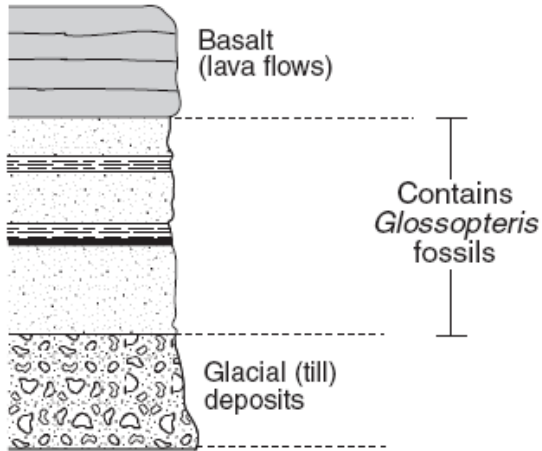


## Earth's History Regents Review

The cross section below shows a rock sequence that has not been overturned.



Which event occurred last at this location?

- (1) Shale was deposited.
- (2) Glacial till was deposited.
- (3) Basaltic lava flows solidified.
- (4) *Glossopteris* flourished and then became extinct.

During which two geologic time periods did most of the surface bedrock of the Taconic Mountains form?

- (1) Cambrian and Ordovician
- (2) Silurian and Devonian
- (3) Pennsylvanian and Mississippian
- (4) Triassic and Jurassic

Which event in Earth's history was dependent on the development of a certain type of life-form?

- (1) addition of free oxygen to Earth's atmosphere
- (2) formation of clastic sedimentary rocks
- (3) movement of tectonic plates
- (4) filling of the oceans by precipitation

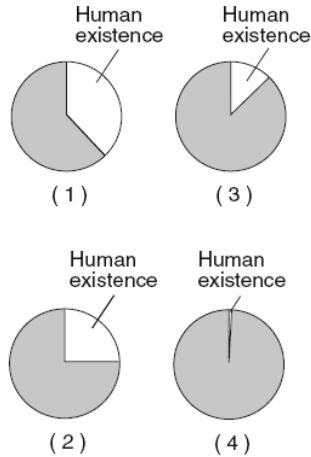
How old is a fossil that has radioactively decayed through 4 half-lives of carbon-14?

- |                  |                  |
|------------------|------------------|
| (1) 5,700 years  | (3) 22,800 years |
| (2) 17,100 years | (4) 28,500 years |

Which geologic event occurred in New York State at approximately the same time that eurypterids were becoming extinct?

- (1) the opening of the Atlantic Ocean
- (2) the uplift of the Appalachian Mountains
- (3) the formation of the Catskill Delta
- (4) the intrusion of the Palisades Sill

Which graph best represents human existence on Earth, compared with Earth's entire history?



Alternating parallel bands of normal and reversed magnetic polarity are found in the basaltic bedrock on either side of the

- (1) Mid-Atlantic Ridge
- (2) Yellowstone Hot Spot
- (3) San Andreas Fault
- (4) Peru-Chile Trench

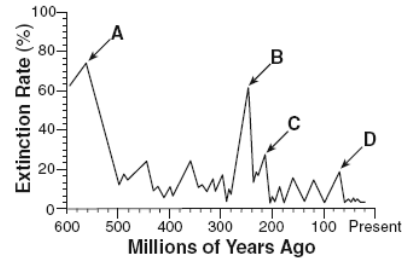
One reason *Tetragraptus* is considered a good index fossil is that *Tetragraptus*

- (1) existed during a large part of the Paleozoic Era
- (2) has no living relatives found on Earth today
- (3) existed over a wide geographic area
- (4) has been found in New York State

A whalebone that originally contained 200 grams of radioactive carbon-14 now contains 25 grams of carbon-14. How many carbon-14 half-lives have passed since this whale was alive?

- (1) 1
- (2) 2
- (3) 3
- (4) 4

The graph below shows the extinction rate of organisms on Earth during the last 600 million years. Letters A through D represent mass extinctions.



Which letter indicates when dinosaurs became extinct?

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

Which geologic event occurred in New York State at approximately the same time that eurypterids were becoming extinct?

- (1) the opening of the Atlantic Ocean
- (2) the uplift of the Appalachian Mountains
- (3) the formation of the Catskill Delta
- (4) the intrusion of the Palisades Sill

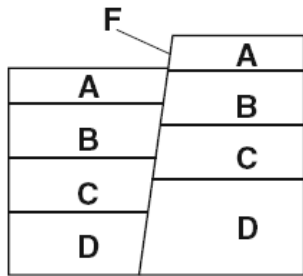
An igneous rock contains 10 grams of radioactive potassium-40 and a total of 10 grams of its decay products. During which geologic time interval was this rock most likely formed?

- (1) Middle Archean
- (2) Late Archean
- (3) Middle Proterozoic
- (4) Late Proterozoic

Scientists believe that a large asteroid struck Earth approximately 65 million years ago. It is often theorized that this event contributed to the

- (1) end of the last ice age
- (2) breaking up of the supercontinent Pangea
- (3) evolution of the first birds
- (4) extinction of the dinosaurs

The cross section below shows rock layers A, B, C, D, and fault F. The rock layers have not been overturned.



Which sequence places the rock layers and fault in order from oldest to youngest?

- (1)  $D \rightarrow C \rightarrow B \rightarrow A \rightarrow F$
- (2)  $A \rightarrow B \rightarrow C \rightarrow D \rightarrow F$
- (3)  $F \rightarrow D \rightarrow C \rightarrow B \rightarrow A$
- (4)  $F \rightarrow A \rightarrow B \rightarrow C \rightarrow D$

Which two landscape regions in New York State have the oldest surface bedrock?

- (1) Allegheny Plateau and Newark Lowlands
- (2) Tug Hill Plateau and Erie-Ontario Lowlands
- (3) Taconic Mountains and the Catskills
- (4) Adirondack Mountains and Hudson Highlands

The presence of eurypterid fossils in New York State bedrock indicates that

- (1) eurypterids lived in land environments
- (2) eurypterids first appeared on Earth during the Devonian Period
- (3) most of New York State was once a mountainous region
- (4) areas of New York State were once covered with shallow seas

The presence of brachiopod, nautiloid, and coral fossils in the surface bedrock of a certain area indicates the area was once covered by

- (1) tropical vegetation
- (2) glacial deposits
- (3) volcanic ash
- (4) ocean water

What is the geologic age sequence of the surface bedrock from Ithaca, New York, to Watertown, New York?

- (1) Ordovician, Taconic, Cambrian
- (2) Ordovician, Tertiary, Pleistocene
- (3) Devonian, Silurian, Cambrian
- (4) Devonian, Silurian, Ordovician

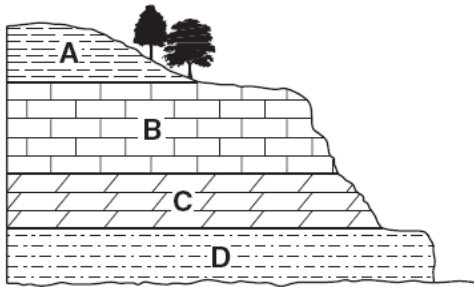
Which group of organisms is inferred to have existed for the *least* amount of time in geologic history?

- (1) trilobites
- (2) dinosaurs
- (3) eurypterids
- (4) placoderm fish

Based on fossil evidence, most scientists infer that

- (1) life has not changed significantly throughout Earth's history
- (2) life has evolved from complex to simple forms
- (3) many organisms that lived on Earth have become extinct
- (4) mammals developed early in the Precambrian time period

The cross section below shows sedimentary bedrock layers A, B, C, and D exposed at Earth's surface.



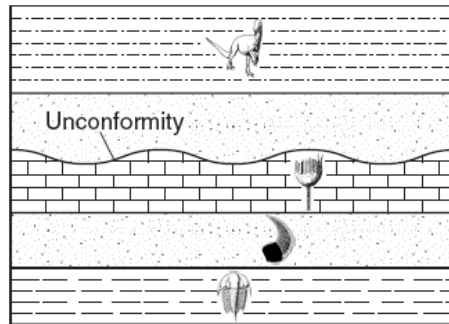
Which layer appears to be the *least* resistant to weathering?

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

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

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.



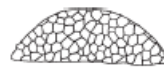
(Not drawn to scale)

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



Condor

(1)



*Lichenaria*

(3)



*Bothriolepis*

(2)



*Maclurites*

(4)

Earth's early atmosphere formed during the Early Archean Era. Which gas was generally absent from the atmosphere at that time?

- (1) water vapor                      (3) nitrogen
- (2) carbon dioxide                (4) oxygen

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

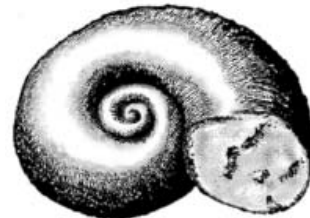
Which statement best explains why no Permian age bedrock is found in New York State?

- (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.

Which characteristic is most useful in correlating Devonian-age sedimentary bedrock in New York State with Devonian-age sedimentary bedrock in other parts of the world?

- (1) color                                (3) rock types
- (2) index fossils                      (4) particle size

The diagram below shows an index fossil found in surface bedrock in some parts of New York State.



*Maclurites*

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

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

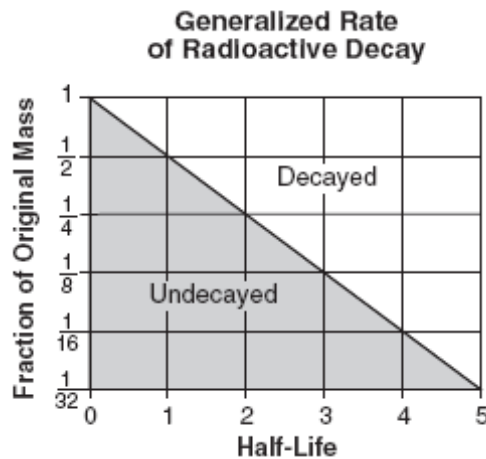
The fossil below was found in surface bedrock in the eastern United States.



Which statement best describes the formation of the rock containing this fossil?

- (1) The rock was formed by the metamorphism of sedimentary rock deposited in a terrestrial environment during the Cretaceous Period.
  - (2) The rock was formed by the compaction and cementation of sediments deposited in a terrestrial environment during the Triassic Period.
  - (3) The rock was formed by the compaction and cementation of sediments deposited in a marine environment during the Cambrian Period.
  - (4) The rock was formed from the solidification of magma in a marine environment during the Triassic Period.
- 

Base your answers to the following 2 questions on the graph below, which shows the generalized rate of decay of radioactive isotopes over 5 half-lives.



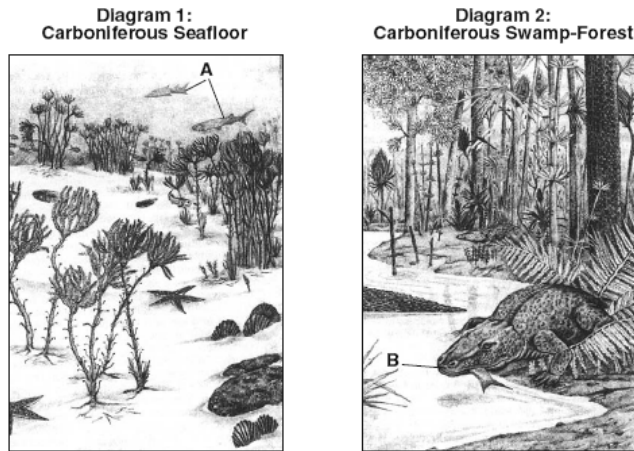
If the original mass of a radioactive isotope was 24 grams, how many grams would remain after 3 half-lives?

- (1) 12
- (2) 24
- (3) 3
- (4) 6

Which radioactive isotope takes the greatest amount of time to undergo the change shown on the graph?

- (1) carbon-14
  - (2) potassium-40
  - (3) uranium-238
  - (4) rubidium-87
-

Base your answers on the following 2 on the diagrams below. Diagram 1 is a drawing of a seafloor environment during the Carboniferous Period. Diagram 2 is a drawing of a Carboniferous swamp-forest environment. Two organisms are labeled *A* and *B*.



Adapted from: Chet Raymo and Maureen Raymo, *Written in Stone: A Geological History of the Northeastern United States*, Second Edition, Black Dome Press Corp., 2001

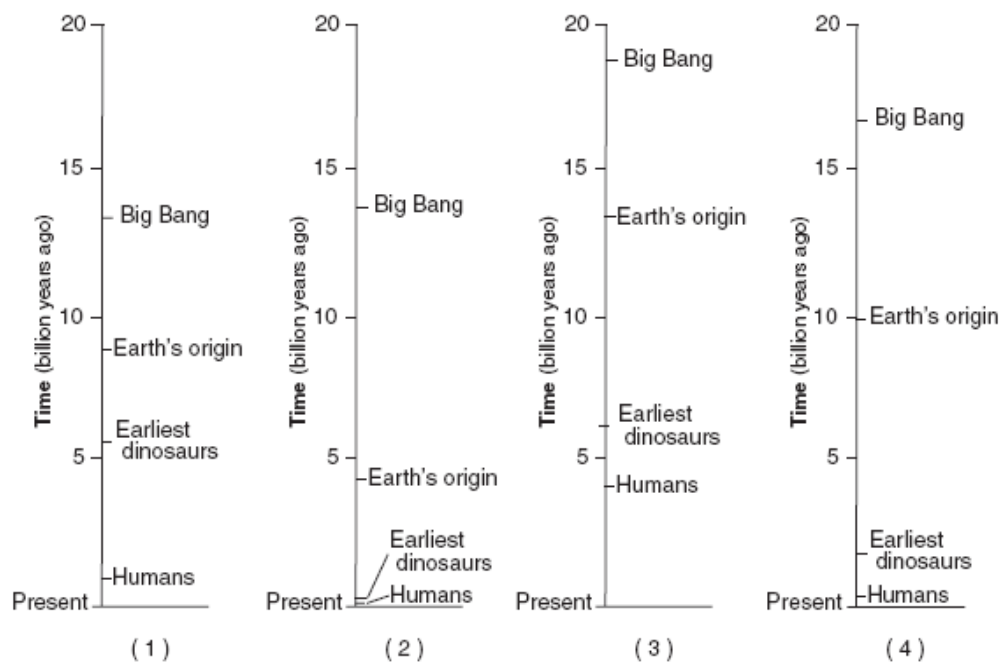
If the fish labeled *A* in diagram 1 are placoderms, the diagram represents conditions during which geologic epoch?

- (1) Early Mississippian
- (2) Late Mississippian
- (3) Early Pennsylvanian
- (4) Late Pennsylvanian

29 In which type of rock would fossils of organisms *A* and *B* most likely be found?

- (1) felsic igneous
- (2) vesicular igneous
- (3) clastic sedimentary
- (4) nonfoliated metamorphic

Which time line most accurately indicates when this sequence of events in Earth's history occurred?



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

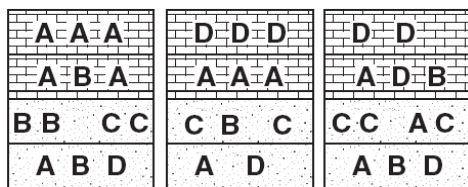
Which statement can best be supported by the fossil record?

- (1) Humans have lived on Earth throughout geologic history.
- (2) The organisms on Earth have not changed.
- (3) Most life-forms that existed on Earth have become extinct.
- (4) Dinosaurs existed on Earth for more than 544 million years.

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%

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.

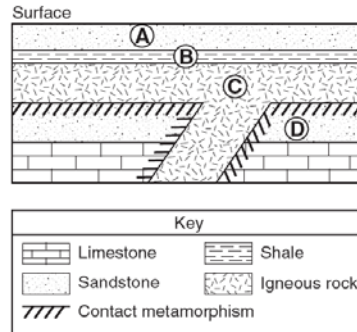


Which letter best represents an index fossil?

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

The diagram below shows a geologic cross section.

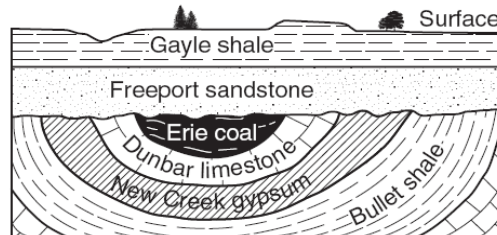
Letters A through D represent different rock units.



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

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

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



## Fossils and the History of Earth's Rotation

Data from coral fossils support the hypothesis that Earth's rotation rate has been slowing down by about 2.5 seconds per 100,000 years. Scientists believe this is due to the frictional effects of ocean tides. This slowing rotation rate decreases the number of days in the year. Scientists have discovered that corals produce a thin layer of shell every day, resulting in growth rings. These daily layers are separated by yearly ridges. The Devonian coral fossil, *Pleurodictyum*, has approximately 400 growth rings between each yearly ridge, which suggests that there were about 400 days in a year during the Devonian Period. Supporting this hypothesis, scientists have found coral from the Pennsylvanian Period that have about 390 growth rings per year, while present-day corals have about 365 growth rings per year.

Approximately how many fewer Earth days per year are there today than there were during the Devonian Period?

- (1) 10
- (2) 25
- (3) 35
- (4) 40

What inference can be made about the number of growth rings per year for a coral from the Permian Period and Ordovician Period compared to the number of growth rings per year for the Devonian coral, *Pleurodictyum*?

- (1) Ordovician coral would have fewer, but Permian coral would have more.
- (2) Ordovician coral would have more, but Permian coral would have fewer.
- (3) Both Ordovician and Permian coral would have fewer.
- (4) Both Ordovician and Permian coral would have more.

The evidence of the fossil *Pleurodictyum* found in surface bedrock in the Finger Lakes region of New York State suggests that this region was once

- (1) covered by a glacial ice sheet
- (2) covered by a warm, shallow sea
- (3) located in a desert area
- (4) located in a tropical rain forest

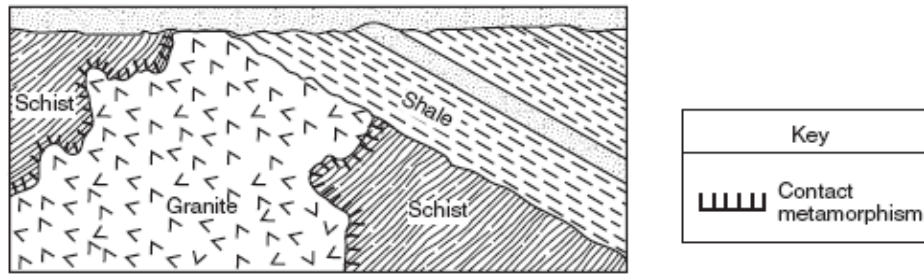
It is inferred that during the early Archean Era the atmosphere of Earth contained water vapor, carbon dioxide, nitrogen, and other gases in small amounts. These gases probably came from

- (1) precipitation of groundwater
- (2) volcanic eruptions
- (3) evaporation of Paleozoic oceans
- (4) convection currents in the mantle

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

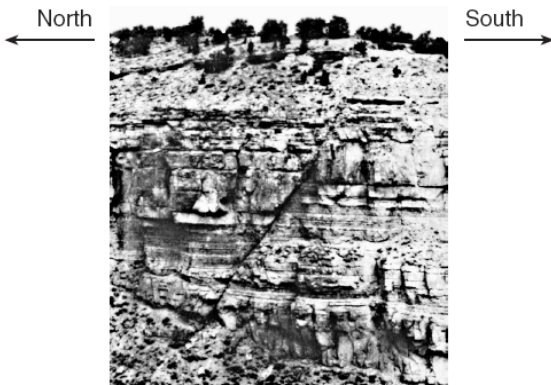
The geologic cross section below shows a complex structure containing a granite intrusion.



If the granite intrusion occurred 24 million years ago, what are the most probable ages of the schist and shale, in millions of years?

- (1) schist – 25; shale – 23  
 (2) schist – 25; shale – 26  
 (3) schist – 23; shale – 25  
 (4) schist – 23; shale – 20

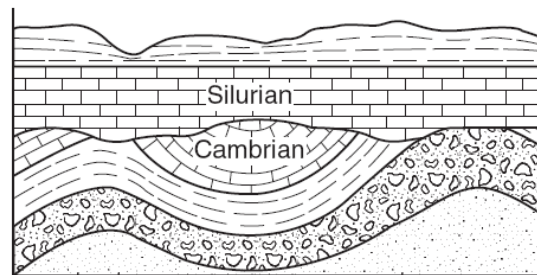
The photograph below shows an escarpment (cliff) located in the western United States. The directions for north and south are indicated by arrows. A fault in the sedimentary rocks is shown on the front of the escarpment.



The photograph shows that the fault most likely formed

- (1) after the rock layers were deposited, when the north side moved downward  
 (2) after the rock layers were deposited, when the north side moved upward  
 (3) before the rock layers were deposited, when the south side moved downward  
 (4) before the rock layers were deposited, when the south side moved upward

The geologic cross section below shows the geologic age of two rock layers separated by an unconformity.



The unconformity at the bottom of the Silurian rock layer indicates a gap in the geologic time record. What is the *minimum* time, in millions of years, shown by the gap?

- (1) 13  
 (2) 47  
 (3) 101  
 (4) 126

Which type of rock most likely contains fossils?

- (1) scoria
- (2) gabbro
- (3) schist
- (4) shale

Fossilized footprints of *Coelophysis* dinosaurs have been found in bedrock closest to which New York State location?

- (1) New York City
- (2) Old Forge
- (3) Watertown
- (4) Niagara Falls

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 life forms, while younger bedrock contains less variety of life-forms

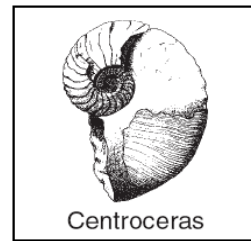
Which mountain range resulted from the collision of North America and Africa, as parts of Pangea joined together in the late Pennsylvanian Period?

- (1) Appalachian Mountains
- (2) Acadian Mountains
- (3) Taconic Mountains
- (4) Grenville Mountains

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

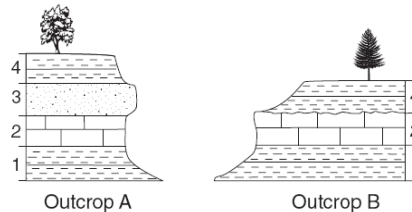
The diagram below shows a fossil found in the surface bedrock of New York State.



Which other fossil is most likely to be found in the same age bedrock?

- (1) *Phacops*
- (2) condor
- (3) *Coelophysis*
- (4) *Tetragraptus*

Bedrock outcrops *A* and *B* are located at two different locations along the Genesee River in western New York State. Rock layers 1, 2, and 4 are the same in both outcrops. Which statement best explains why rock layer 3 is missing from outcrop *B*?



- (1) A fault exists between outcrops *A* and *B*.
- (2) Erosion created an unconformity between rock layers 2 and 4 in outcrop *B*.
- (3) A volcanic eruption destroyed rock layer 3 in outcrop *B*.
- (4) Metamorphism of outcrop *A* created rock layer 3.

According to plate tectonic theory, during which geologic time interval did the continents of North America and Africa separate, resulting in the initial opening of the Atlantic Ocean?

- (1) Mesozoic Era           (3) Proterozoic Eon
- (2) Paleozoic Era       (4) Archean Eon

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

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

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

Near which location in New York State would a geologist have the greatest chance of finding dinosaur footprints in the surface bedrock?

- (1) 41° 10' N latitude, 74° W longitude
- (2) 42° 10' N latitude, 74° 30' W longitude
- (3) 43° 30' N latitude, 76° W longitude
- (4) 44° 30' N latitude, 75° 30' W longitude

Bedrock of which four consecutive geologic periods is best preserved in New York State?

- (1) Cambrian, Ordovician, Silurian, Devonian
- (2) Devonian, Carboniferous, Permian, Triassic
- (3) Permian, Triassic, Jurassic, Cretaceous
- (4) Jurassic, Cretaceous, Tertiary, Quaternary

According to the Geologic History of New York State in the *Earth Science Reference Tables*, the inferred latitude of New York State 362 million years ago was closest to

- (1) where it is now       (3) the Equator
- (2) the North Pole       (4) 45° south

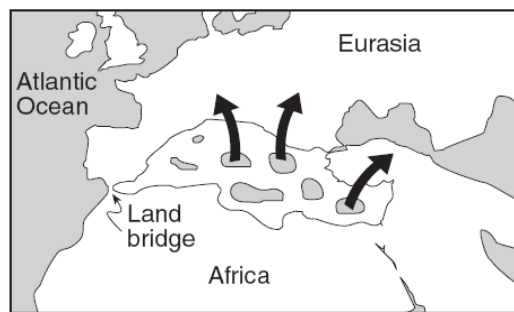
Fossil pollen has been recovered from sediments deposited in late-Pleistocene lakes. The pollen's geologic age can most accurately be measured by using

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

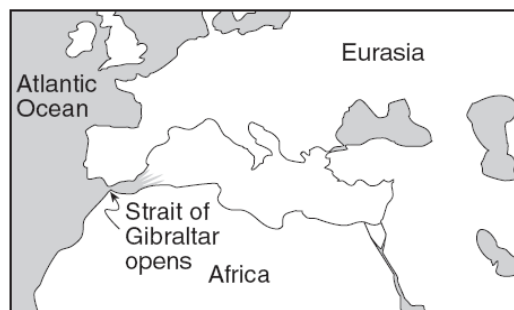
Base your answers on the next 2 questions on the maps below, which show changes in the distribution of land and water in the Mediterranean Sea region that scientists believe took place over a period of 6 million years.



**About 10 Million Years Ago**



**About 8 to 5.5 Million Years Ago  
Evaporation from Mediterranean Sea**



**About 4 Million Years Ago  
Mediterranean Sea Refills  
with Atlantic Ocean Water**

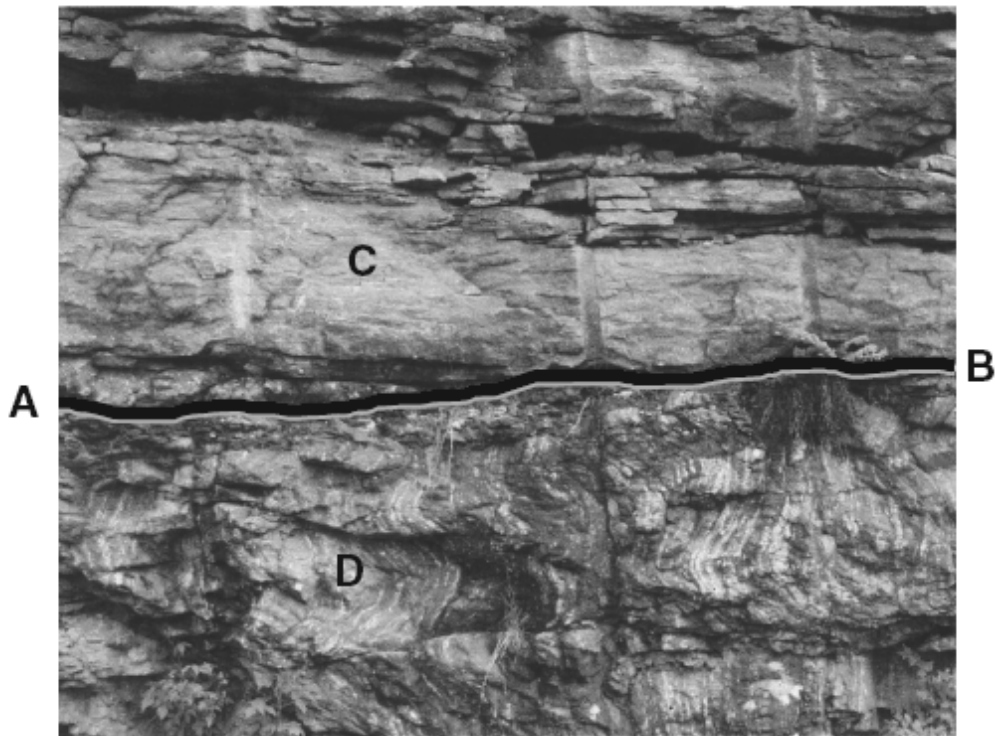
Which type of rock was precipitated from seawater as the Mediterranean Sea evaporated between 8 million years ago and 5.5 million years ago?

- (1) rock salt
- (2) basalt
- (3) sandstone
- (4) metaconglomerate

During which geologic time period did the changes shown in the maps take place?

- (1) Cambrian
- (2) Cretaceous
- (3) Permian
- (4) Neogene

Base your answers on the next 2 questions on the photograph below, which shows a bedrock outcrop in northeastern New York State. Line *AB* is an unconformity between sandstone *C* and metamorphic rock *D*.



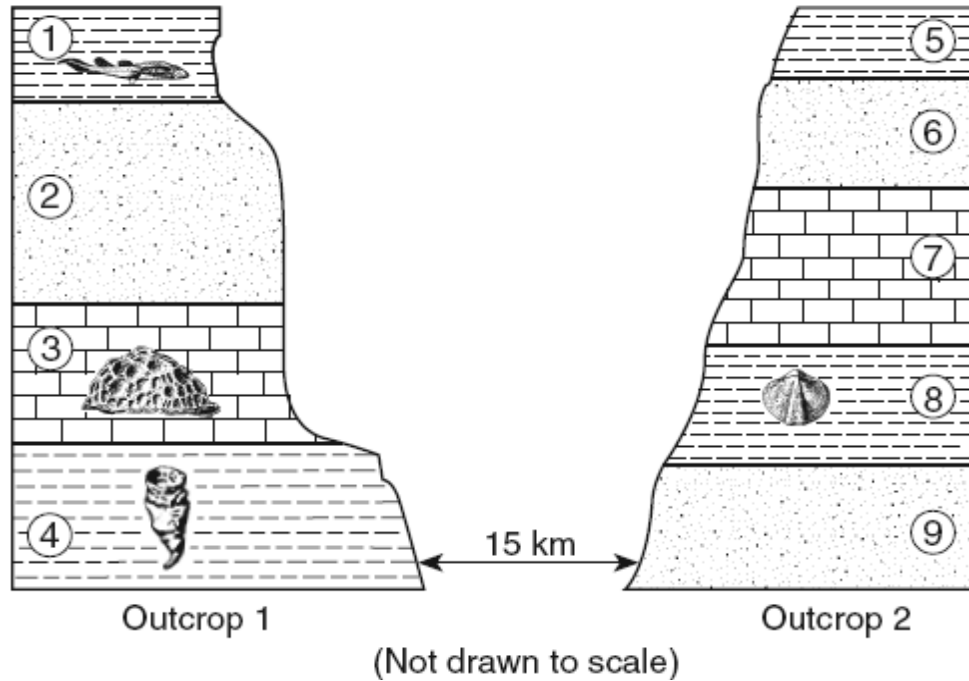
The lower layers of sediment found in sandstone *C* were deposited 520 million years ago. During which period of geologic time did this deposition occur?

- (1) Cambrian
- (2) Ordovician
- (3) Silurian
- (4) Triassic

After the metamorphism of rock *D*, which sequence of events most probably formed unconformity *AB*?

- (1) flooding → deposition → erosion → uplift
  - (2) uplift → erosion → flooding → deposition
  - (3) deposition → flooding → uplift → erosion
  - (4) erosion → flooding → uplift → deposition
-

Base your answers to the next two questions on the cross sections below, which represent two bedrock outcrops 15 kilometers apart. The rock layers have been numbered for identification and some contain the index fossil remains shown.



When these rocks were deposited as sediments, this area was most likely

- (1) under the ocean
- (2) a desert between high mountains
- (3) repeatedly covered by lava flows
- (4) glaciated several times

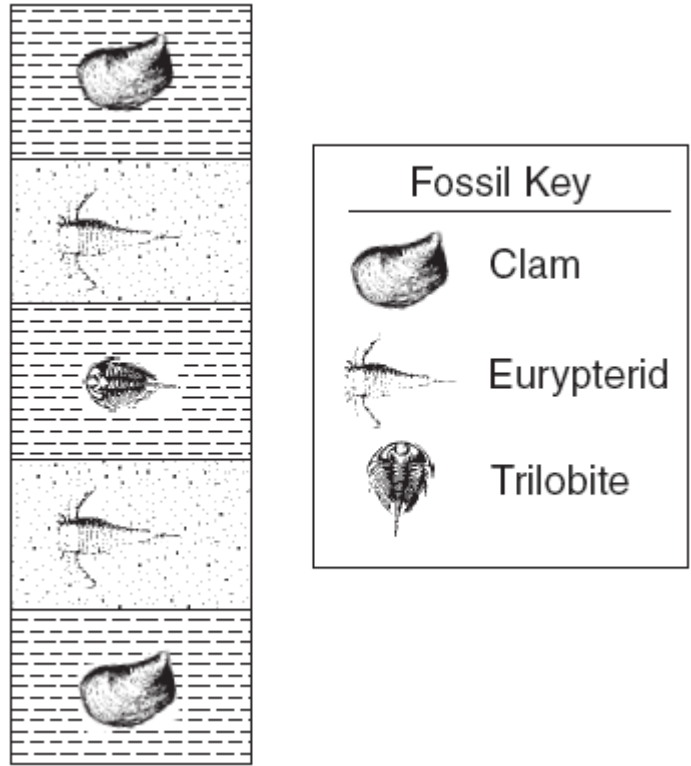
Both organisms that formed the fossils found in rock layers 3 and 4

- (1) lived during the same period of geologic time
- (2) lived in polar regions
- (3) are members of the same group of organisms
- (4) are still alive today

Evidence best indicates that rock layers 4 and 8 were deposited during the same geologic period because both layers

- (1) contain the same index fossil
- (2) are composed of glacial sediments
- (3) contain index fossils of the same age
- (4) are found in the same area

The diagram below represents bedrock layers found in an outcrop. Three index fossils are found within the bedrock layers.



Which evidence best suggests that this outcrop has undergone crustal movement?

- (1) The same rock layers appear twice within the outcrop.
- (2) The trilobite fossil is not found in all five layers.
- (3) The sedimentary layers have the same thickness.
- (4) The eurypterid fossil is absent in the middle layer.

Which index fossil may be found in the surface bedrock near Ithaca, New York?



**Elliptocephala**  
(1)



**Coelophysis**  
(2)



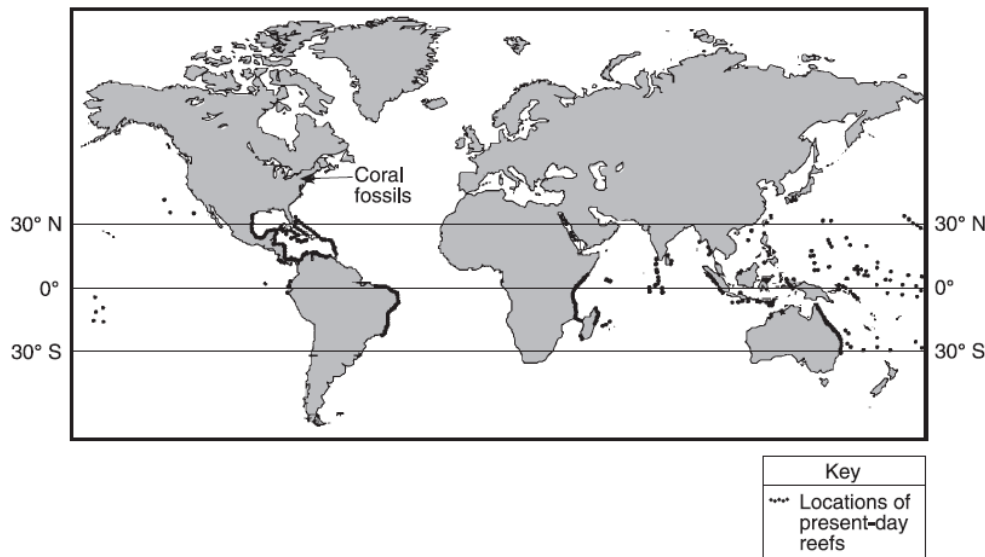
**Bothriolepis**  
(3)



**Maclurites**  
(4)



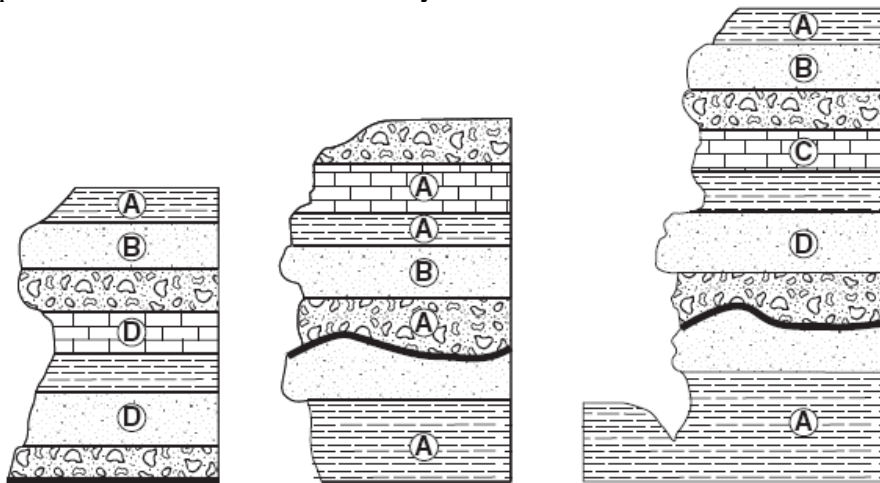
On the map below, the darkened areas represent locations where living corals currently exist. The arrow points to a location where coral fossils have been found in Devonian-age bedrock in New York State.



Devonian-age coral fossils found in some New York State bedrock are *not* located in the same general region that present-day corals are living because during the Devonian Period

- (1) corals migrated to New York State
- (2) corals lived everywhere on Earth
- (3) New York State was closer to the equator
- (4) New York State had a colder climate

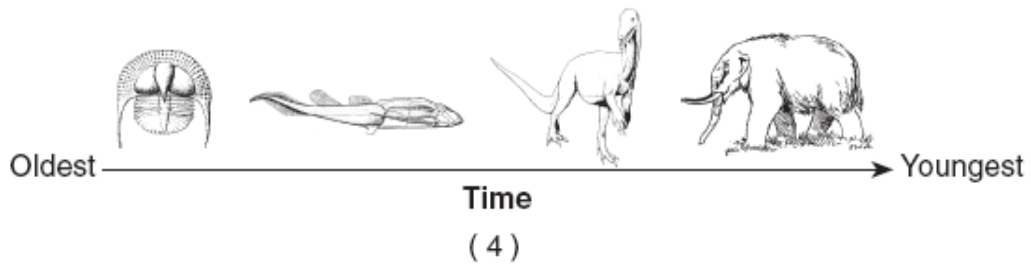
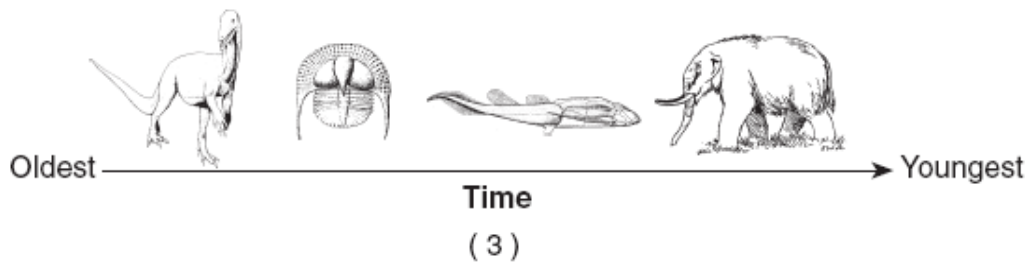
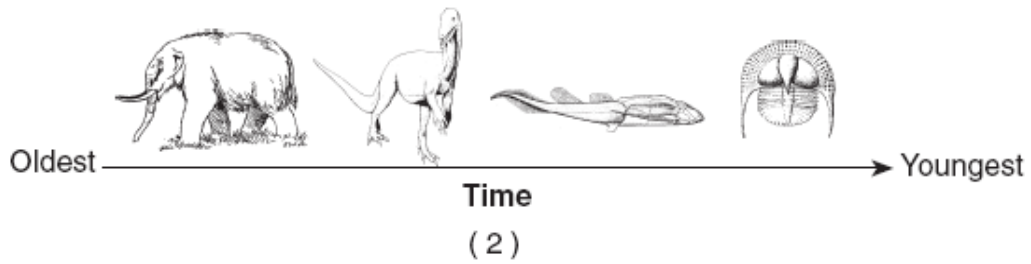
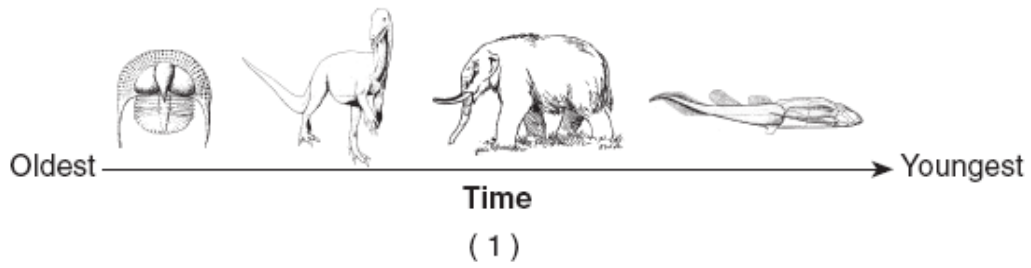
The cross sections below represent three widely separated outcrops of exposed bedrock. Letters A, B, C, and D represent fossils found in the rock layers.



Which fossil appears to have the best characteristics of an index fossil?

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

Which sequence of New York State index fossils shows the order in which the organisms appeared on Earth?



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

Three extinct organisms are shown in the diagrams below.



*Cystiphyllum*,  
a solitary coral



*Baragwanathia*,  
a lycopod — an  
early land plant

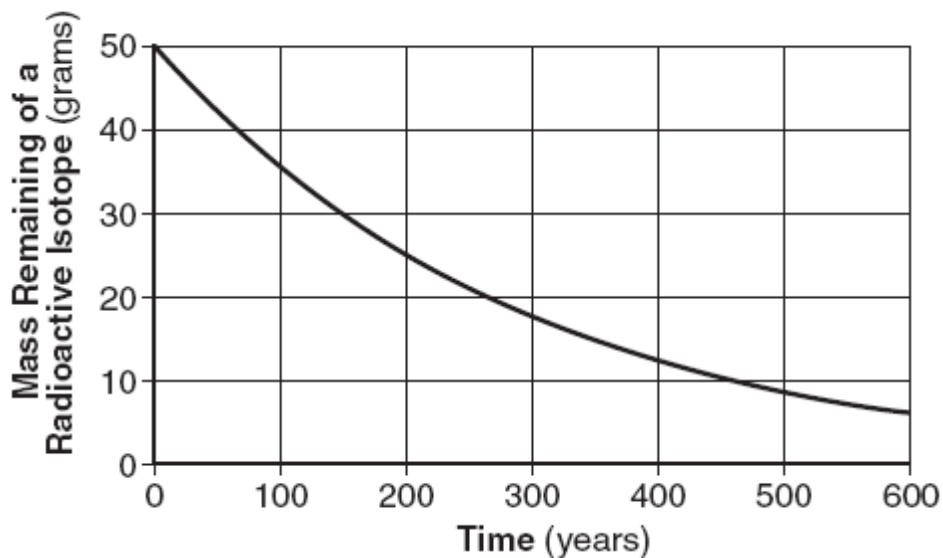


*Palaeophonus*,  
a scorpion — one of  
the first land animals

Which other life-form reached its peak development during the same period in geologic history that these three life-forms first appeared on Earth?

- (1) dinosaurs  
(2) stromatolites  
(3) mastodonts  
(4) eurypterids
- 

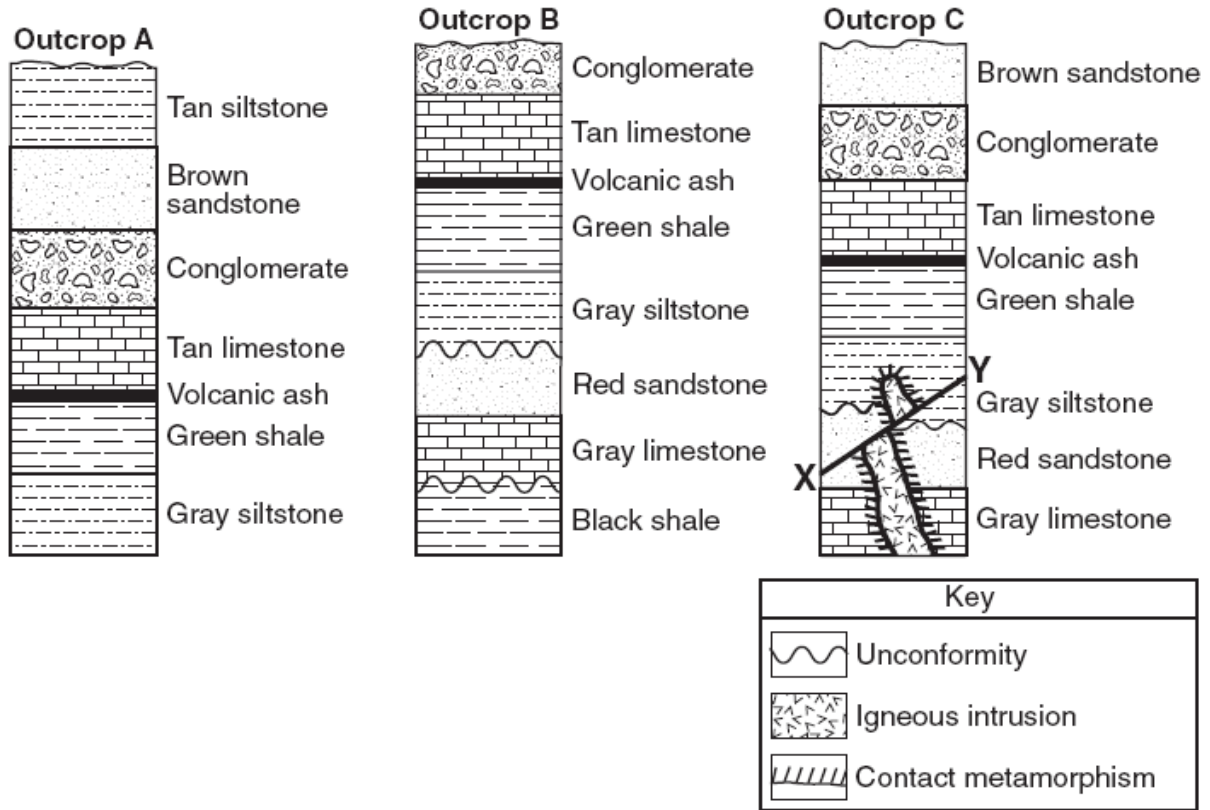
The graph below shows the radioactive decay of a 50-gram sample of a radioactive isotope.



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

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

Base your answers to the next 4 questions 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.



The volcanic ash layer is considered a good time marker for correlating rocks because the volcanic ash layer

- (1) has a dark color
- (2) can be dated using carbon-14
- (3) lacks fossils
- (4) was rapidly deposited over a wide area

Which sedimentary rock shown in the outcrops is the youngest?

- (1) black shale
- (2) conglomerate
- (3) tan siltstone
- (4) brown sandstone

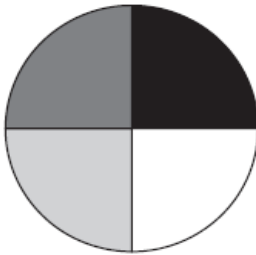
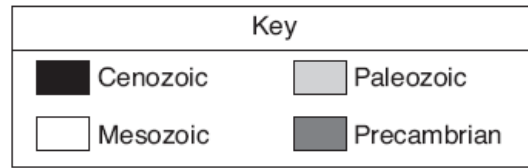
What is the youngest geologic feature in the three bottom layers of outcrop C?

- (1) fault
- (2) igneous intrusion
- (3) unconformity
- (4) zone of contact metamorphism

Which processes were primarily responsible for the formation of most of the rock in outcrop A?

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

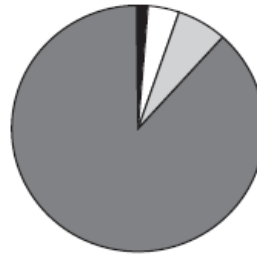
Which pie graph best represents the percentage of total time for the four major divisions of geologic time?



(1)



(2)

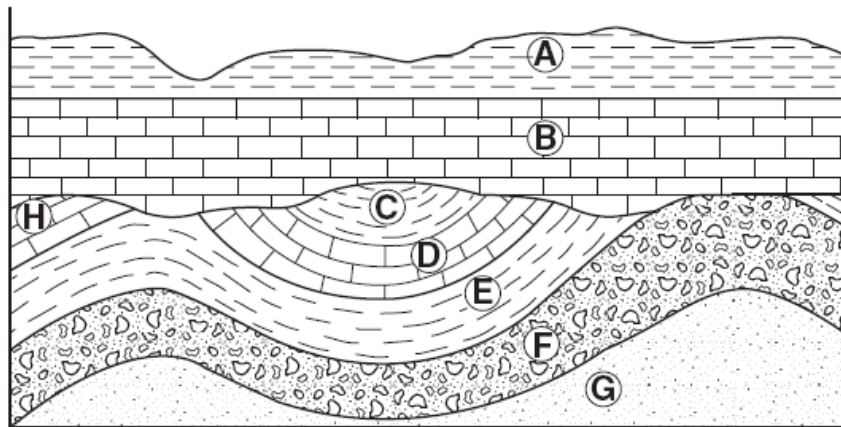


(3)



(4)

Base your answers to the next 3 questions on the geologic cross section below in which overturning has not occurred. Letters *A* through *H* represent rock layers.



Which sequence of events most likely caused the unconformity shown at the bottom of rock layer *B*?

- (1) folding → uplift → erosion → deposition
- (2) intrusion → erosion → folding → uplift
- (3) erosion → folding → deposition → intrusion
- (4) deposition → uplift → erosion → folding

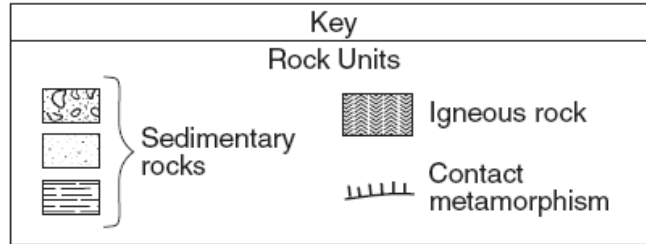
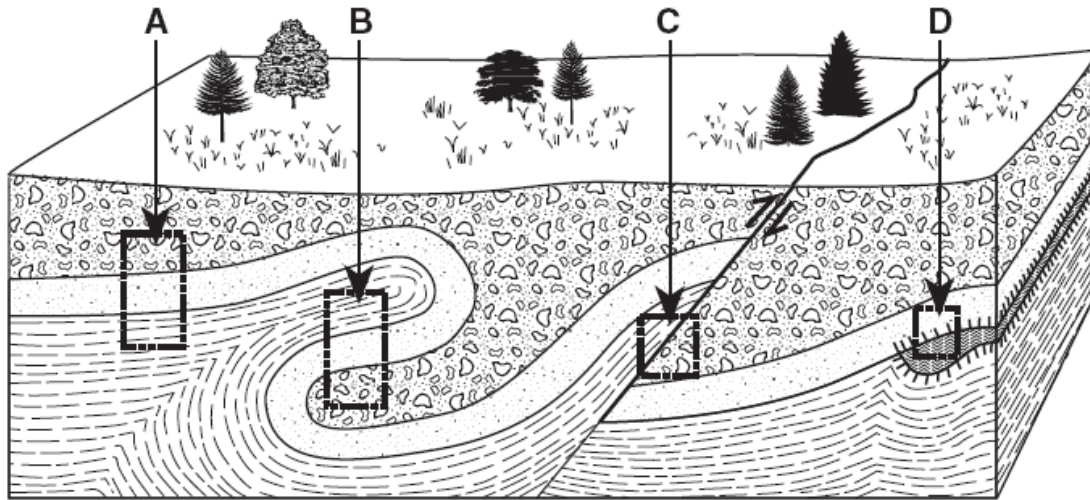
The folding of rock layers *G* through *C* was most likely caused by

- (1) erosion of overlying sediments
- (2) contact metamorphism
- (3) the collision of lithospheric plates
- (4) the extrusion of igneous rock

Which two letters represent bedrock of the same age?

- (1) *A* and *E*
- (2) *B* and *D*
- (3) *F* and *G*
- (4) *D* and *H*

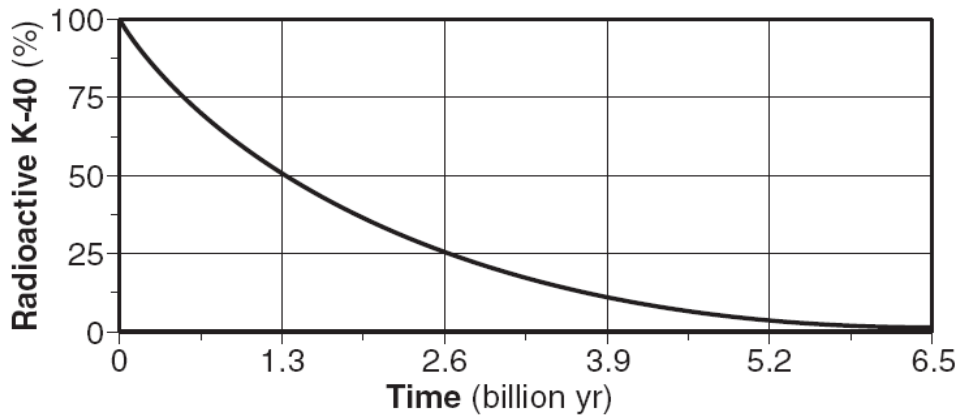
The block diagram below of a portion of Earth's crust shows four zones labeled A, B, C, and D outlined with dashed lines.



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

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

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

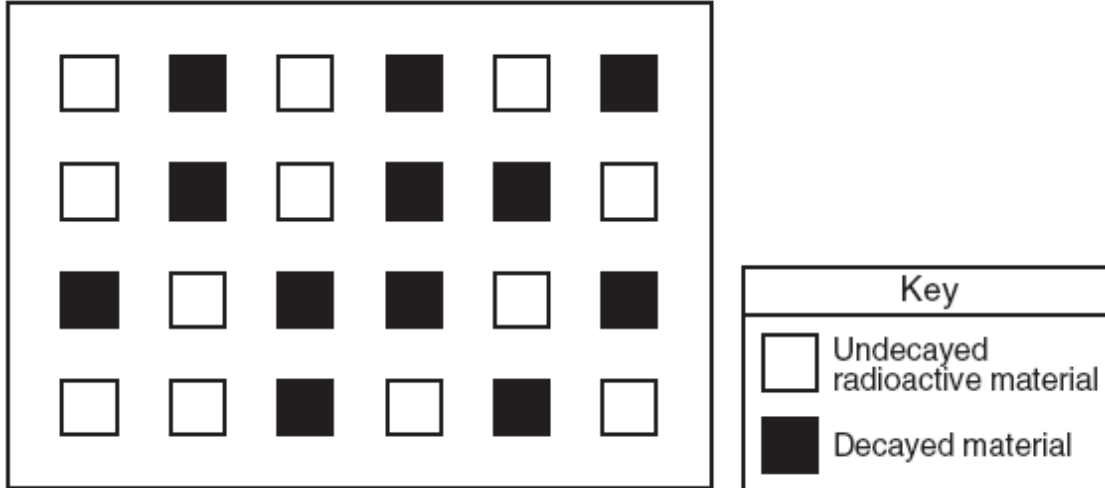


Analysis of a basalt rock sample shows that 25% of its radioactive K-40 remained undecayed. How old is the basalt?

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

Base your answers on the next 2 questions on the diagram below, which represents a model of a radioactive sample with a half-life of 5000 years. The white boxes represent undecayed radioactive material and the shaded boxes represent the decayed material after the first half-life.

### Radioactive Sample After First Half-Life



How many *more* boxes should be shaded to represent the additional decayed material formed during the second half-life?

- (1) 12 (3) 3  
 (2) 6 (4) 0

Which radioactive isotope has a half-life closest in duration to this radioactive sample?

- (1) carbon-14 (3) uranium-238  
 (2) potassium-40 (4) rubidium-87
- 

Base your answers on the next 3 questions on the newspaper article shown below and on your knowledge of Earth science.

#### **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

These fossilized jellyfish were most likely discovered in which type of rock?

- (1) sandstone (3) pumice  
 (2) granite (4) slate

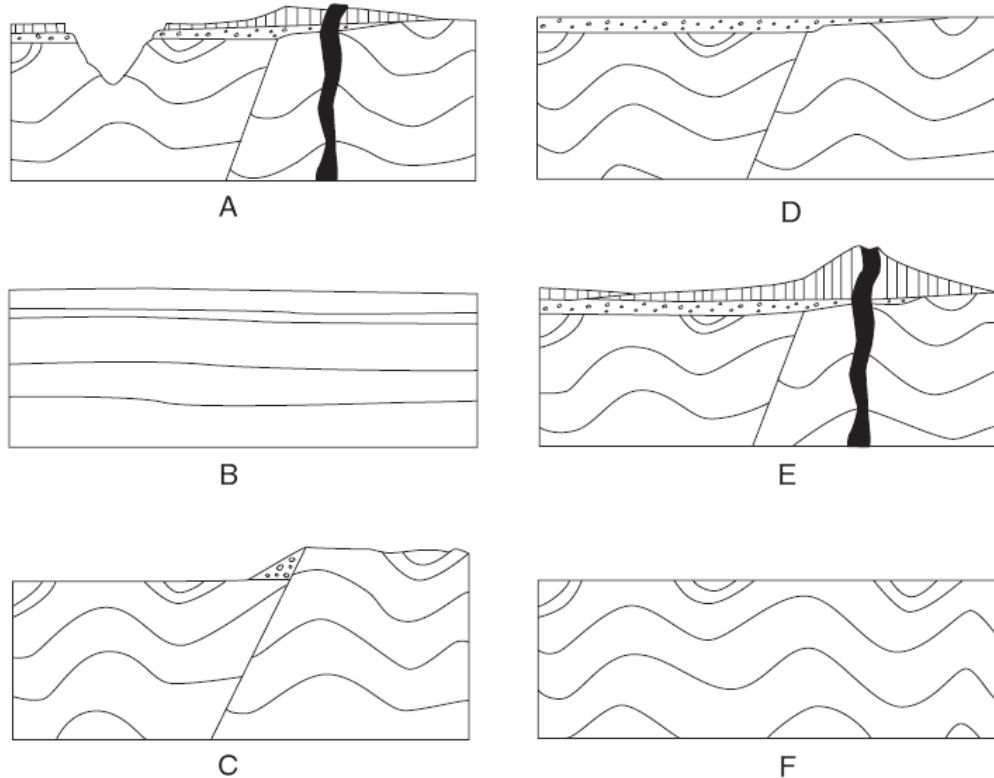
Which two marine organisms most likely lived at the same time as these jellyfish?

- (1) crinoids and dinosaurs
- (2) ammonoids and placoderm fish
- (3) brachiopods and gastropods
- (4) amphibians and eurypterids

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.

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)  $B \rightarrow D \rightarrow C \rightarrow F \rightarrow A \rightarrow E$
- (2)  $B \rightarrow F \rightarrow C \rightarrow D \rightarrow E \rightarrow A$
- (3)  $E \rightarrow A \rightarrow D \rightarrow F \rightarrow C \rightarrow B$
- (4)  $E \rightarrow A \rightarrow F \rightarrow C \rightarrow D \rightarrow B$



Base your answers to the next 3 questions 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.



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

This feathered dinosaur is not considered an index fossil because it

- (1) existed too long ago
- (2) was preserved in ash
- (3) was a land-dwelling animal
- (4) was found in only one area

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

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 gram of the original carbon-14 remain?

- (1) 22,800 yr    (3) 34,200 yr  
(2) 28,500 yr    (4) 39,900 yr

Which event occurred earliest in geologic history?

- (1) appearance of the earliest grasses  
(2) appearance of the earliest birds  
(3) the Grenville Orogeny  
(4) the intrusion of the Palisades Sill

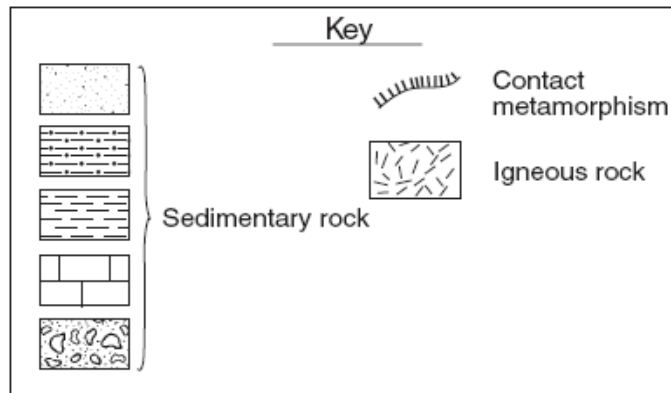
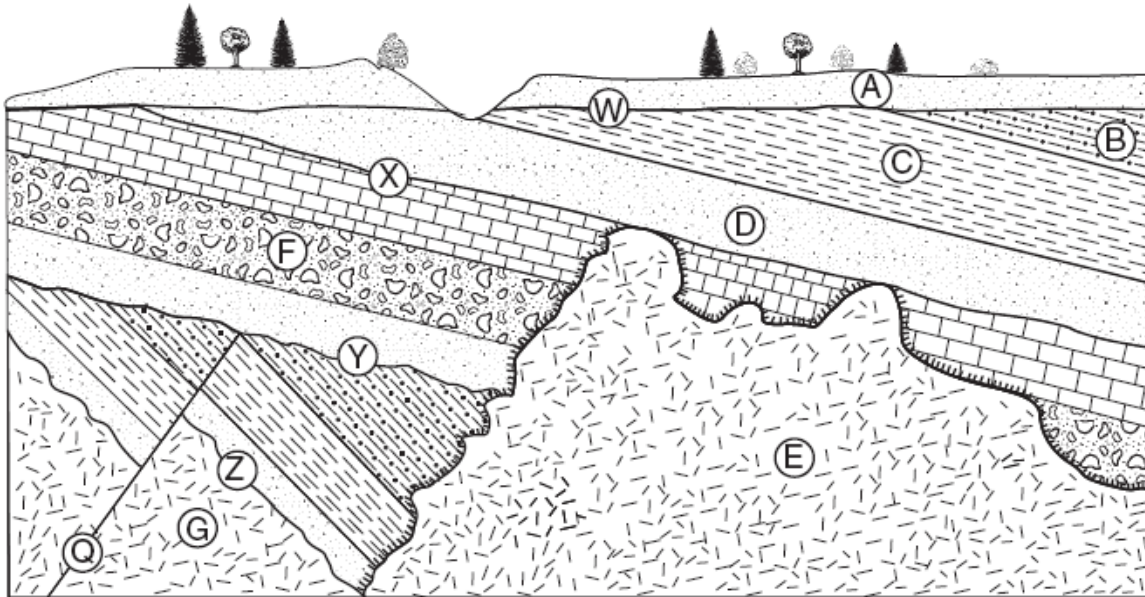
The characteristic of the radioactive isotope uranium-238 that makes this isotope useful for accurately dating the age of a rock is the isotope's

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

A very large, circular, impact crater under the coast of Mexico is believed to be approximately 65 million years old. This impact event is inferred to be related to the

- (1) appearance of the earliest trilobites  
(2) advance and retreat of the last continental ice sheet  
(3) extinction of the dinosaurs  
(4) formation of Pangea

Base your answers to the following 5 questions on the geologic cross section of bedrock shown below. A through G identifies rock layers and Q represents a fault. Lines W, X, Y, and Z are locations of unconformities. The rocks have not been overturned.



Which rock or feature is oldest?

- (1) rock A (3) fault Q
- (2) rock G (4) unconformity Z

The unconformities shown in the cross section represent

- (1) buried erosional surfaces
- (2) locations of index fossils
- (3) volcanic ash deposits
- (4) boundaries between oceanic and continental crust

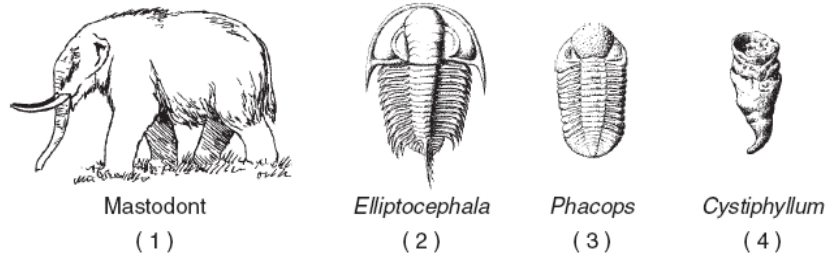
The movement of bedrock along fault Q most probably produced

- (1) gaps in the rock record
- (2) an earthquake
- (3) a volcanic lava flow
- (4) zones of contact metamorphism

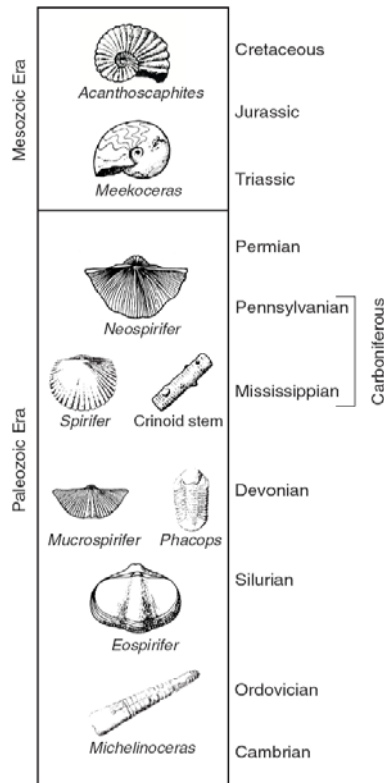
Which rock most likely formed in the zone of contact between rock E and rock F?

- (1) obsidian (3) metaconglomerate
- (2) slate (4) sandstone

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



Base your answers to the next 2 questions on the chart below, which shows the geologic ages of some well known fossils.



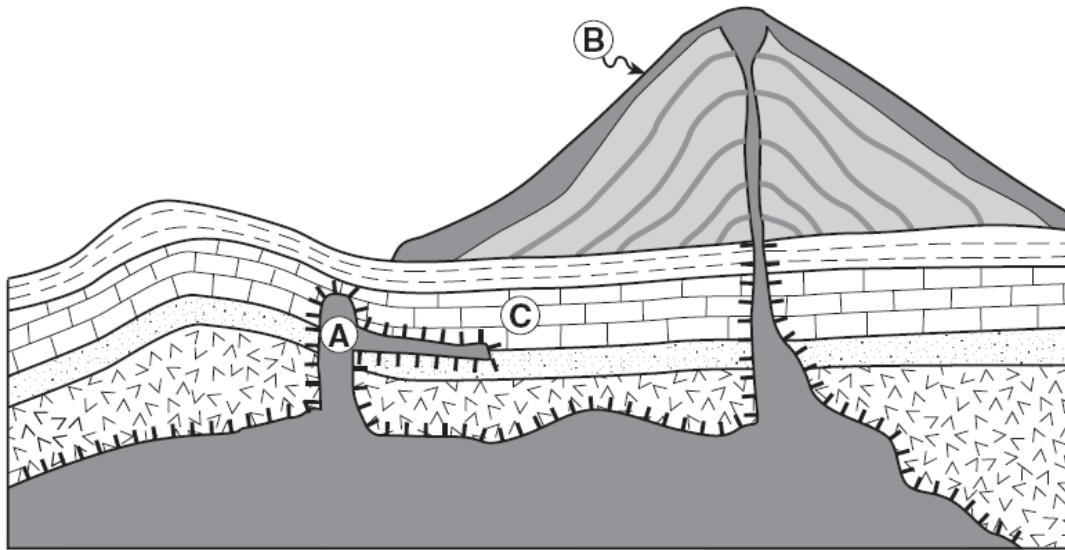
The *Spirifer*, Crinoid stem, and *Neospirifer* fossils might be found in some of the surface bedrock of which New York State landscape region?








- (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

Which New York State fossil is found in rocks of the same period of geologic history as *Meekoceras*?

- (1) Condor
- (2) Placoderm fish
- (3) *Eurypterus*
- (4) *Coelophysis*

Base your answers to the next 3 questions 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		

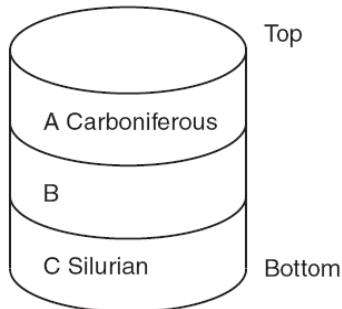
Which statement correctly describes the relative ages of rocks *A* and *C* and gives the best supporting evidence from the cross section?

- (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*.

Rock *B* is most likely which type of igneous rock?

- (1) granite
- (2) peridotite
- (3) pegmatite
- (4) basalt

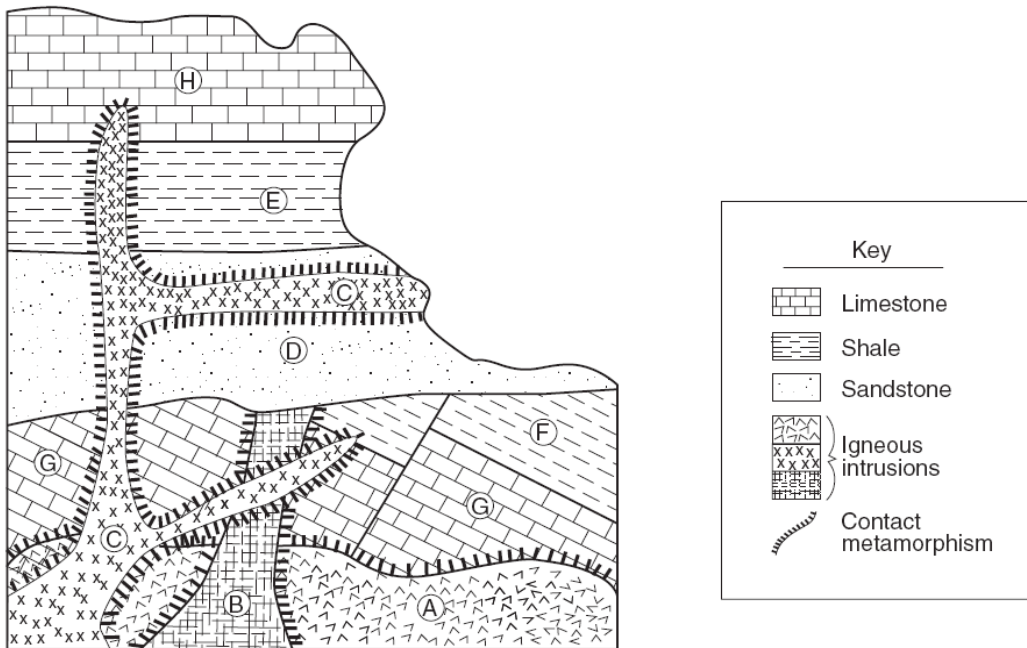
The geologic drill core below shows bedrock layers *A*, *B*, and *C* that have not been overturned. The geological ages of layers *A* and *C* are shown.



What is the geologic age of layer *B*?

- (1) Cambrian                      (3) Devonian  
 (2) Ordovician                  (4) Permian

Base your answers to the next 2 questions on the diagram below, which shows a cross section of Earth's crust.



Which statement gives an accurate age relationship for the bedrock in the cross section?

- (1) Intrusion *A* is younger than intrusion *C*.  
 (2) Intrusion *C* is younger than intrusion *B*.  
 (3) Intrusion *B* is older than intrusion *A*.  
 (4) Intrusion *C* is older than layer *E*.

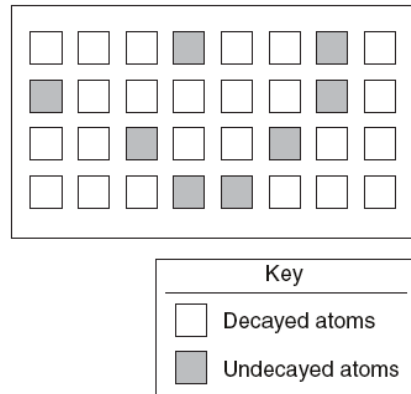
The most apparent buried erosional surface is found between rock units

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

Which inference is best supported by the rock and fossil record in New York State?

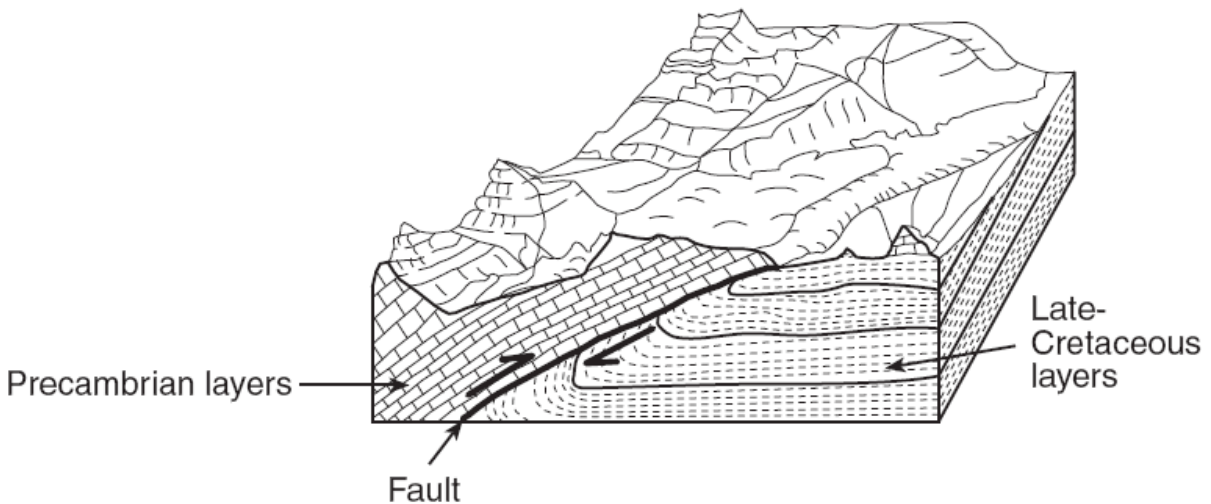
- (1) Eurypterids lived in shallow seas near present day Syracuse.
- (2) *Coelophysis* wandered through jungles near present-day Albany.
- (3) The first coral reefs formed off the shoreline of present-day Long Island.
- (4) The condor nested on the peaks of the ancestral Adirondack Mountains during the Grenville Orogeny.

The diagram below represents the present number of decayed and undecayed atoms in a sample that was originally 100% radioactive material. If the half-life of the radioactive material is 1,000 years, what is the age of the sample represented by the diagram?



- (1) 1,000 yr
- (2) 2,000 yr
- (3) 3,000 yr
- (4) 4,000 yr

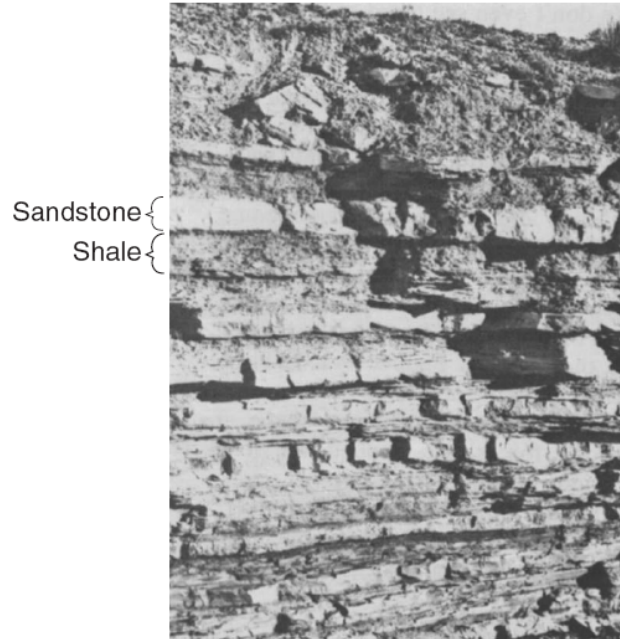
The geologic block diagram below shows surface features and subsurface structures of a section of Montana.



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

The photograph below shows an outcrop of horizontal rock layers in New York State.



Rock outcrops like this are most commonly found in which area of New York State?

- (1) Hudson Highlands (3) Atlantic Coastal Plain  
(2) Adirondack Mountains (4) Appalachian Plateau
- 

During which geologic time period did the earliest reptiles and great coal-forming forests exist?

- (1) Devonian (3) Mississippian  
(2) Quaternary (4) Pennsylvanian

Which radioactive isotope is most useful for determining the age of mastodont bones found in late Pleistocene sediments?

- (1) uranium-238 (3) potassium-40  
(2) carbon-14 (4) rubidium-87

An unconformity can be observed at location Z. Which rock layer was most probably removed by erosion during the time represented by the unconformity?

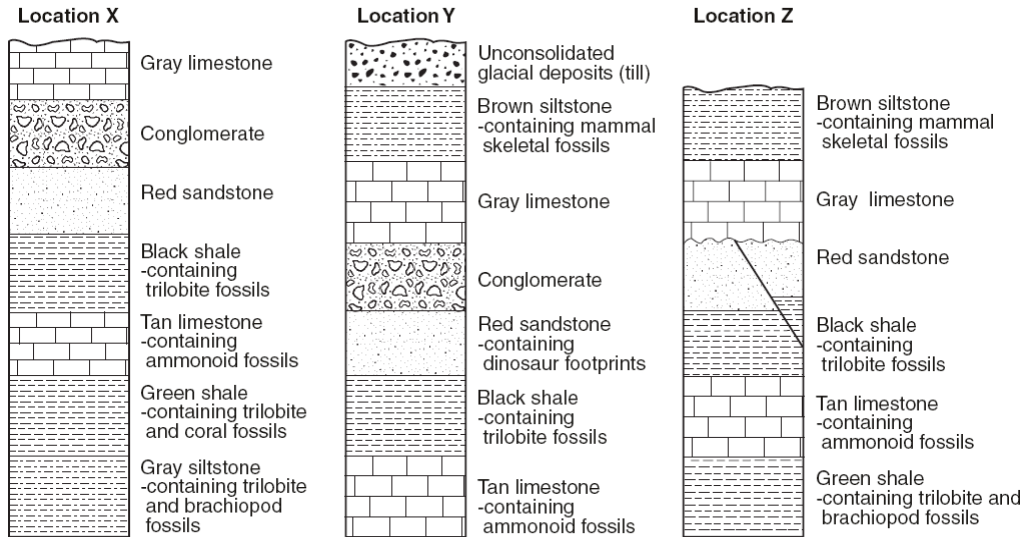
- (1) conglomerate (3) black shale  
(2) gray siltstone (4) brown siltstone

What is the age of the most abundant surface bedrock in the Finger Lakes region of New York State?

- (1) Cambrian (3) Pennsylvanian  
(2) Devonian (4) Permian



Base your answers to the next 5 questions on the cross sections below, which show widely separated outcrops at locations X, Y, and Z.



Which rock layer is oldest?

- (1) gray siltstone
- (2) green shale
- (3) tan limestone
- (4) brown siltstone

At location Y, the boundary between the red sandstone and the black shale marks the

- (1) beginning of the Cenozoic Era
- (2) beginning of the Mesozoic Era
- (3) end of the Cenozoic Era
- (4) end of the Mesozoic Era

The fossils in the rock formations at location X indicate that this area was often covered by

- (1) tropical rain forests
- (2) glacial ice
- (3) desert sand
- (4) seawater

Which rock layer was formed by the compaction and cementation of particles that were all less than 0.0004 centimeter in diameter?

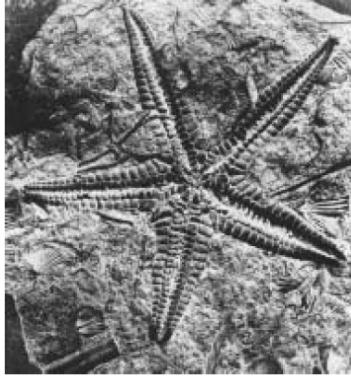
- (1) red sandstone
- (2) green shale
- (3) brown siltstone
- (4) conglomerate

The absolute age of a rock is the approximate number of years ago that the rock formed. The absolute age of an igneous rock can best be determined by

- (1) comparing the amounts of decayed and undecayed radioactive isotopes in the rock
- (2) comparing the sizes of the crystals found in the upper and lower parts of the rock
- (3) examining the rock's relative position in a rock outcrop
- (4) examining the environment in which the rock is found

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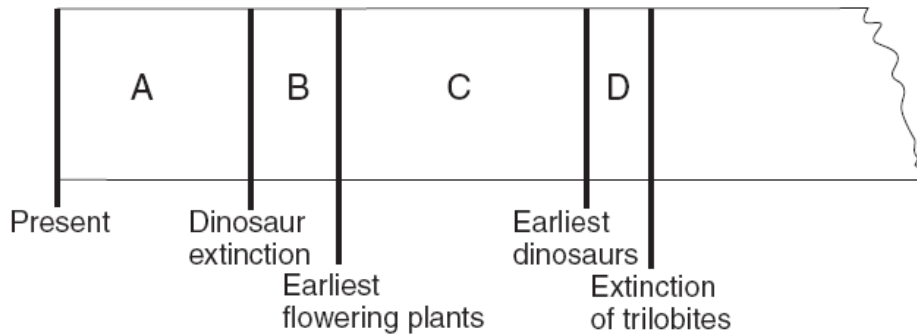
The Devonian-aged siltstone shown in the photograph below occurs as surface bedrock near Hamilton, New York.



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.
- 

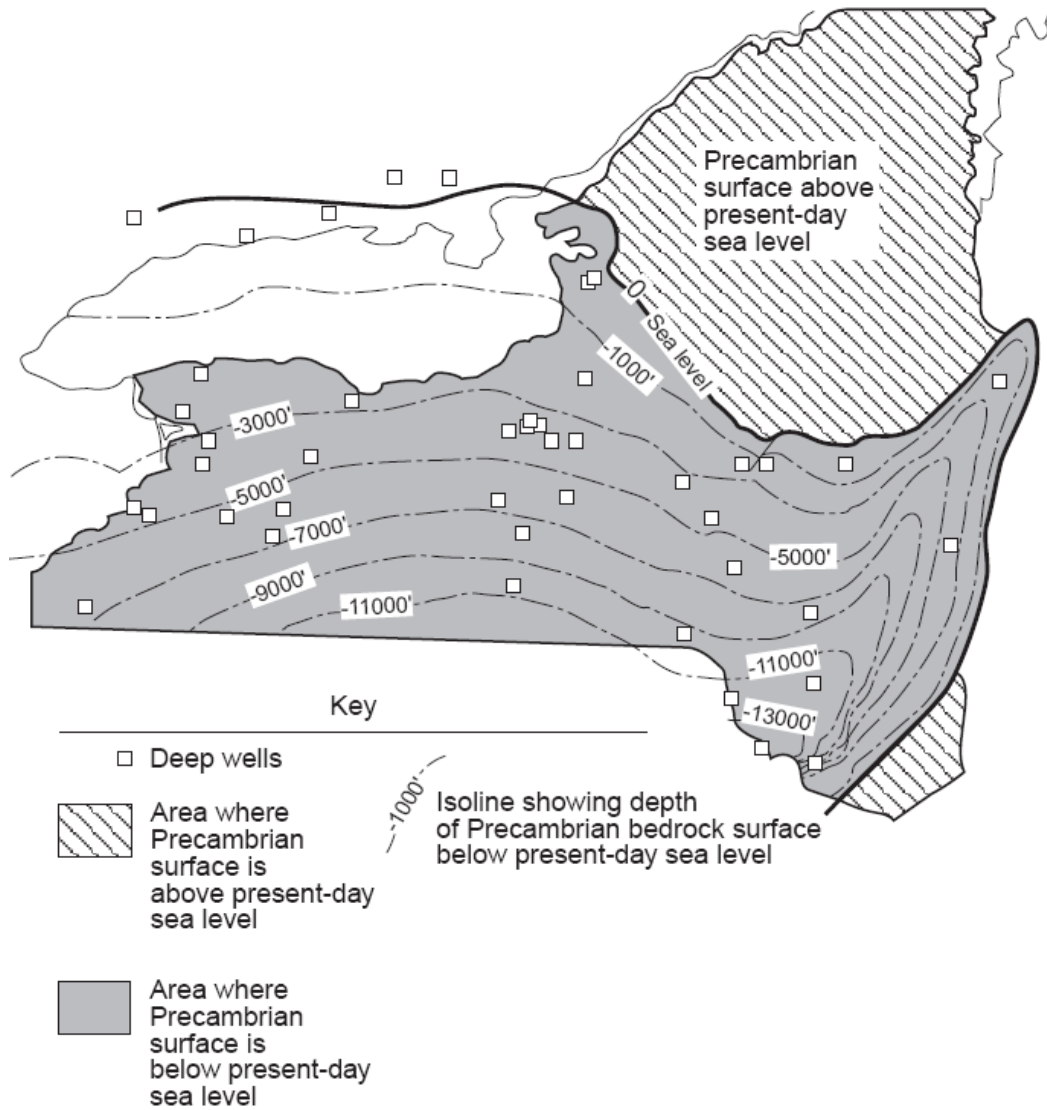
The diagram below is a portion of a geologic time line. Letters *A* through *D* represent the time intervals between the labeled events, as estimated by some scientists.



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

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

Base your answers to the next 3 questions on the map below, which shows most of New York State. Isolines indicate the depth of the Precambrian bedrock surface below present-day sea level. Depths are in feet.



According to the map, in which two present-day New York State landscape regions is the most Precambrian bedrock likely to be exposed on the land surface?

- (1) Erie-Ontario Lowlands and Tug Hill Plateau
- (2) Allegheny Plateau and Catskills
- (3) Adirondack Mountains and Hudson Highlands
- (4) Hudson-Mohawk Lowlands and Champlain Lowlands

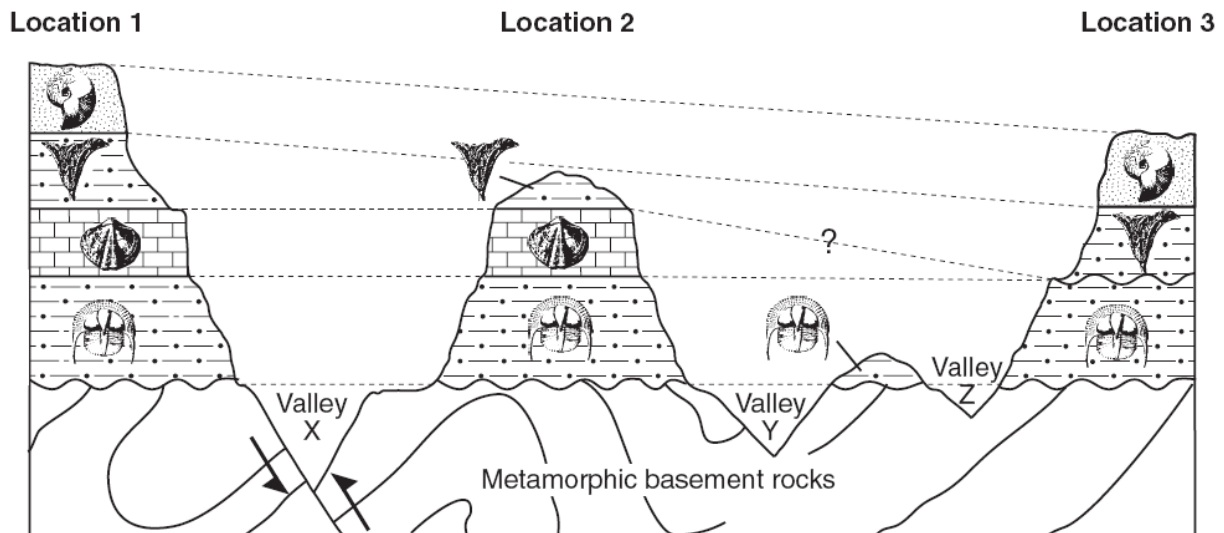
What is the geologic age of most of the bedrock covering the Precambrian rock in present-day New York State?

- (1) Paleozoic
- (2) Cenozoic
- (3) Mesozoic
- (4) Archean

Which map best shows the location of the -4,000-foot isoline?



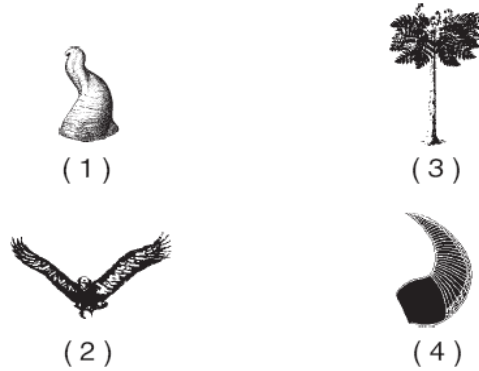
Base your answers to the next 2 questions on the geologic cross section below, which shows a view of rock layers at Earth's surface. The dashed lines connect points of the same age. Major fossils contained within each rock layer are shown. The valleys are labeled X, Y, and Z.



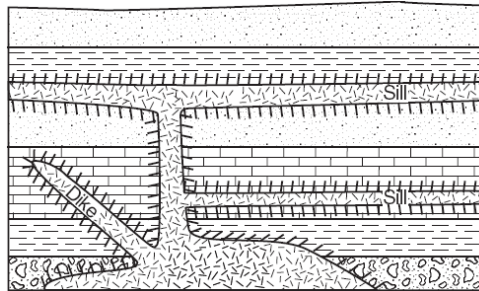
In which type of environment were the sediments that formed these sedimentary rock layers most likely deposited?

- (1) glacial
- (2) mountainous
- (3) marine
- (4) terrestrial plateau

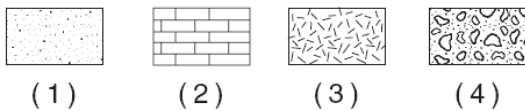
Which fossil would most likely be found in the same siltstone layer as the *Cryptolithus* fossil?




Base your answers to the next 2 questions on the geologic cross section below. Overturning has not occurred. The dike and sills shown in the cross section are igneous intrusions.



Which rock type is the oldest?



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

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

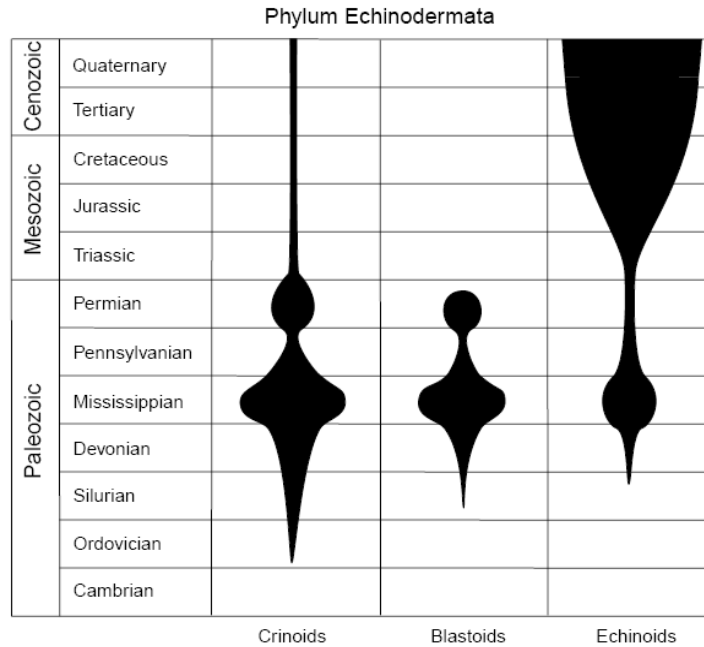
Carbon-14, an isotope used to date recent organic remains, would most likely be useful in determining the age of a fossil

- (1) trilobite (3) armored fish
- (2) *Coelophysis* (4) Beluga whale

The sedimentary rock layers at the three locations can be most accurately correlated by comparing the

- (1) thickness of the sedimentary rock layers
- (2) foliation bands in the metamorphic basement rocks
- (3) fossils in the sedimentary rocks
- (4) minerals in the igneous rocks

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.

During which geologic time span could this “game” have occurred?



The primitive game of “Pull the mammoth’s tail and run”

- (1) Pleistocene Epoch
- (2) Pennsylvanian Epoch
- (3) Precambrian Era
- (4) Paleozoic Era

