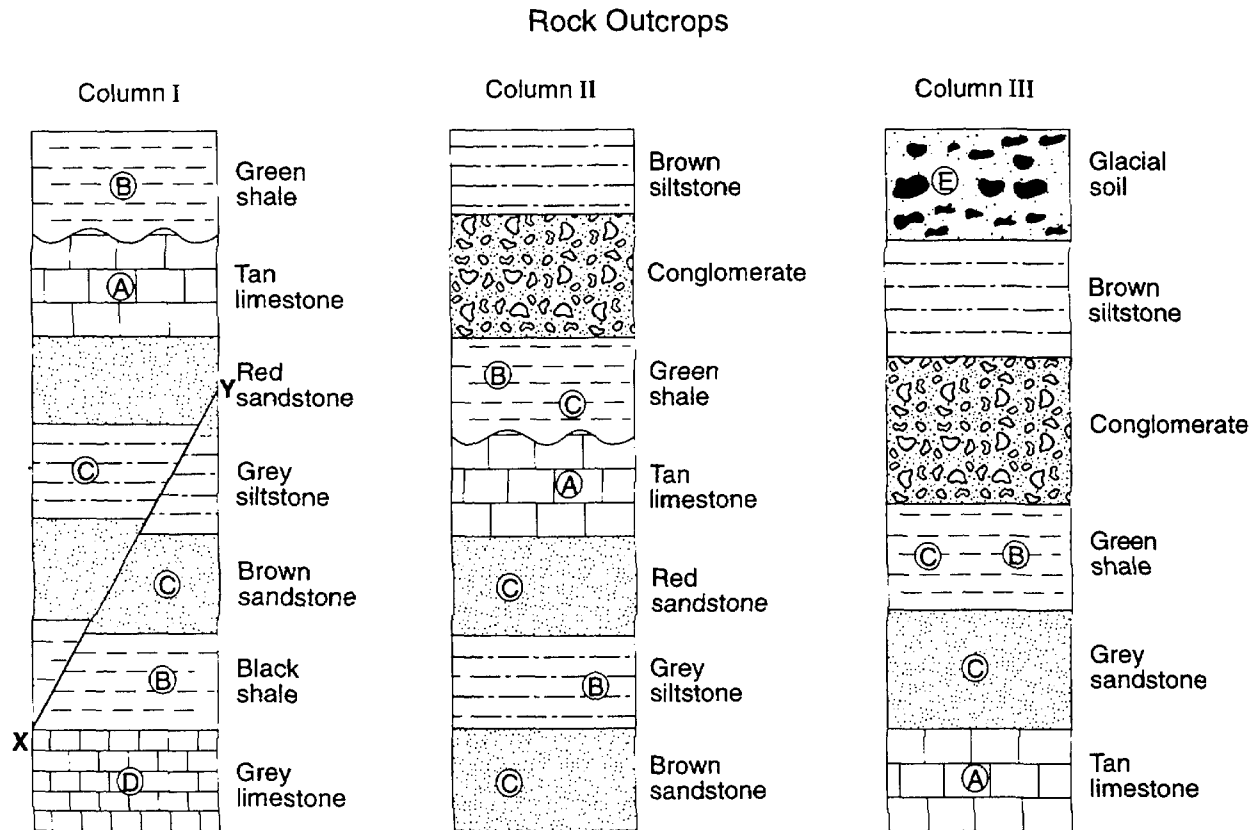
14. Base your answer to the following question on the geologic cross section below. Overturning has not occurred. The dike and sills shown in the cross section are igneous intrusions.



Which feature is represented by symbol A along the edges of the dike and sills?

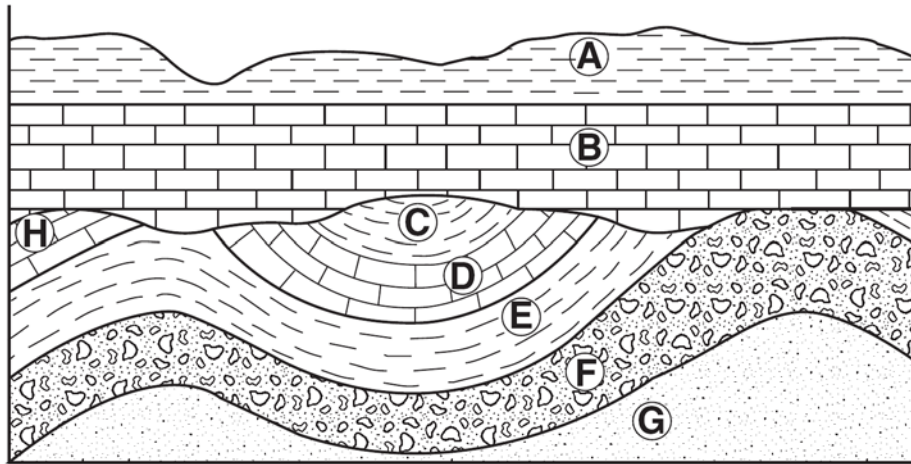
- (1) contact metamorphic rock
- (2) an unconformity
- (3) a glacial moraine
- (4) index fossils

Base your answers to questions 15 and 16 on the diagram below which shows three geologic columns representing widely separated rock outcrops. Letters A through E represent fossils found in the outcrops. Line XY represents a fault in column I. The layers have not been overturned.



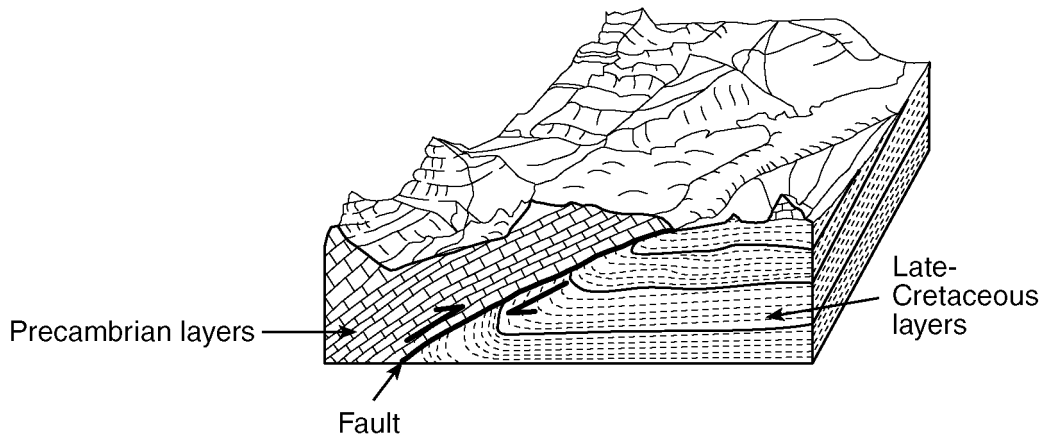
15. Which rock would most likely be produced by the metamorphism of the grey limestone?
- (1) quartzite (2) slate (3) marble (4) gneiss
16. When did fault XY, located in column I, most likely occur?
- (1) before the formation of the grey limestone (3) during the formation of the black shale
- (2) during the formation of the grey siltstone (4) after the formation of the red sandstone

Base your answers to questions **17** and **18** on the geologic cross section below in which overturning has not occurred. Letters *A* through *H* represent rock layers.



17. The folding of rock layers *G* through *C* was most likely caused by
- | | |
|------------------------------------|--|
| (1) erosion of overlying sediments | (3) the collision of lithospheric plates |
| (2) contact metamorphism | (4) the extrusion of igneous rock |
18. Which sequence of events most likely caused the unconformity shown at the bottom of rock layer *B*?
- | | |
|---|--|
| (1) folding → uplift → erosion → deposition | (3) erosion → folding → deposition → intrusion |
| (2) intrusion → erosion → folding → uplift | (4) deposition → uplift → erosion → folding |

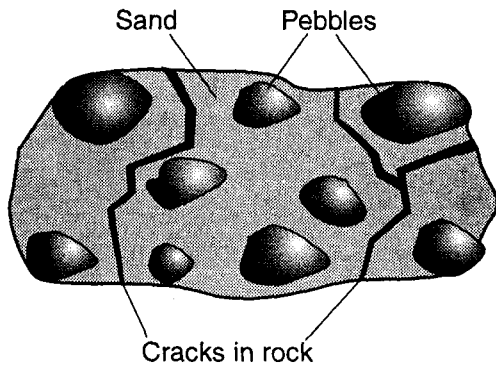
19. The geologic block diagram below shows surface features and subsurface structures of a section of Montana.



The faulting shown in the diagram could have occurred

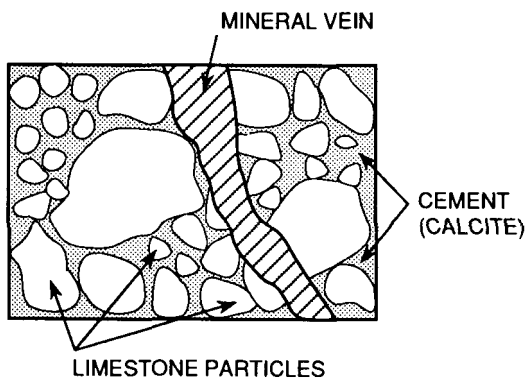
- | | | | |
|-----------------------------|---------------------------|---------------------------|--------------------------|
| (1) 2,100 million years ago | (2) 520 million years ago | (3) 250 million years ago | (4) 50 million years ago |
|-----------------------------|---------------------------|---------------------------|--------------------------|

24. The diagram below represents a sedimentary rock composed of pebbles and sand.



Which statement most accurately compares the ages of the cracks and pebbles to the age of the sedimentary rock in which they are found?

- (1) The cracks and pebbles are both younger than the sedimentary rock.
 - (2) The cracks and pebbles are both older than the sedimentary rock.
 - (3) The cracks are younger and the pebbles are older than the sedimentary rock.
 - (4) The cracks are older and the pebbles are younger than the sedimentary rock.
25. The diagram below shows a sample of conglomerate rock.



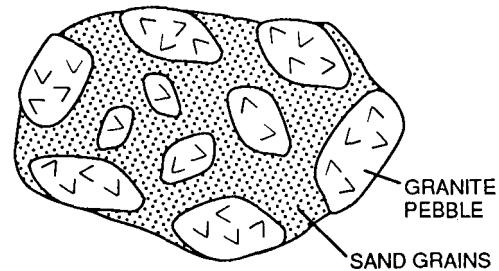
The oldest part of this sample is the

- (1) conglomerate rock sample
- (2) calcite cement
- (3) limestone particles
- (4) mineral vein

26. How would the age of sandstone fragments found in a conglomerate rock compare with the age of the conglomerate rock?

- (1) The sandstone fragments are younger than the conglomerate rock.
- (2) The sandstone fragments are older than the conglomerate rock.
- (3) The sandstone fragments and the conglomerate rock are the same age.
- (4) The sandstone fragments may be either younger or older than the conglomerate rock.

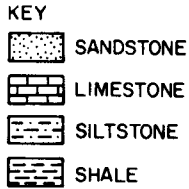
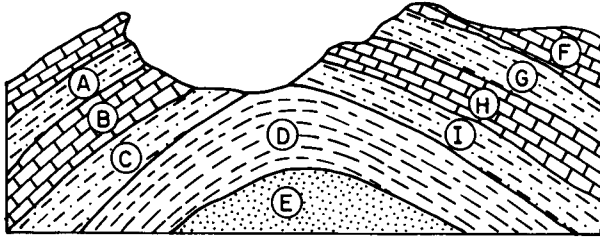
27. The diagram below represents a rock consisting of granite pebbles and sand grains cemented together.



How does the age of the granite pebbles compare to the age of the rock itself?

- (1) The pebbles are younger than the rock.
- (2) The pebbles are older than the rock.
- (3) The pebbles are the same age as the rock.
- (4) The relative age of the pebbles cannot be determined.

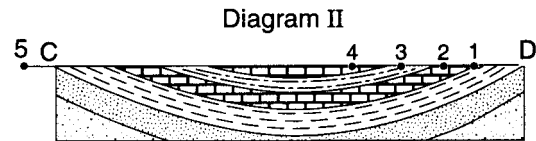
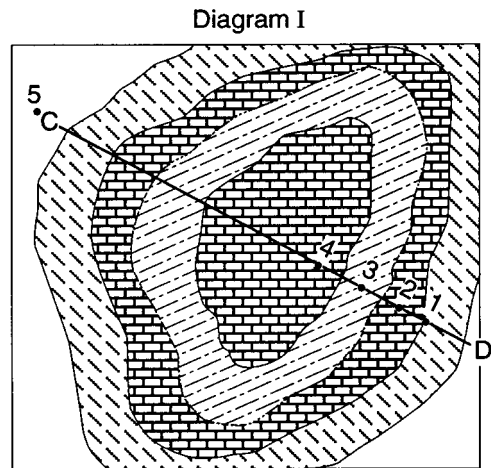
28. Base your answer to the following question on the diagram below which represents a cross section of an eroded fold that has *not* been overturned.



The fossils found in rock layer *G* will most closely resemble those found in rock layer

- | | |
|--------------|--------------|
| (1) <i>A</i> | (3) <i>C</i> |
| (2) <i>I</i> | (4) <i>E</i> |

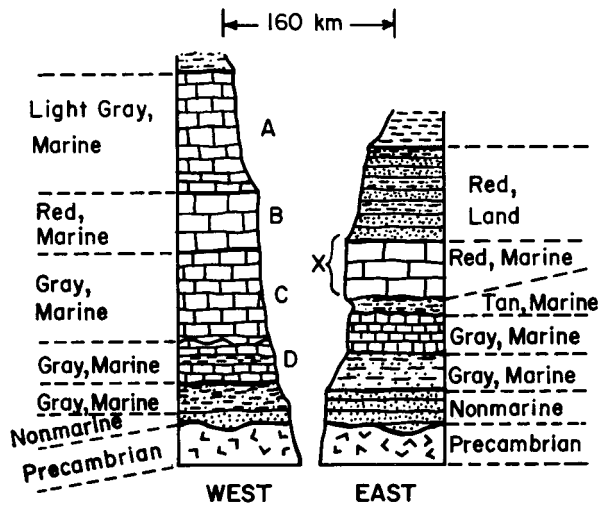
29. Base your answer to the following question on the diagrams below. Diagram I shows part of a geologic map. Diagram II shows a geologic cross section taken along line *CD*. The rock layers shown have not been overturned. Numbers 1 through 5 represent locations on the surface bedrock.



Which type of surface bedrock would most likely be found at location 5?

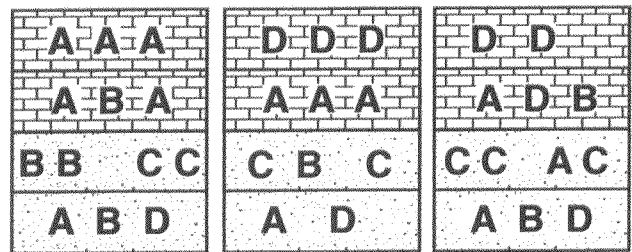
- | | |
|---------------|------------------------|
| (1) shale | (3) chemical limestone |
| (2) sandstone | (4) siltstone |

30. The diagram below represents two geologic rock columns. The color and environment of deposition of each sedimentary rock are indicated beside the rock layers. Which rock layer in the West geologic column is most likely the same as rock layer X in the East column?



- (1) A (3) C
 (2) B (4) D
31. The presence of which index fossil in the surface bedrock most likely indicates that a forest environment once existed in the region?
- (1) *Aneurophyton* (3) *Centroceras*
 (2) *Cystiphyllum* (4) *Bothriolepis*

32. Which group of organisms is inferred to have existed for the *least* amount of time in geologic history?
- (1) trilobites (3) eurypterids
 (2) dinosaurs (4) placoderm fish
33. Which characteristic is most useful in correlating Devonian-age sedimentary bedrock on the East Coast with Devonian-age sedimentary bedrock in other parts of the world?
- (1) color (3) rock types
 (2) index fossils (4) particle size
34. The three cross sections of sedimentary bedrock shown below represent widely separated surface exposures of layers that contain fossils. Letters A, B, C, and D represent four different marine fossils found in these rock layers.



- Which letter best represents an index fossil?
- (1) A (3) C
 (2) B (4) D

Base your answers to questions 35 through 37 on the reading passage and the drawing below and on your knowledge of Earth science.

Fossil With Signs of Feathers Is Cited as Bird-Dinosaur Link

Paleontologists have discovered in China a fossil dinosaur with what are reported to be clear traces of feathers from head to tail, the most persuasive evidence so far, scientists say, that feathers predated the origin of birds and that modern birds are descendants of dinosaurs.

Entombed in fine-grained rock, the unusually well-preserved skeleton resembles that of a duck with a reptilian tail, altogether about three feet in length. Its head and tail are edged with the imprint of downy fibers. The rest of the body, except for bare lower legs, shows distinct traces of tufts and filaments that appear to have been primitive feathers. On the backs of its short forelimbs are patterns of what look like modern bird feathers.

Other dinosaur remains with what appear to be featherlike traces have been unearthed in recent years, but nothing as complete as this specimen, paleontologists said. Etched in the rock like a filigree decoration surrounding the skeleton are imprints of where the down and feathers appear to have been.

The 130-million-year-old fossils were found a year ago by farmers in Liaoning Province in northeastern China. After an analysis by Chinese and American researchers, the fossil animal was identified as a dromaeosaur, a small fast-running dinosaur related to velociraptor. The dinosaurs belonged to a group of two-legged predators known as advanced theropods . . .

excerpted from "Fossil With Signs of Feathers Is Cited as Bird-Dinosaur Link"

John Noble Wilford

New York Times, April 26, 2001

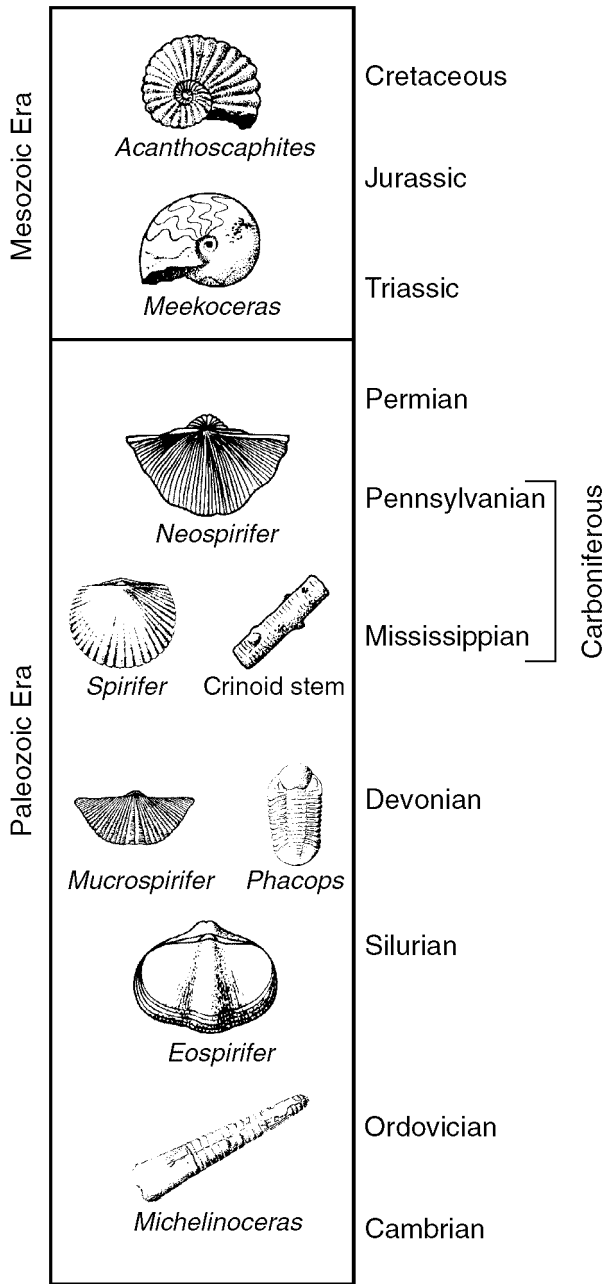
The drawing below shows an artist's view of the dinosaur, based on the fossilized remains.



35. This feathered dinosaur is not considered an index fossil because it
- | | |
|--------------------------|--------------------------------|
| (1) existed too long ago | (3) was a land-dwelling animal |
| (2) was preserved in ash | (4) was found in only one area |
36. During which period of geologic time have paleontologists inferred that the feathered dinosaur mentioned in the passage existed?
- | | | | |
|--------------|----------------|---------------|-------------|
| (1) Cambrian | (2) Cretaceous | (3) Paleogene | (4) Permian |
|--------------|----------------|---------------|-------------|

37. The reference to the bird-dinosaur link is most likely referring to the concept of
 (1) plate tectonics (2) evolution (3) dynamic equilibrium (4) recycling

Base your answers to questions 38 and 39 on the chart below, which shows the geologic ages of some well-known fossils.

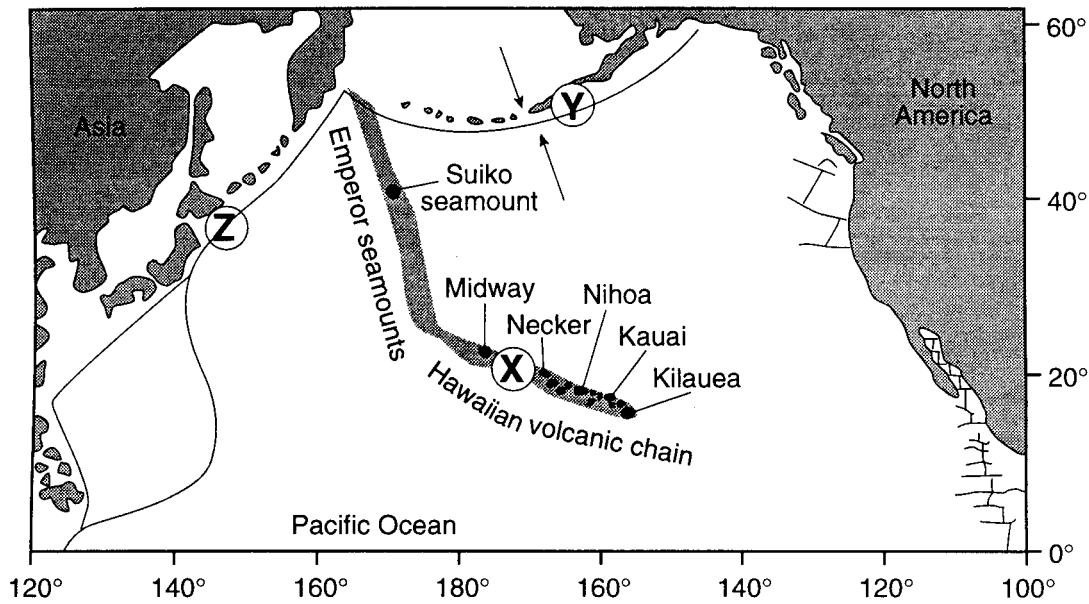


39. Which New York State fossil is found in rocks of the same period of geologic history as *Meekoceras*?
 (1) Condor (3) *Eurypterus*
 (2) Placoderm fish (4) *Coelophysis*
-

38. The *Spirifer*, Crinoid stem, and *Neospirifer* fossils might be found in some of the surface bedrock of which New York State landscape region?
 (1) The Allegheny Plateau southeast of Jamestown
 (2) The Catskills near Slide Mountain
 (3) The Adirondack Mountains near Mt. Marcy
 (4) The Erie-Ontario Lowlands northeast of Niagara Falls

Base your answers to questions 40 and 41 on the map and data table below. The map shows the locations of volcanic islands and seamounts that erupted on the seafloor of the Pacific Plate as it moved northwest over a stationary mantle hotspot beneath the lithosphere. The hotspot is currently under Kilauea. Island size is not drawn to scale. Locations X, Y and Z are on Earth's surface.

Map of Volcanic Features

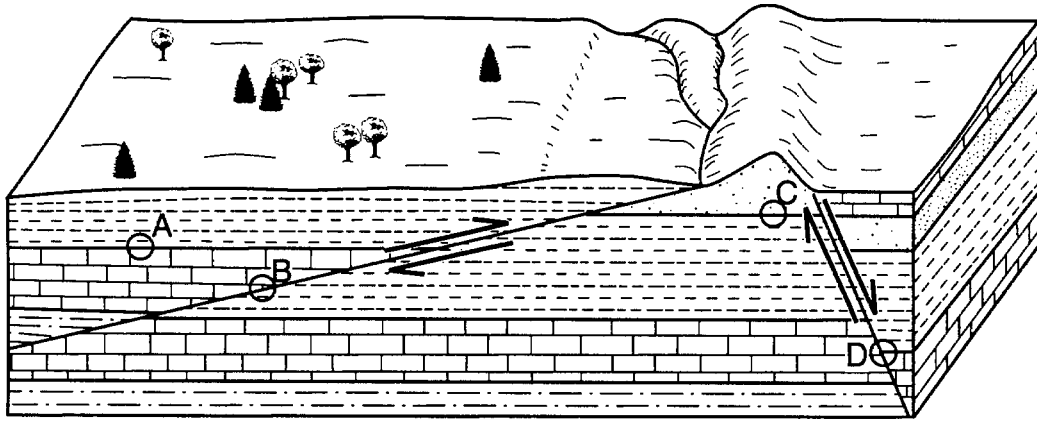


Data Table
Age of Volcanic Features

Volcanic Feature	Distance from Kilauea (km)	Age (millions of years)
Kauai	545	5.6
Nihoa	800	6.9
Necker	1,070	10.4
Midway	2,450	16.2
Suiko seamount	4,950	41.0

40. According to the data table, what is the approximate speed at which the island of Kauai has been moving away from the mantle hotspot, in kilometers per million years?
- (1) 1 (2) 10 (3) 100 (4) 1,000
41. Approximately how far has location X moved from its original location over the hotspot?
- (1) 3,600 km (2) 2,500 km (3) 1,800 km (4) 20 km

42. The geologic cross section below represents an area where faulting has occurred. Rock layers have not been overturned.



Within which circled area does older rock directly overlie younger rock?

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





43. The time line below represents the entire geologic history of Earth.

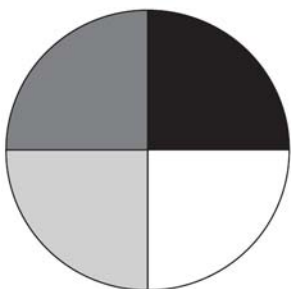


Which letter best represents the first appearance of humans on Earth?

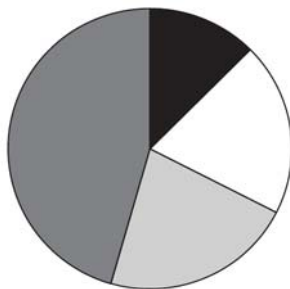
- (1) A (2) B (3) C (4) D

44. Which pie graph best represents the percentage of total time for the four major divisions of geologic time?

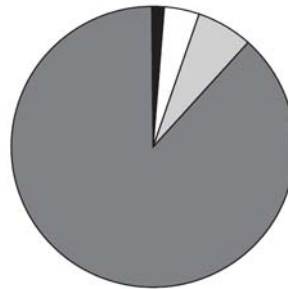
Key			
	Cenozoic		Paleozoic
	Mesozoic		Precambrian



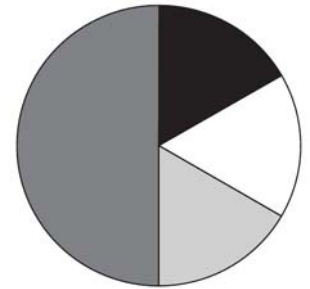
(1)



(2)

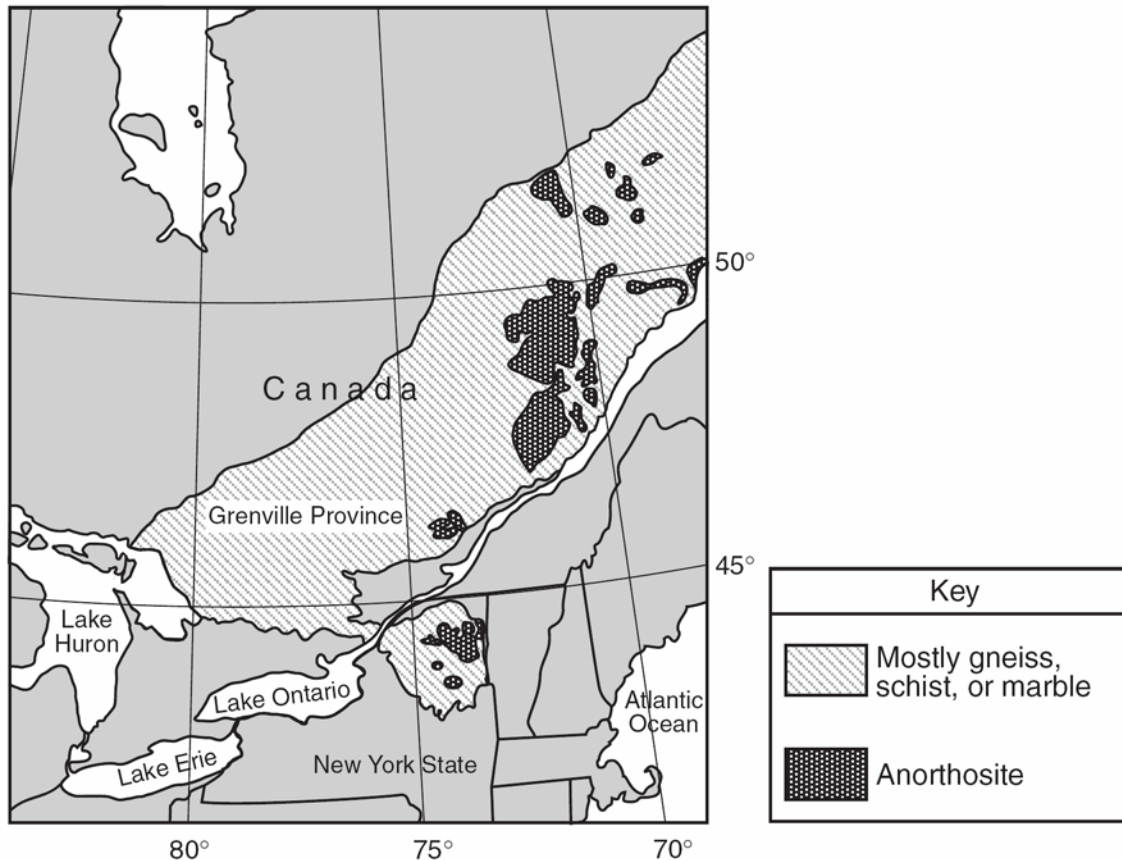


(3)



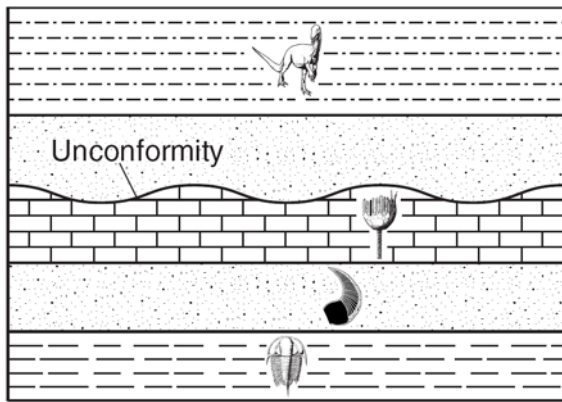
(4)

Base your answers to questions 45 through 47 on the map below. The map shows some regions where metamorphic bedrock of the Grenville Province in northeastern North America is exposed at Earth's surface.



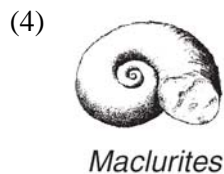
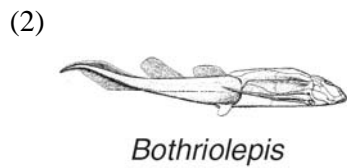
45. The bedrock of the Grenville Province is generally thought to have formed approximately
 (1) 250 million years ago (2) 400 million years ago (3) 560 million years ago (4) 1100 million years ago
46. Which location has surface bedrock that consists mostly of gneiss, schist, or marble?
 (1) 43° N 81° W (2) 46° N 78° W (3) 47° N 69° W (4) 49° N 71° W
47. Which New York State location has surface bedrock that consists mainly of anorthositic rock?
 (1) Old Forge (2) Massena (3) Mt. Marcy (4) Utica
-
48. Which sequence shows the correct order of Earth's geologic time intervals from oldest to youngest?
 (1) Archean → Mesozoic → Cenozoic → Paleozoic → Proterozoic
 (2) Archean → Proterozoic → Paleozoic → Mesozoic → Cenozoic
 (3) Cenozoic → Mesozoic → Paleozoic → Proterozoic → Archean
 (4) Cenozoic → Paleozoic → Archean → Mesozoic → Proterozoic
49. Approximately what percentage of the estimated age of Earth does the Cenozoic Era represent?
 (1) 1.4% (2) 5.0% (3) 11.9% (4) 65.0%

50. The geologic cross section below shows an unconformity in New York State bedrock layers that have not been overturned. Index fossils found throughout some rock layers are shown.

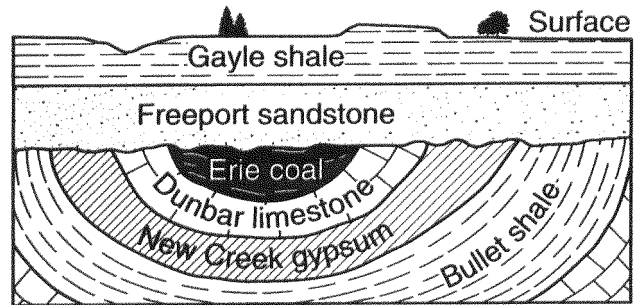


(Not drawn to scale)

Which New York State index fossil may have been present in a rock layer that is missing due to the unconformity?

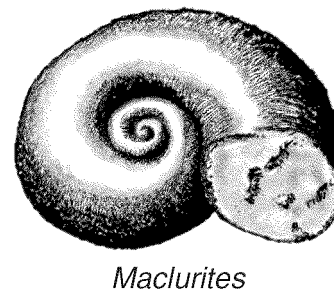


51. The diagram below represents a geologic cross section of a portion of Earth's crust.



Folding and erosion occurred after the formation of the

- (1) Gayle shale
 - (2) Freeport sandstone
 - (3) Erie coal, but before formation of Freeport sandstone
 - (4) Dunbar limestone, but before formation of Erie coal
52. Fossils of trilobites, graptolites, and eurypterids are found in the same bedrock layer in New York State. During which geologic time interval could this bedrock layer have formed?
- (1) Late Ordovician to Early Devonian
 - (2) Late Silurian to Early Cretaceous
 - (3) Early Permian to Late Jurassic
 - (4) Early Cambrian to Middle Ordovician
53. The diagram below shows an index fossil found in surface bedrock in some parts of New York State.



In which New York State landscape region is this gastropod fossil most likely found in the surface bedrock?

- (1) Tug Hill Plateau
- (2) Allegheny Plateau
- (3) Adirondack Mountains
- (4) Newark Lowlands

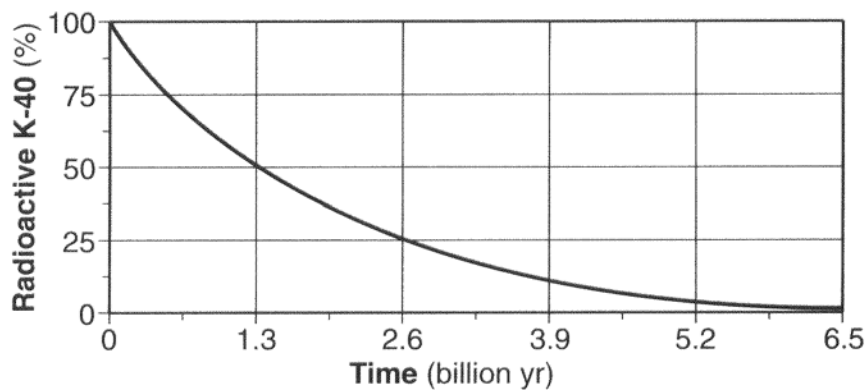
54. Which statement best explains why no Permian-age bedrock is found in New York State?

- (1) The extinction of many life-forms occurred at the end of the Permian Period.
- (2) Only rocks of igneous origin formed in New York State during the Permian Period.
- (3) Permian-age rocks have been metamorphosed and cannot be identified.
- (4) Permian-age rocks were either eroded away or never formed in New York State.

55. There is evidence that an asteroid or a comet crashed into the Gulf of Mexico at the end of the Mesozoic Era. Consequences of this impact event may explain the

- (1) extinction of many kinds of marine animals, including trilobites
- (2) extinction of ammonoids and dinosaurs
- (3) appearance of the earliest birds and mammals
- (4) appearance of great coal-forming forests and insects

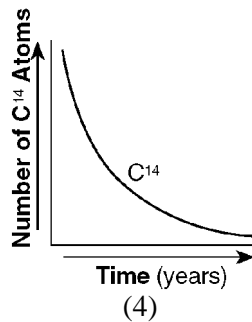
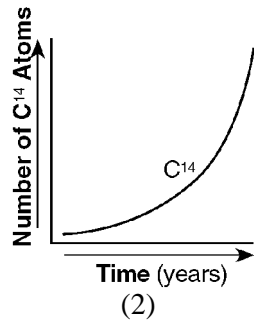
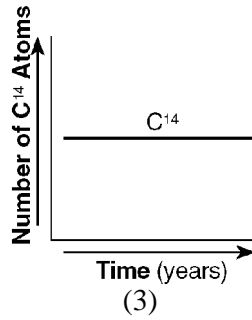
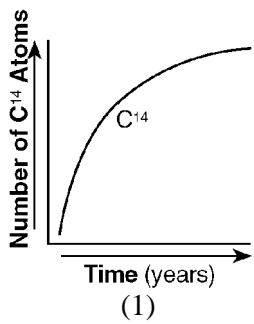
56. The graph below shows the rate of decay of the radioactive isotope K-40 into the decay products Ar-40 and Ca-40.



Analysis of a basalt rock sample shows that 25% of its radioactive K-40 remained undecayed. How old is the basalt?

- (1) 1.3 billion years
- (2) 2.6 billion years
- (3) 3.9 billion years
- (4) 4.6 billion years

57. Which graph best shows the radioactive decay of carbon-14?



58. A sample of wood that originally contained 100 grams of carbon-14 now contains only 25 grams of carbon-14. Approximately how many years ago was this sample part of a living tree?

- (1) 2,850 years (3) 11,400 years
(2) 5,700 years (4) 17,100 years

59. Uranium-238 that crystallized at the same time Earth formed has undergone approximately how many half-lives of radioactive decay?

- (1) one half-life (3) three half-lives
(2) two half-lives (4) four half-lives

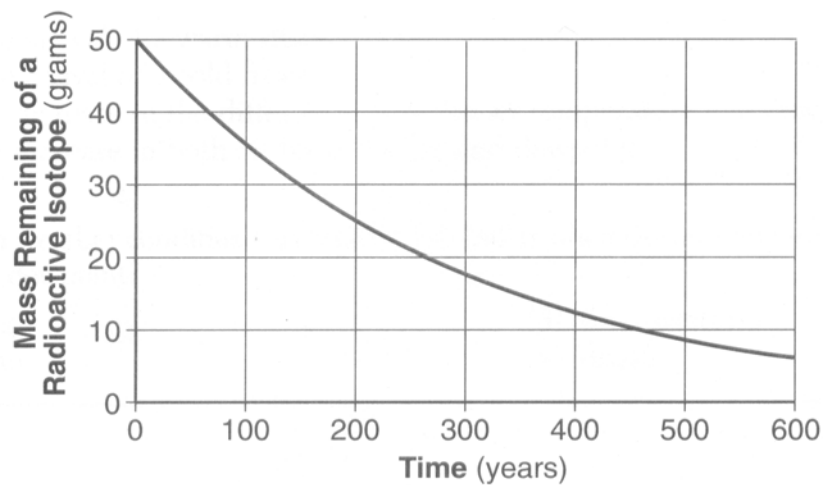
60. Fossil pollen has been recovered from sediments deposited in late-Pleistocene lakes. The pollen's geologic age can most accurately be measured by using

- (1) rubidium-87 (3) oxygen-18
(2) potassium-40 (4) carbon-14

61. The characteristic of the radioactive isotope uranium-238 that makes this isotope useful for accurately dating the age of a rock is the isotope's

- (1) organic origin
(2) constant half-life
(3) common occurrence in sediments
(4) resistance to weathering and erosion

62. The graph below shows the radioactive decay of a 50-gram sample of a radioactive isotope.

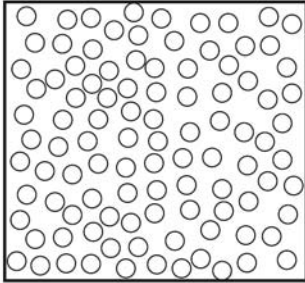


According to the graph, what is the half-life of this isotope?

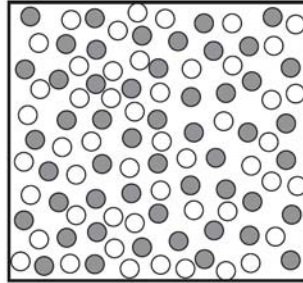
- (1) 100 years (2) 150 years (3) 200 years (4) 300 years

63. The models below represent the decay of radioactive atoms to stable atoms after their first and second half-lives.

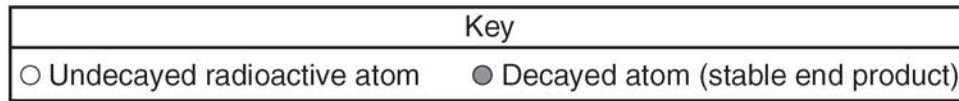
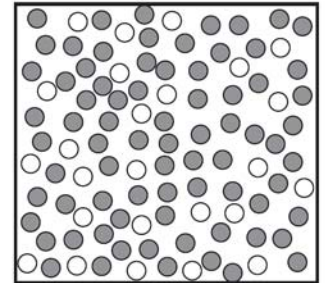
Original sample of undecayed atoms



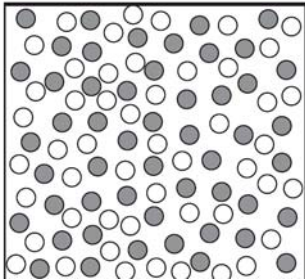
Atoms after one half-life



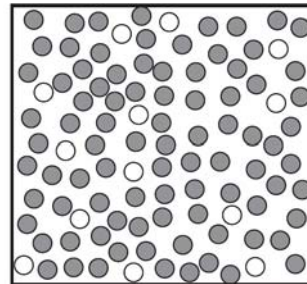
Atoms after two half-lives



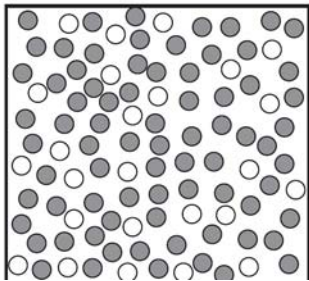
Which model best represents the number of undecayed and decayed atoms after three half-lives?



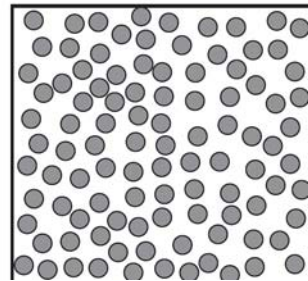
(1)



(3)



(2)



(4)

64. A fossil shell contains 25% of the original amount of its carbon-14. Approximately how many years ago was this shell part of a living organism?

- | | |
|----------------------|----------------------|
| (1) 5,700 years ago | (3) 17,100 years ago |
| (2) 11,400 years ago | (4) 22,800 years ago |

65. The table below gives information about the radioactive decay of carbon-14. Part of the table has been deliberately left blank for student use.

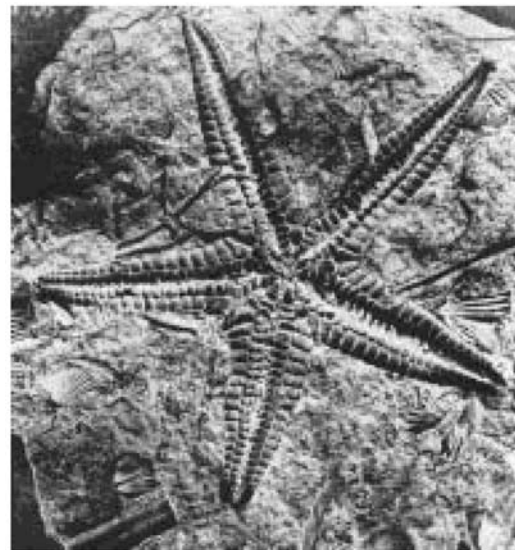
Half-life	Mass of Original Carbon-14 Remaining (grams)	Number of Years
0	1	0
1	$\frac{1}{2}$	5,700
2	$\frac{1}{4}$	11,400
3	$\frac{1}{8}$	17,100
4	$\frac{1}{16}$	
5		
6		
7		

After how many years will $\frac{1}{128}$ gram of the original carbon-14 remain?

- (1) 22,800 yr (3) 34,200 yr
 (2) 28,500 yr (4) 39,900 yr
66. A student filled a graduated cylinder with 1,000 milliliters of water to represent a radioactive substance. After 30 seconds, the student poured out one-half of the water in the cylinder to represent the decay occurring within the first half-life. The student repeated the process every 30 seconds. How much water did the student pour from the cylinder at the 2-minute mark?
- (1) 12.5 mL (3) 125.0 mL
 (2) 62.5 mL (4) 250.0 mL

67. Specific mass extinction of living organisms and global climatic changes in geologic history are inferred by most scientists to have been caused by
- (1) the impact of asteroids or large meteors on Earth's surface
 - (2) the gravitational pull of the Sun on Earth's surface
 - (3) large energy surges from the surface of the Sun
 - (4) earthquakes occurring along crustal plate boundaries

68. The Devonian-aged siltstone shown in the photograph below occurs as surface bedrock near Hamilton, New York.

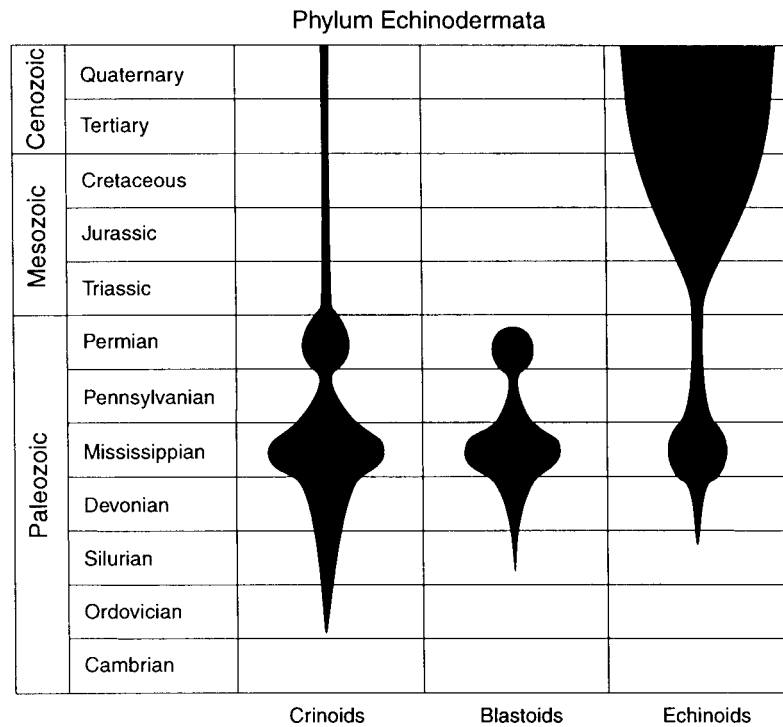


0 2 cm

What does the presence of the fossils suggest about the Hamilton area during the Devonian?

- (1) It had a terrestrial environment sometime between 443 and 418 million years ago.
- (2) It had a terrestrial environment sometime between 418 and 362 million years ago.
- (3) It had a marine environment sometime between 443 and 418 million years ago.
- (4) It had a marine environment sometime between 418 and 362 million years ago.

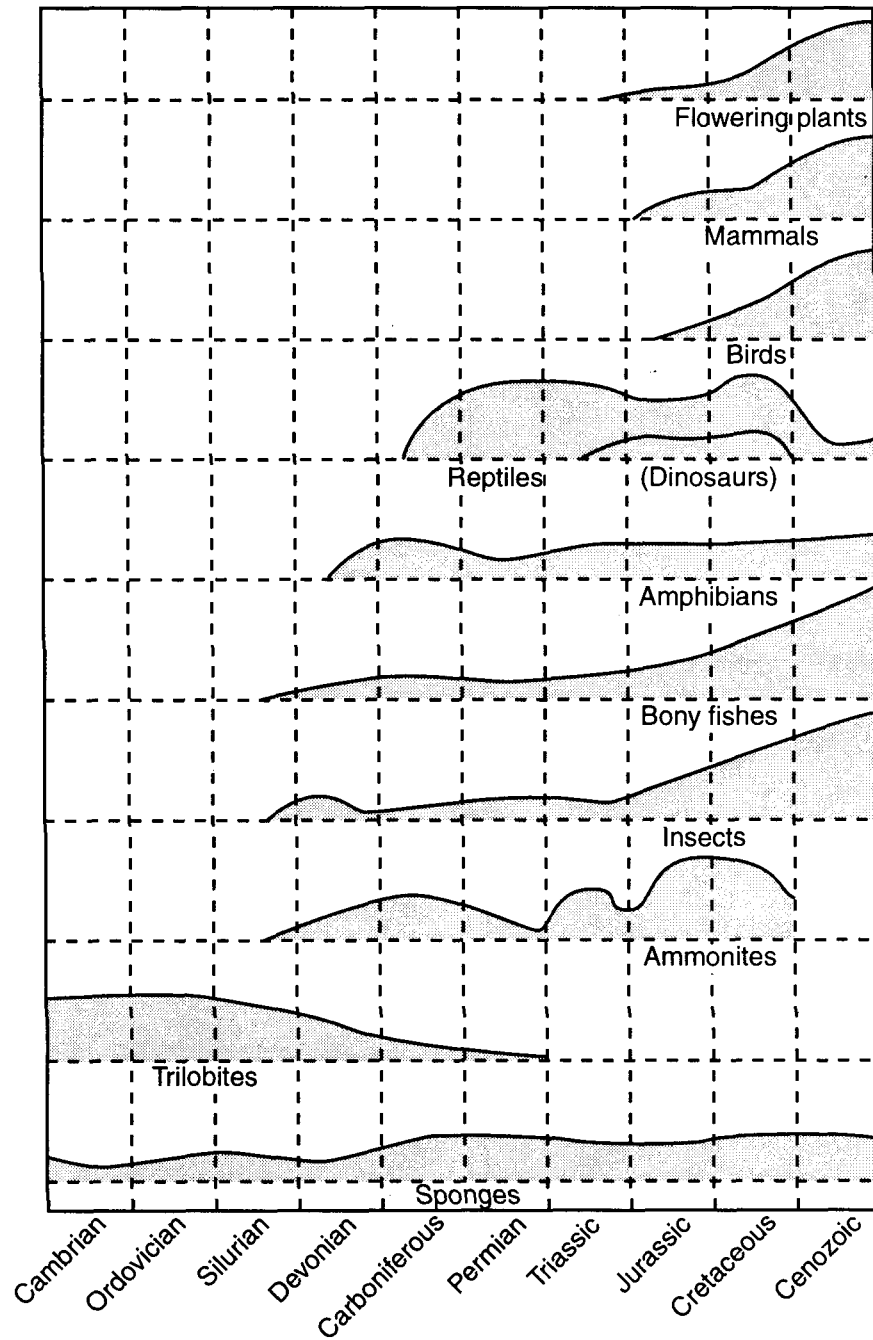
69. The diagram below shows the abundance of organisms called crinoids, blastoids, and echinoids throughout different geologic periods. The number of species living at any given time is represented by the width of the blackened areas.



Which statement about crinoids, blastoids, and echinoids is best supported by the diagram?

- (1) They are now extinct.
- (2) They came into existence during the same geologic period.
- (3) They existed during the Devonian Period.
- (4) They have steadily increased in number since they first appeared.

70. Base your answer to the following question on the chart below. The thickness of the shaded areas shows the relative abundance of some animals and plants through geologic time.



Which life-form was most abundant 250 million years ago?

- (1) dinosaurs (2) reptiles (3) bony fishes (4) trilobites

71. According to fossil evidence, which sequence shows the order in which these four life-forms first appeared on Earth?

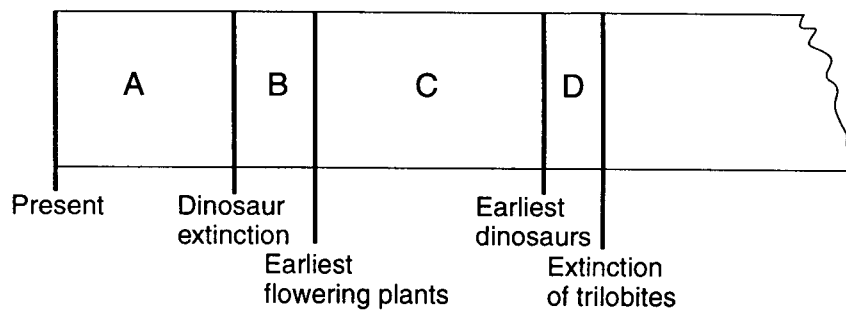
- (1) reptiles → amphibians → insects → fish
 (2) insects → fish → reptiles → amphibians
 (3) amphibians → reptiles → fish → insects
 (4) fish → insects → amphibians → reptiles

72. Earth's fossil record shows evidence that
- (1) very few life-forms have become extinct
 - (2) life-forms existed on land before life-forms existed in water
 - (3) more complex life-forms probably have evolved from less complex life-forms
 - (4) older bedrock contains a great variety of lifeforms, while younger bedrock contains less variety of life-forms

73. Which group of organisms, some of which were preserved as fossils in early Paleozoic rocks, are still in existence today?

- (1) brachiopods
- (2) eurypterids
- (3) graptolites
- (4) trilobites

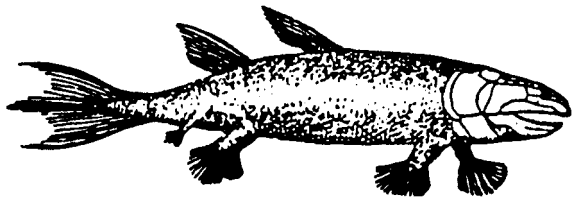
74. The diagram below is a portion of a geologic time line. Letters A through between the labeled events, as estimated by some scientists.



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

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

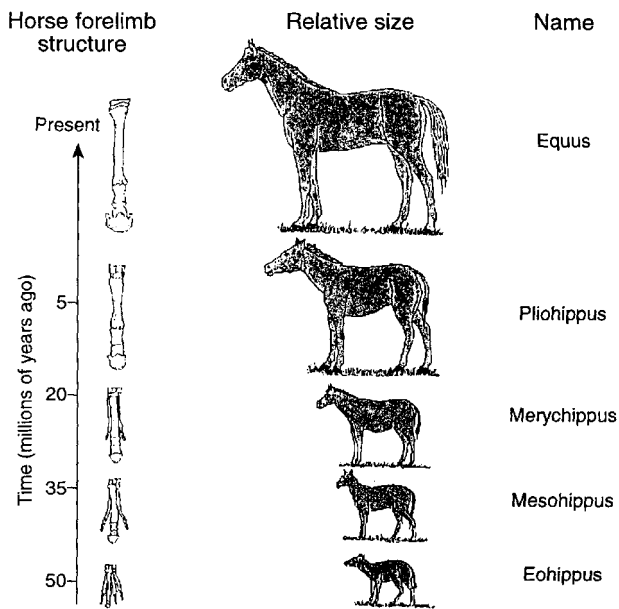
75. The primitive lobe-finned fish shown below is thought to be an ancestor of early amphibians.



This evolutionary development from fish to amphibian is believed to have occurred during the

- (1) Triassic Period
- (2) Devonian Period
- (3) Tertiary Period
- (4) Permian Period

76. Base your answer to the following question on the diagram, which shows the evolutionary development of the horse, as supported by the fossil record.



Which statement best explains the changing appearance of the horse, as supported by the fossil record?

- (1) The horse evolved due to the influence of humans.
- (2) The horse evolved from a complex life-form to a simpler life-form.
- (3) The horse evolved into a life-form better able to survive.
- (4) The horse evolved from larger ancestors without forelimbs.

77. The changes observed in the fossil record from the Precambrian Era to the Cenozoic Era best provide evidence of

- (1) sublimation
- (2) radioactive decay
- (3) evolution
- (4) planetary motion

78. Theories of evolution suggest that variations between members of the same species give the species greater probability of

- (1) remaining unchanged
- (2) surviving environmental changes
- (3) becoming fossilized
- (4) becoming extinct

79. Trilobite fossils from different time periods show small changes in appearance. These observations suggest that the changes may be the result of

- (1) evolutionary development
- (2) a variety of geologic processes
- (3) periods of destruction of the geologic record
- (4) the gradual disintegration of radioactive substances

Base your answers to questions **80** through **83** on the passage and the cross section below. The passage describes the geologic history of the Pine Bush region near Albany, New York. The cross section shows the bedrock and overlying sediment along a southwest to northeast diagonal line through a portion of this area. Location A shows an ancient buried stream channel and location B shows a large sand dune.

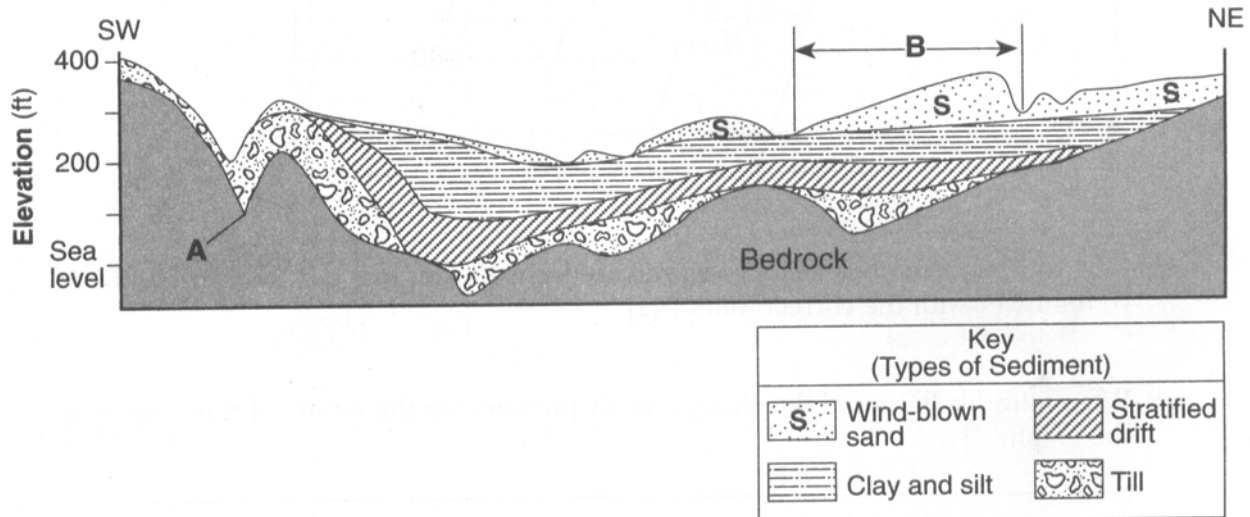
The Pine Bush Region

The Pine Bush region, just northwest of Albany, New York, is a 40-square mile area of sand dunes and wetlands covered by pitch pine trees and scrub oak bushes. During the Ordovician Period, this area was covered by a large sea. Layers of mud and sand deposited in this sea were compressed into shale and sandstone bedrock.

During most of the Cenozoic Era, running water eroded stream channels into the bedrock. One of these buried channels is shown at location A in the cross section. Over the last one million years of the Cenozoic Era, this area was affected by glaciation. During the last major advance of glacial ice, soil and bedrock were eroded and later deposited as till (a mixture of boulders, pebbles, sand, and clay).

About 20,000 years ago, the last glacier in New York State began to melt. The meltwater deposited pebbles and sand, forming the stratified drift. During the 5000 years it took to melt this glacier, the entire Pine Bush area became submerged under a large 350-foot-deep glacial lake called Lake Albany. Delta deposits of cobbles, pebbles, and sand formed along the lake shorelines, and beds of silt and clay were deposited farther into the lake.

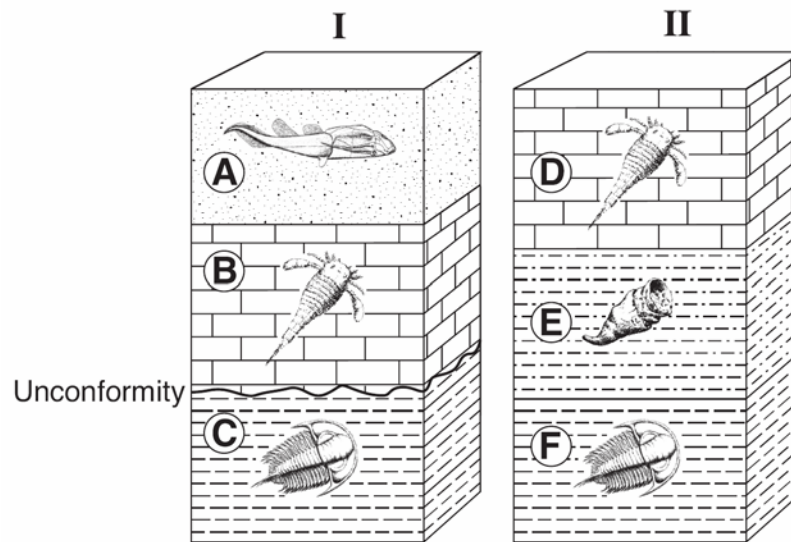
Lake Albany drained about 12,000 years ago, exposing the lake bottom. Wind erosion created the sand dunes that cover much of the Pine Bush area today.



80. How does the shape of the sand dune at location *B* provide evidence that the prevailing winds that formed this dune are blowing from the southwest?
81. Explain why the till layer is composed of unsorted sediment.
82. List, from oldest to youngest, the *four* types of sediment shown above the bedrock in the cross section.

83. What evidence shown at location A suggests that the channel in the bedrock was eroded by running water?

Base your answers to questions 84 through 87 on the diagrams below, which represent two bedrock outcrops, I and II, found several kilometers apart in New York State. Rock layers are lettered A through F. Drawings represent specific index fossils.



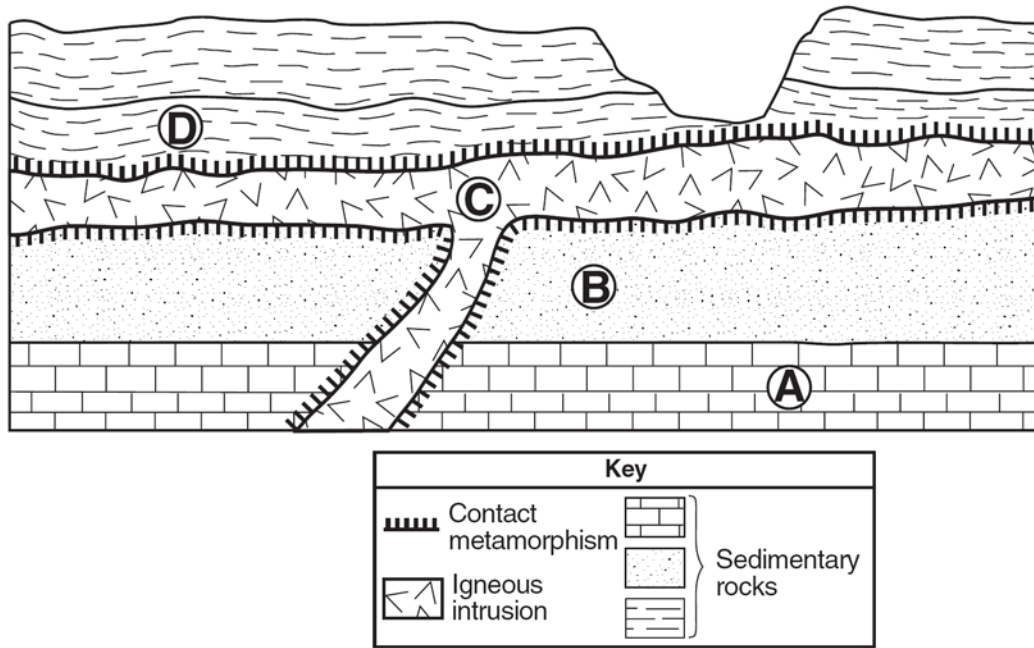
84. Explain why carbon-14 can *not* be used to find the geologic age of these index fossils.

85. Describe *one* characteristic a fossil must have in order to be considered a good index fossil.

86. Identify *two* processes that produced the unconformity in outcrop I.

87. During which geologic time period was rock layer C deposited?

88. Base your answer to the following question on the cross section below. The cross section shows a portion of Earth's crust. Letters *A*, *B*, *C*, and *D* represent rock units that have not been overturned.



State *one* piece of evidence shown in the cross section that indicates that rock unit *D* is older than igneous intrusion *C*.

Answer Key

1. 1 27. 2 53. 1 79. 1
2. 4 28. 1 54. 4
3. 1 29. 2 55. 2
4. 1 30. 2 56. 2
5. 3 31. 1 57. 4
6. 4 32. 4 58. 3
7. 1 33. 2 59. 1
8. 2 34. 3 60. 4
9. 3 35. 4 61. 2
10. 2 36. 2 62. 3
11. 4 37. 2 63. 3
12. 4 38. 1 64. 2
13. 2 39. 4 65. 4
14. 1 40. 3 66. 2
15. 3 41. 3 67. 1
16. 4 42. 2 68. 4
17. 3 43. 4 69. 3
18. 1 44. 3 70. 2
19. 4 45. 4 71. 4
20. 1 46. 2 72. 3
21. 3 47. 3 73. 1
22. 4 48. 2 74. 3
23. 1 49. 1 75. 2
24. D and the igneous intrusions 50. 2 76. 3
25. 3 51. 3 77. 3
26. 2 52. 1 78. 2
80. *Examples:* –The gentle slope of the dune is on the southwest side. –The windward side has a less steep slope. –The steeper side is leeward.
81. *Example:* –Glacial deposits are unsorted. –Till is a direct ice deposit.
82. 1.till
2.stratified drift
3.clay and silt
4.wind-blown sand
83. *Examples:* –The channel at A has a V-shape. –Running water produces V-shaped channels.
84. *Examples:* — Carbon-14’s half-life is too short. — Not enough carbon-14 is left to measure. — The fossils are too old.
85. *Examples:* — widespread geographic distribution — short existence in geologic time
86. *Examples:* — uplift — erosion — weathering — subsidence — deposition — burial
87. Cambrian Period
88. *Examples:* — Intrusions are younger than any rock they metamorphose. — Contact metamorphism can be seen between rock layer
-