

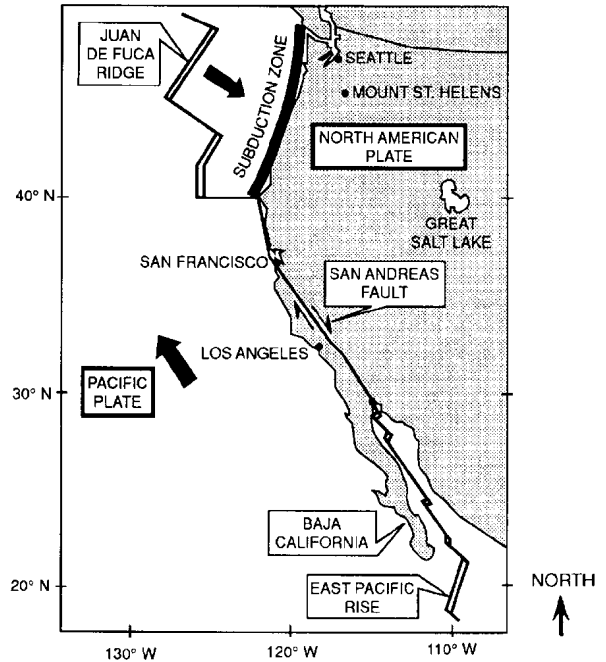
1. Crustal formation, which may cause the widening of an ocean, is most likely occurring at the boundary between the

- A) African Plate and the Eurasian Plate
- B) Pacific Plate and the Philippine Plate
- C) **Indian-Australian Plate and the Antarctic Plate**
- D) South American Plate and the North American Plate

2. Oceanic crust is sliding beneath the Aleutian Islands in the North Pacific Ocean, forming the Aleutian Trench at a

- A) **convergent plate boundary between the Pacific Plate and the North American Plate**
- B) convergent plate boundary between the Pacific Plate and the Juan de Fuca Plate
- C) divergent plate boundary between the Pacific Plate and the North American Plate
- D) divergent plate boundary between the Pacific Plate and the Juan de Fuca Plate

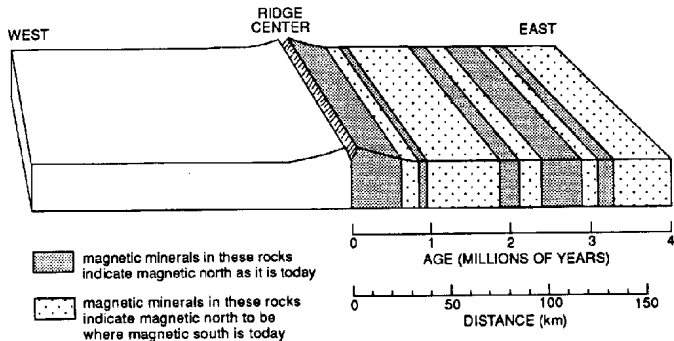
3. Base your answer to the following question on the map below, which shows crustal plate boundaries located along the Pacific coastline of the United States. The arrows show the general directions in which some of the plates appear to be moving slowly.



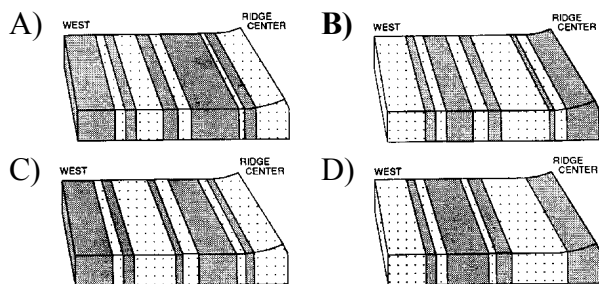
What would a study of the East Pacific rise (a mid-ocean ridge) indicate about the age of the basaltic bedrock in this area?

- A) **The bedrock is youngest at the ridge.**
- B) The bedrock is oldest at the ridge.
- C) The bedrock at the ridge is the same age as the bedrock next to the continent.
- D) The bedrock at the ridge is the same age as the bedrock at the San Andreas fault.

Base your answers to questions 4 through 8 on the diagram below which shows the magnetic orientation of igneous rock on the seafloor on the east (right) side of a mid-ocean ridge. The pattern on the west (left) side of the ridge has been omitted. The age of the igneous rock and its distance from the ridge center are shown.



4. Which diagram below best represents the pattern of magnetic orientation in the seafloor on the west (left) side of the ocean ridge?



5. Which inference can best be made from the diagram?

- A) **The orientation of the Earth's magnetic field has reversed with time.**
- B) The size of the continents has changed with time.
- C) The elevation of sea level has changed with time.
- D) The amount of fossil material preserved in the igneous rock has changed with time.

6. As distance from the center of the ridge increases, the age of the rocks

- A) decreases
- B) increases**
- C) remains the same

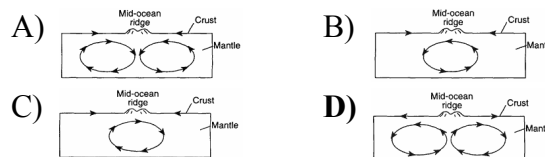
7. According to the diagram, what is the approximate rate of seafloor spreading?

- A) 1 km/million years
- B) 2 km/million years
- C) 40 km/million years**
- D) 50 km/million years

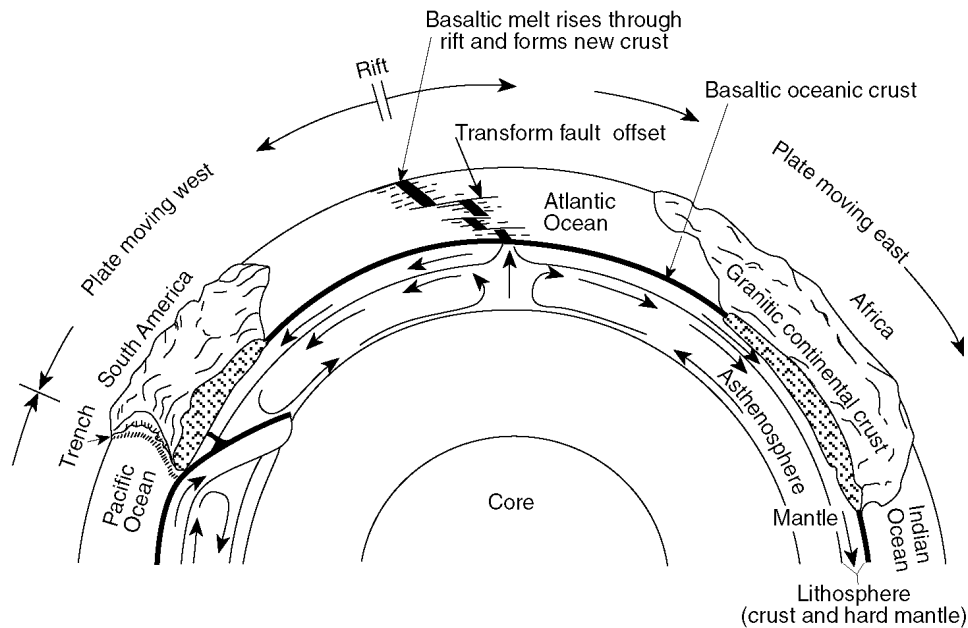
8. The occurrence of high-heat floors at the ridge center provides evidence of the

- A) destruction of oceanic crust
- B) destruction of continental crust
- C) existence of ancestral mountains
- D) existence of rising mantle convection currents**

9. Which cross-sectional diagram of a portion of the crust and mantle best shows the pattern of mantle convection currents that are believed to cause the formation of a mid-ocean ridge?



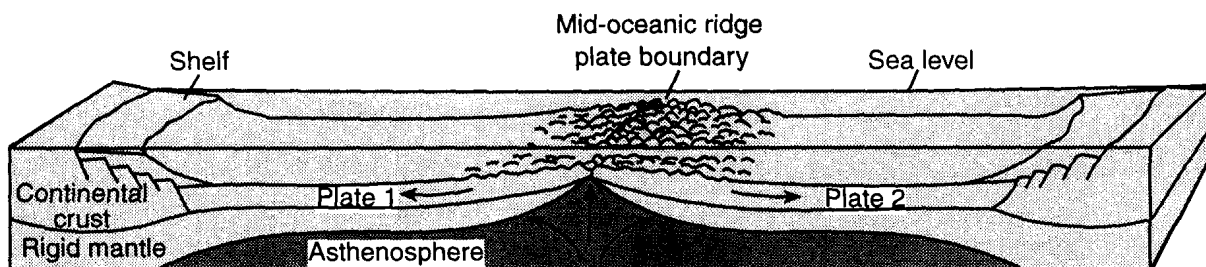
Base your answers to questions 10 through 12 on the diagram below. The diagram shows a model of the relationship between Earth's surface and its interior.



(Not drawn to scale)

10. Mid-ocean ridges (rifts) normally form where tectonic plates are
- A) converging
 - B) **diverging**
 - C) stationary
 - D) sliding past each other
11. According to the diagram, the deep trench along the west coast of South America is caused by movement of the oceanic crust that is
- A) **sinking beneath the continental crust**
 - B) uplifting over the continental crust
 - C) sinking at the Mid-Atlantic ridge
 - D) colliding with the Atlantic oceanic crust
12. The motion of the convection currents in the mantle beneath the Atlantic Ocean appears to be mainly making this ocean basin
- A) deeper
 - B) shallower
 - C) **wider**
 - D) narrower

Base your answers to questions 13 and 14 on the cross section of two crustal plates and the boundary between them shown below. The arrows indicate the direction of rock movement.



13. Which geologic events occur most often at this mid-oceanic ridge plate boundary?
- A) magnetic pole reversals and cooling of ocean water
 - B) meteorite impacts and tilting of shorelines
 - C) hydrospheric pollution and adiabatic heating
 - D) **earthquakes and volcanic eruptions**

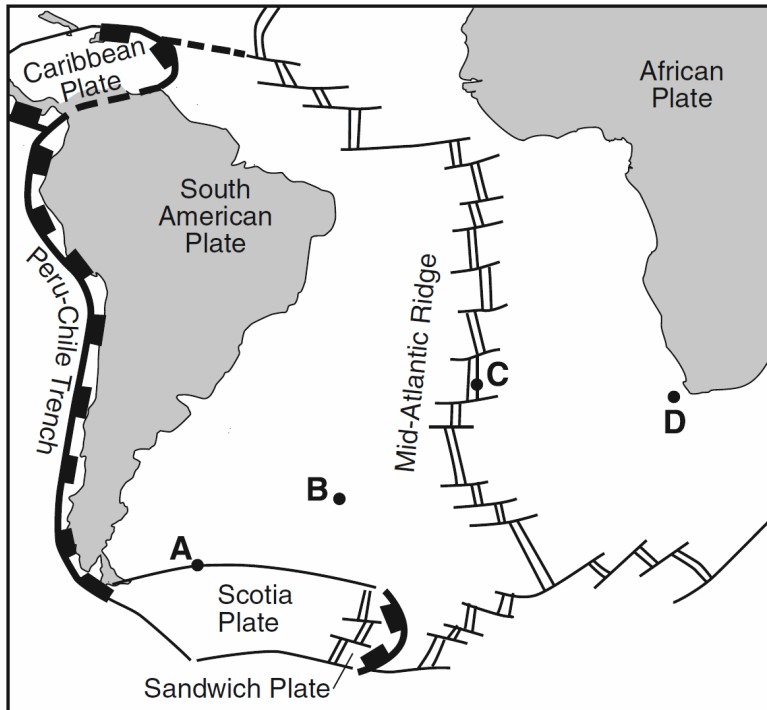
14. The mid-oceanic ridge portion of this cross section best represents
- A) convergence of the Nazca Plate and the South American Plate
 - B) divergence of the African Plate and the South American Plate**
 - C) subduction of the Philippine Plate by the China Plate
 - D) transform faulting between the Pacific Plate and the North American Plate

Base your answers to questions 15 through 17 on the passage below.

Crustal Activity at Mid-Ocean Ridges

Mid-ocean ridges are found at one type of tectonic plate boundary. These ridges consist of extensive underwater mountain ranges split by rift valleys. The rift valleys mark places where two crustal plates are pulling apart, widening the ocean basins, and allowing magma from the asthenosphere to move upward. In some cases, mid-ocean ridges have migrated toward nearby mantle hot spots. This explains why mid-ocean ridges and mantle hot spots are found together at several locations.

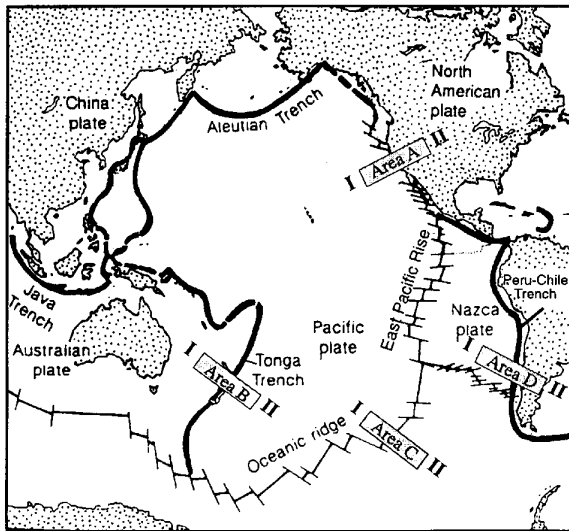
15. Which mantle hot spot is located closest to a mid-ocean ridge?
- A) Canary Islands
 - B) Easter Island**
 - C) Hawaii
 - D) Tasman
16. The map below shows a part of Earth's surface. Points *A* through *D* are locations on the ocean floor.



At which location is the temperature of the ocean floor bedrock most likely highest?

- A) *A*
 - B) *B*
 - C) *C*
 - D) *D*
17. Which type of tectonic plate boundary is located at mid-ocean ridges?
- A) convergent
 - B) transform
 - C) divergent**
 - D) complex

Base your answers to questions 18 and 19 on the map below which shows mid-ocean ridges and trenches in the Pacific Ocean. Specific areas A, B, C, and D are indicated by shaded rectangles.

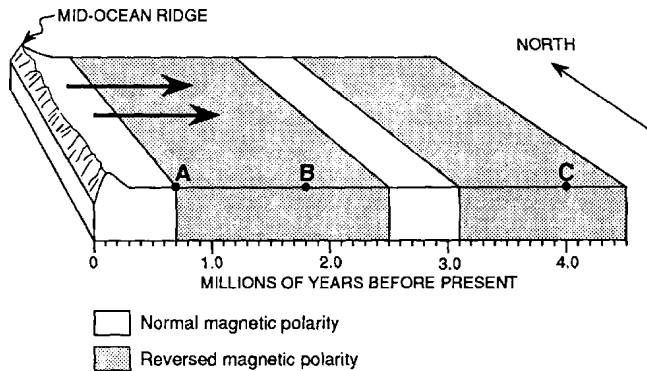


18. The crust at the mid-ocean ridges is composed mainly of
- A) shale
 - B) limestone
 - C) granite
 - D) basalt**
19. Mid-ocean ridges such as the East Pacific Rise and the Oceanic Ridge are best described as
- A) mountains containing folded sedimentary rocks
 - B) mountains containing fossils of present-day marine life
 - C) sections of the ocean floor that contain the youngest oceanic crust**
 - D) sections of the ocean floor that are the remains of a submerged continent

Base your answers to questions 20 through 23 on the information and diagram below.

At intervals in the past, the Earth's magnetic field has reversed. The present North magnetic pole was once the South magnetic pole, and the present South magnetic pole was once the North magnetic pole. A record of these changes is preserved in the igneous rocks that formed at mid-ocean ridges and moved away from the ridges.

The diagram below represents the pattern of normal and reversed magnetic polarity in the igneous rocks composing the ocean crust on the east side of a mid-ocean ridge.



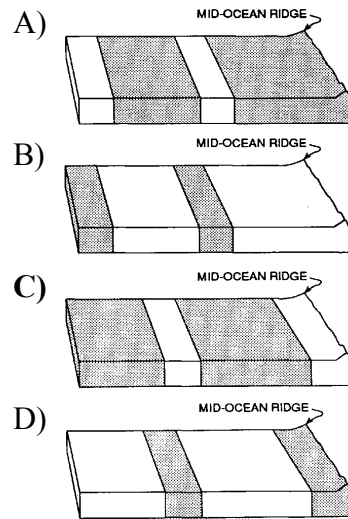
20. The igneous material along this mid-ocean ridge was found to be younger than the igneous material farther from the ridge. This fact supports the theory of

- A) crustal subsidence
- B) seafloor spreading**
- C) superposition
- D) dynamic equilibrium

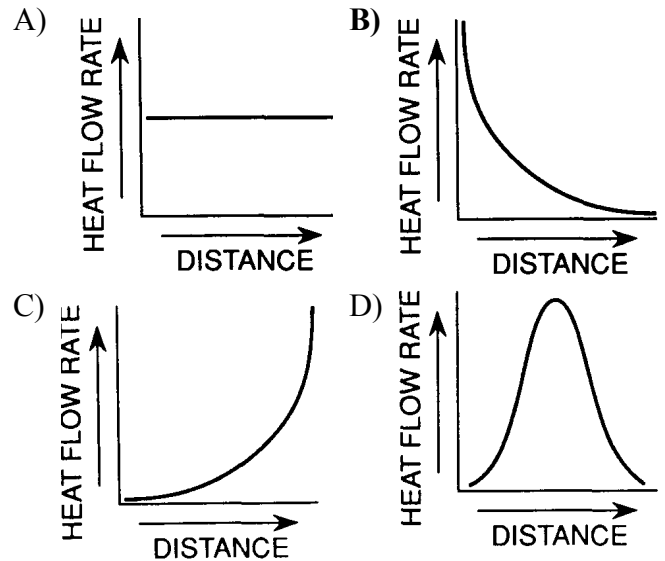
21. Approximately how many million years were required to form the material shown between *A* and *B* in the diagram?

- A) 2.5 B) 1.8 **C) 1.1** D) 0.7

22. Which diagram below best shows the pattern of normal and reversed polarity on the west side of the mid-ocean ridge?

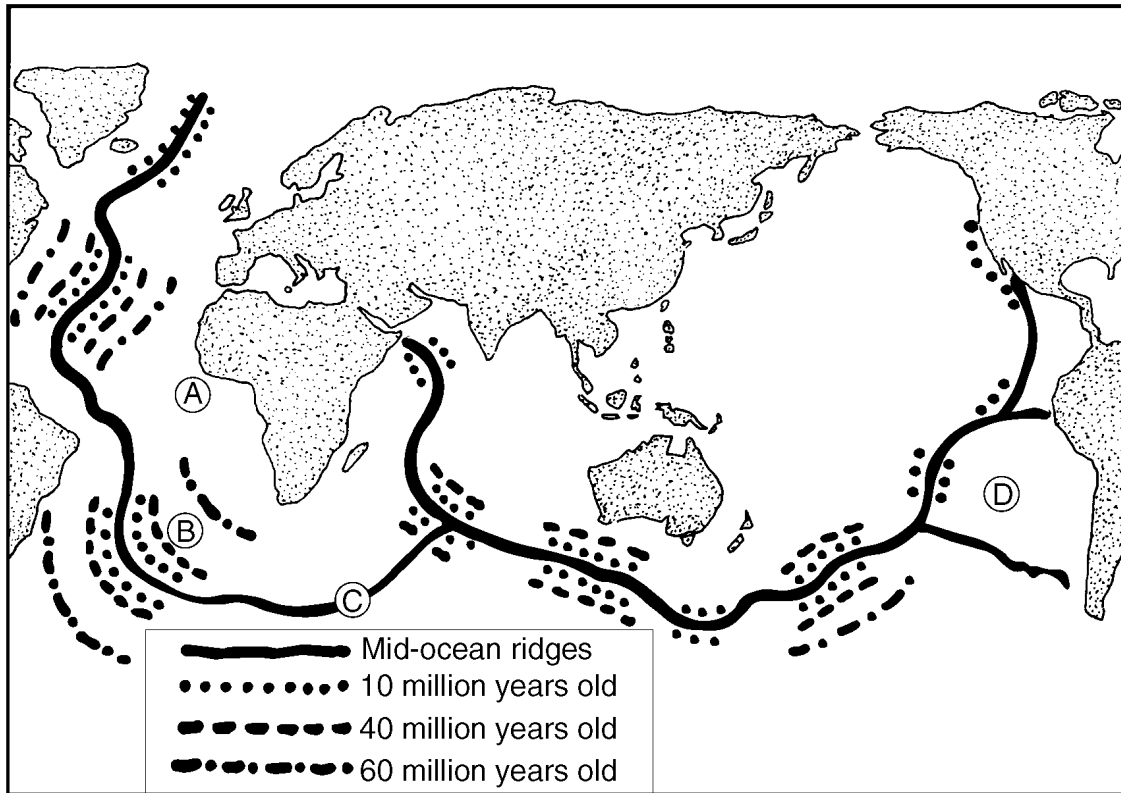


23. The younger extrusive igneous rocks on the ocean floor have a higher heat flow rate than older extrusive igneous rocks. Which graph best shows the relationship between heat flow rate and distance from the mid ocean ridge?



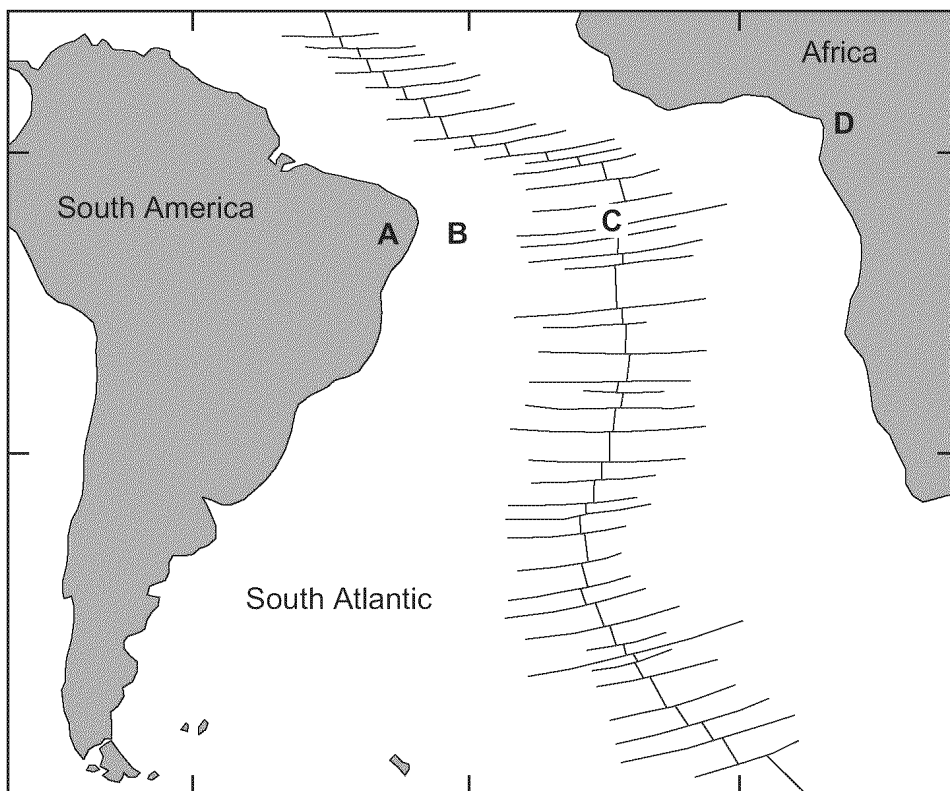
Base your answers to questions 24 through 26 on the map below, which shows the location of mid-ocean ridges and the age of some oceanic bedrock near these ridges. Letters *A* through *D* are locations on the surface of the ocean floor.

Age of Rocks on the Sea Bottom Relative to Ridges

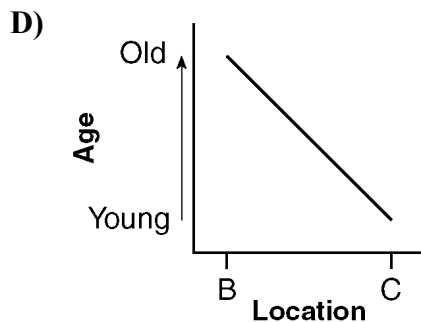
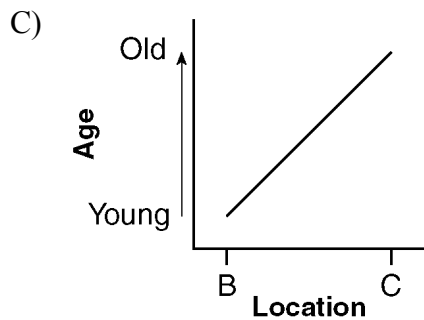
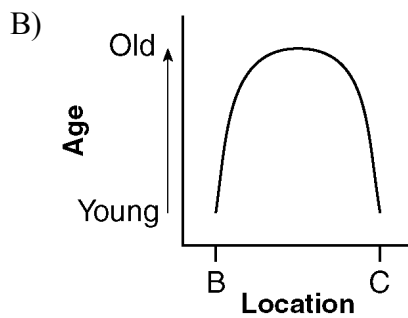
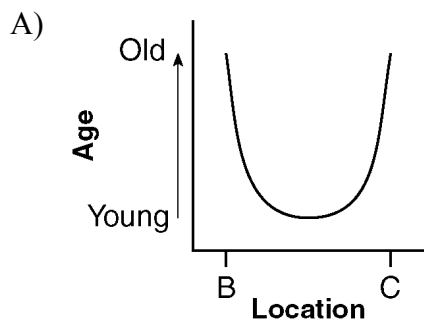


24. Rising convection currents in the asthenosphere would most likely be under location
- A) *A* B) *B* C) *C* D) *D*
25. The age of oceanic bedrock on either side of a mid-ocean ridge is supporting evidence that at the ridges, tectonic plates are
- A) **diverging** B) converging
 C) locked in place D) being subducted
26. What is the most probable age, in millions of years, of the bedrock at location *B*?
- A) 5 B) 12 C) 48 D) 62

Base your answers to questions 27 and 28 on the map below. The map shows the continents of Africa and South America, the ocean between them, and the ocean ridge and transform faults. Locations *A* and *D* are on the continents. Locations *B* and *C* are on the ocean floor.



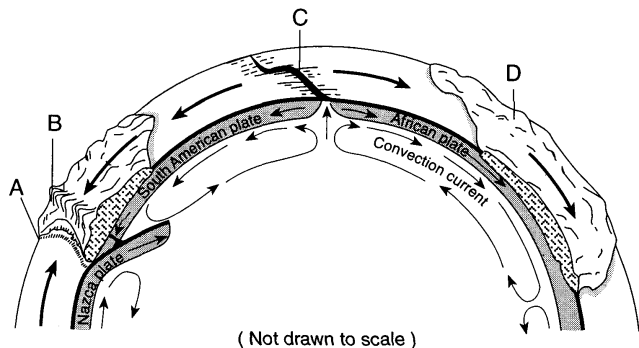
27. Which graph best shows the relative age of the ocean-floor bedrock from location *B* to location *C*?



28. The hottest crustal temperature measurements would most likely be found at location

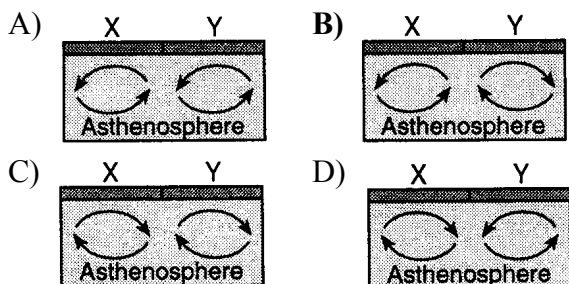
- A) *A* B) *B* C) *C* D) *D*

29. The diagram below shows a cross section of a portion of Earth. The inferred motions of crustal plates are shown. Letters A through D represent locations at Earth's surface.

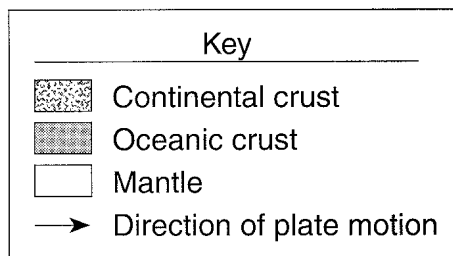


Which letter represents the location of the mid-Atlantic Ridge?

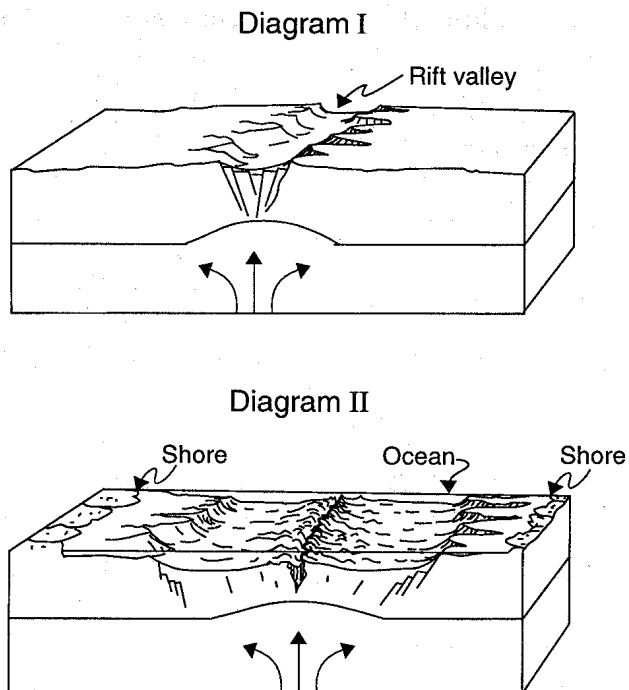
- A) A B) B C) C D) D
30. Which cross-sectional diagram of Earth's asthenosphere best shows the convection currents that would cause crustal plate X to drift away from crustal plate Y?



31. Which cross section below best represents the crustal plate motion that is the primary cause of the volcanoes and deep rift valleys found at mid-ocean ridges?



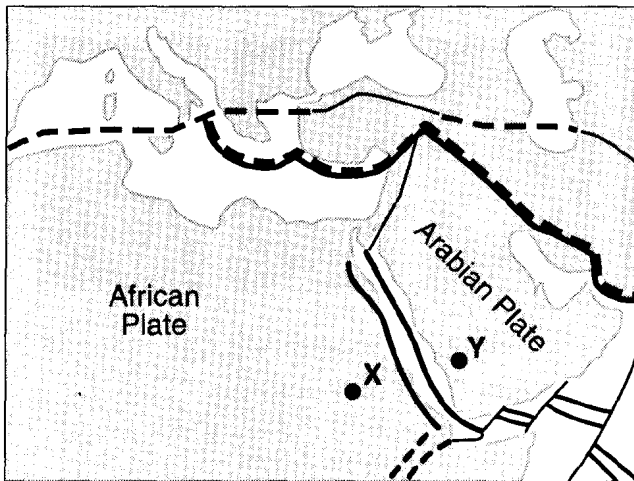
32. Diagrams I and II show the same region of the Earth's surface at two different times in the geologic past.



Which statement best explains the basic cause of the changes that occurred in this region?

- A) Meteor impact on the crust caused widening of the valley.
- B) Mantle convection currents caused crustal movement.**
- C) Climate changes caused flooding.
- D) Temperature changes caused melting of polar ice caps.
33. In which Earth layer are most convection currents that cause seafloor spreading thought to be located?
- A) crust **B) asthenosphere**
- C) outer core D) inner core

34. The map below shows a portion of Earth's surface. Points *X* and *Y* are locations on the lithosphere.



Which cross section shows the inferred movement of material in the asthenosphere beneath points *X* and *Y*?



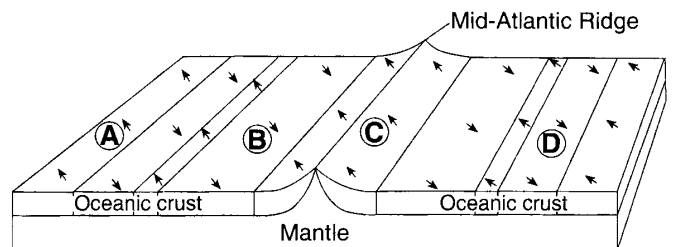
35. Which observation about the Mid-Atlantic Ridge region provides the best evidence that the seafloor has been spreading for millions of years?

- A) The bedrock of the ridge and nearby seafloor is igneous rock.
- B) The ridge is the location of irregular volcanic eruptions.
- C) Several faults cut across the ridge and nearby seafloor.
- D) Seafloor bedrock is younger near the ridge and older farther away.**

36. Seafloor spreading is occurring at the boundary between the

- A) African plate and Antarctic plate**
- B) Nazca plate and South American plate
- C) China plate and Philippine plate
- D) Australian plate and Eurasian plate

37. The diagram below shows the magnetic polarity preserved by minerals within the bedrock of the oceanic crust near the Mid-Atlantic Ridge. Letters *A*, *B*, *C*, and *D* represent locations in the ocean-floor bedrock.



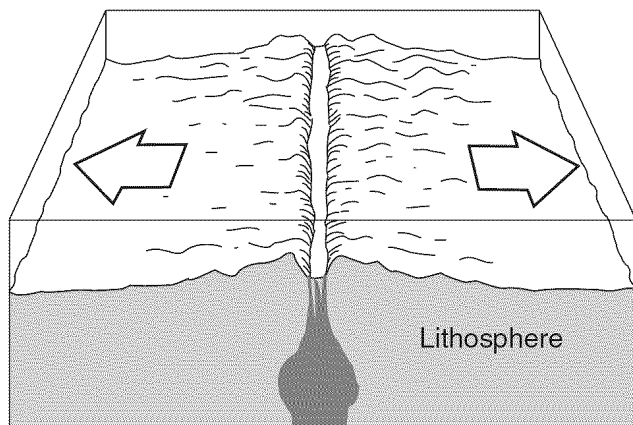
Key	
Magnetic Polarity of the Bedrock	
↖ Normal	↘ Reversed

The most recently formed bedrock is found at location

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

38. The diagram below shows a tectonic plate boundary.

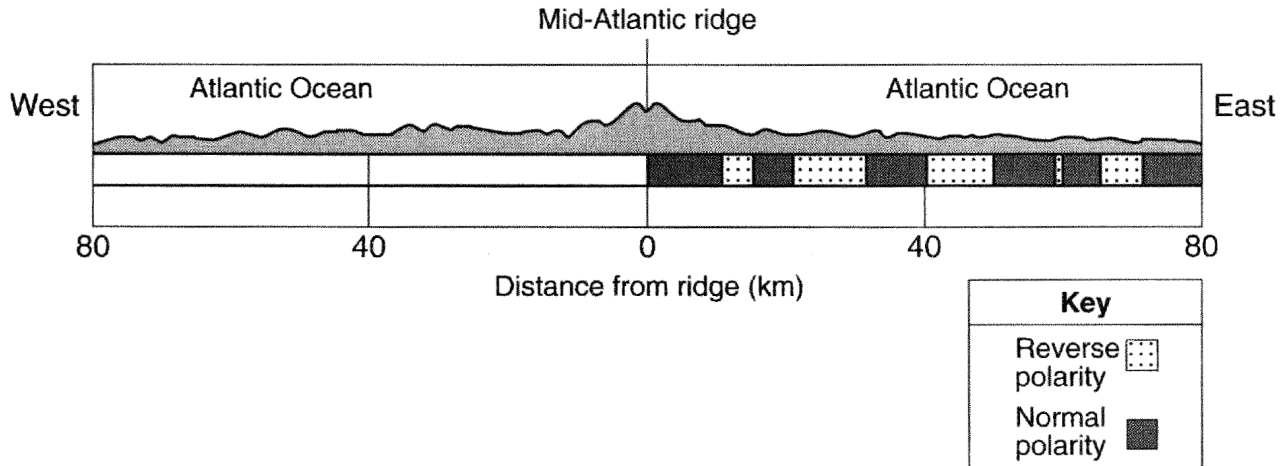
**Oceanic Ridge at a
Divergent Plate Boundary**



Which mantle hot spot is at a plate boundary like the one shown in this diagram?

- A) Hawaii Hot Spot
- B) Yellowstone Hot Spot
- C) Galapagos Hot Spot**
- D) Canary Hot Spot

39. The cross section below represents a pattern of magnetic field reversals preserved in the igneous bedrock of the oceanic crust east of the Mid-Atlantic ridge.



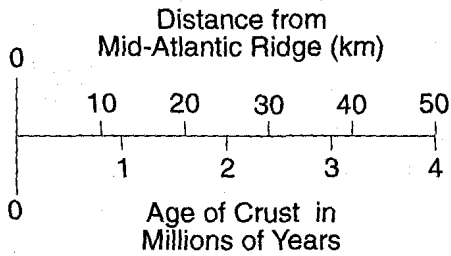
Which cross section best represents the magnetic field pattern west of the Mid-Atlantic ridge?

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

40. Which two tectonic plates are separated by a mid-ocean ridge?

- A) Indian-Australian and Eurasian
- B) Indian-Australian and Pacific
- C) North American and South American
- D) North American and Eurasian**

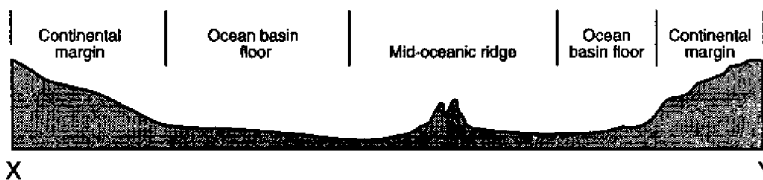
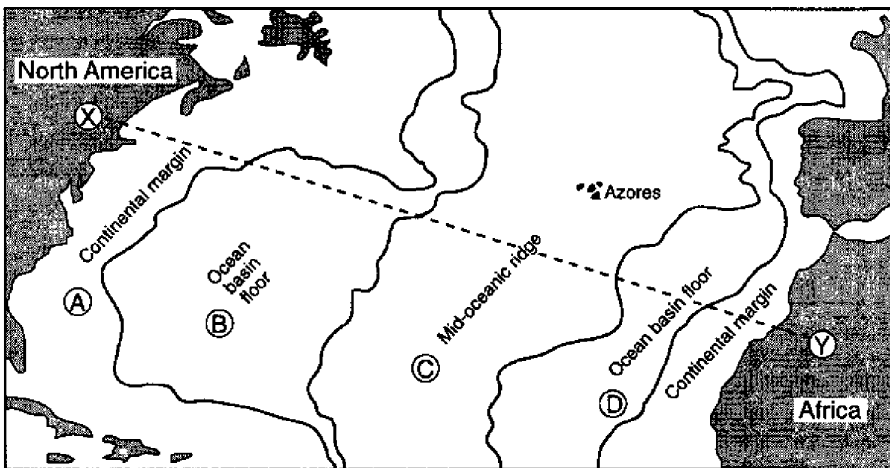
41. The scale below shows the age of the sea-floor crust in relation to its distance from the Mid-Atlantic Ridge.



Crust that originally formed at the Mid-Atlantic Ridge is now 37 kilometers from the ridge. Approximately how long ago did this crust form?

- A) 1.8 million years ago
- B) 2.0 million years ago
- C) 3.0 million years ago**
- D) 4.5 million years ago

Base your answers to questions 42 and 43 on the map and profile shown below. The map shows the major areas of the North Atlantic Ocean. Letters *A*, *B*, *C*, and *D* represent locations on the ocean floor. The profile represents the ocean bottom from point *X* in North America along the dashed line to point *Y* in Africa. Note that the profile is vertically exaggerated.



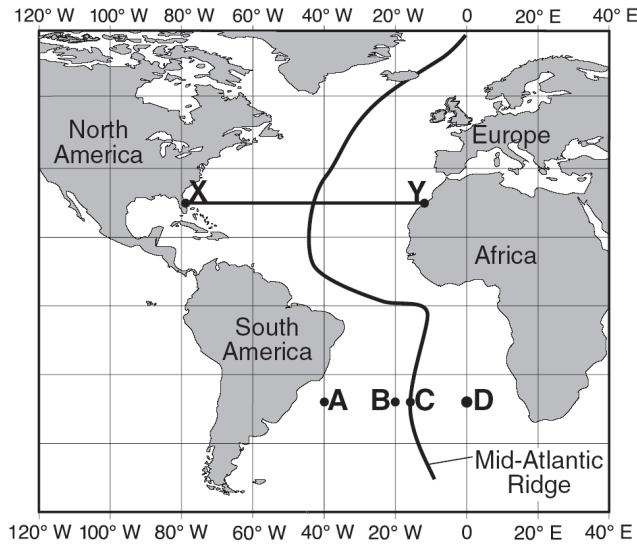
42. Classification of the ocean bottom into the areas shown is based on the

- A) distance from continental landmasses
- B) topography of the ocean floor**
- C) age of ocean-bottom rocks
- D) type of ocean-bottom sediments

43. Which statement about the age of ocean-floor rocks is correct?

- A) All ocean-floor rocks are generally the same age.
- B) Rocks at location *C* are generally older than rocks at locations *A* and *B*.
- C) Rocks at location *C* are generally younger than rocks at locations *A* and *B*.**
- D) Igneous rocks at location *D* are generally younger than rocks at location *C*.

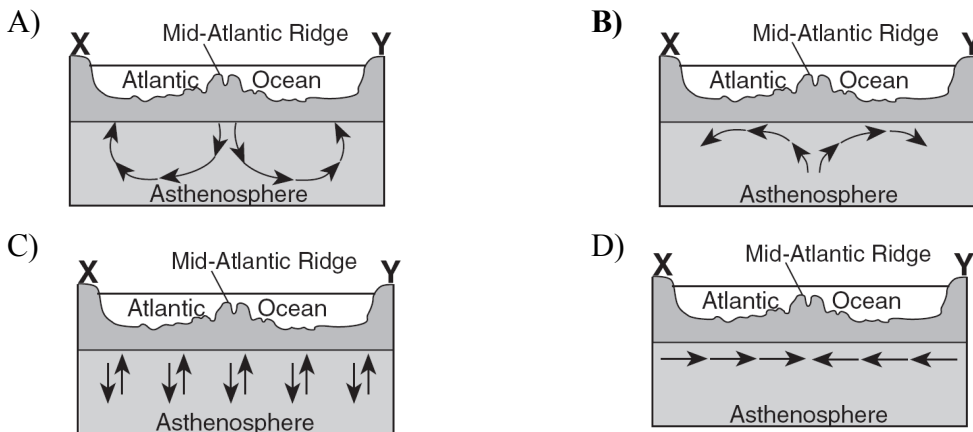
Base your answers to questions 44 and 45 on the map of the Mid-Atlantic Ridge shown below. Points *A* through *D* are locations on the ocean floor. Line *XY* connects locations in North America and Africa.



44. Samples of ocean-floor bedrock were collected at points *A*, *B*, *C*, and *D*. Which sequence show the correct order of the age of the bedrock from from oldest to youngest?

- A) $D \rightarrow C \rightarrow B \rightarrow A$
- B) $A \rightarrow D \rightarrow B \rightarrow C$
- C) $C \rightarrow B \rightarrow D \rightarrow A$
- D) $A \rightarrow B \rightarrow D \rightarrow C$

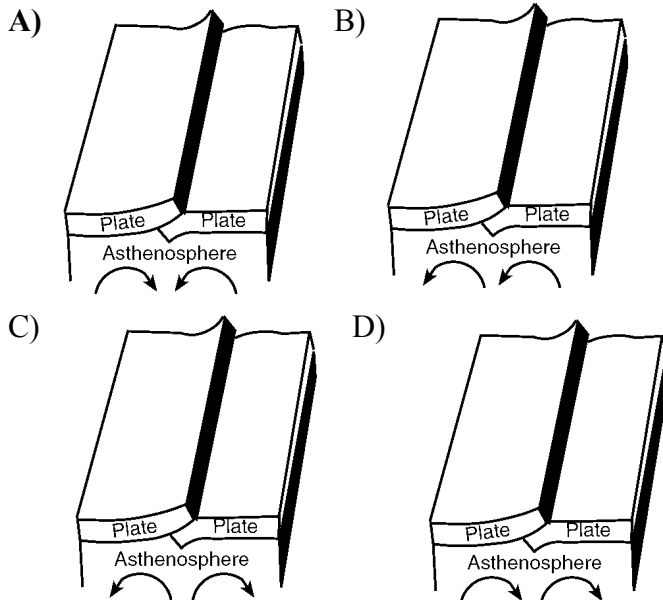
45. In which cross section do the arrows best show the convection occurring within the asthenosphere beneath line *XY*?



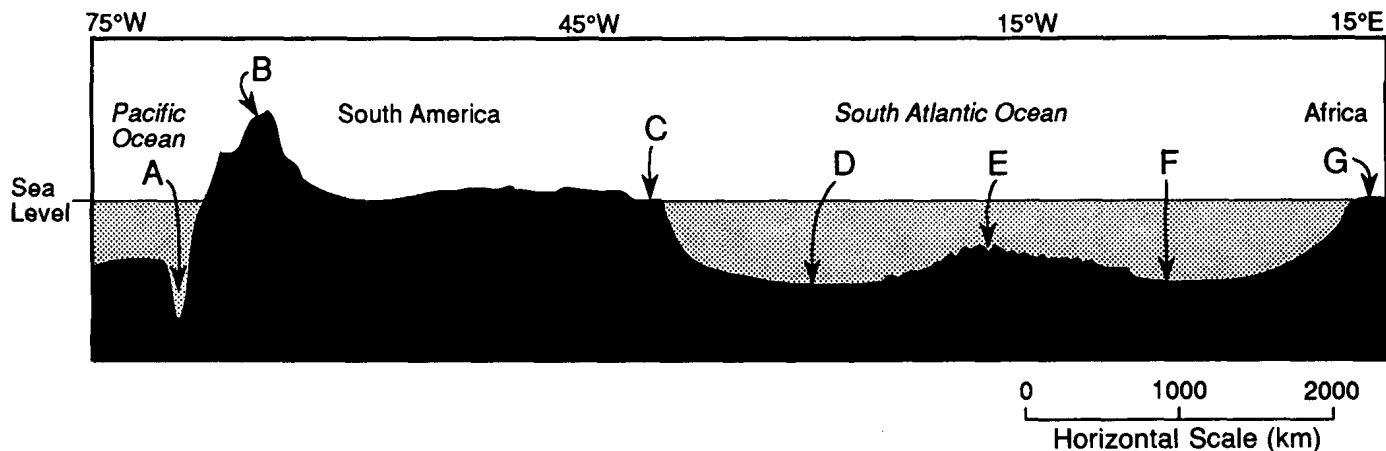
46. Which information indicates that new seafloor rock is forming along a mid-ocean ridge and then moving horizontally away from the ridge?

- A) Most volcanoes are located under ocean water.
- B) Seafloor rock is older than continental rock.
- C) Fossils of marine organisms can be found at high elevations on continents
- D) The age of seafloor rock increases as the distance from the mid-ocean ridge increases.**

47. Which diagram correctly shows how mantle convection currents are most likely moving beneath colliding lithospheric plates?



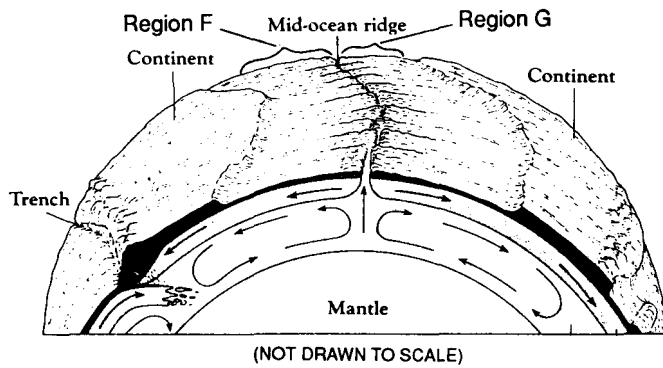
Base your answers to questions 48 and 49 on the diagram below which is a cross section of the major surface features of the Earth along the Tropic of Capricorn ($23\frac{1}{2}^{\circ}$ S) between 75° W and 15° E longitude. Letters *A* through *G* represent locations on the Earth's crust.



KEY:
 —→ DIRECTION OF PLATE MOVEMENT
 - - - → DIRECTION OF MANTLE CONVECTION CURRENTS

48. Which location is closest to the Prime Meridian (0° longitude)?
 A) *A* B) *F* C) *G* D) *D*
49. Which two locations in the diagram have bedrock of approximately the same age, which has been separated by seafloor spreading?
 A) *A* and *C* B) *C* and *E* C) *D* and *F* D) *E* and *F*

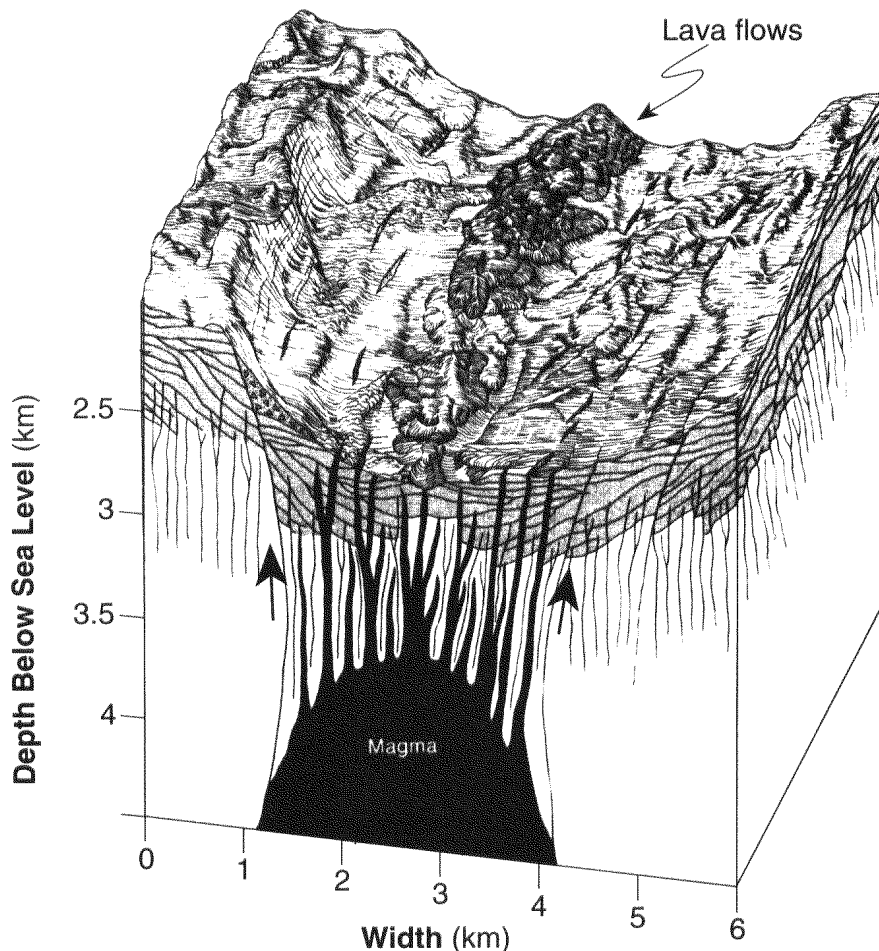
50. The diagram below represents a partial cross section of a model of the Earth. The arrows show inferred motions within the Earth.



Which property of the oceanic crust in regions *F* and *G* is a result of these inferred motions?

- A) The crystal size of the rock decreases constantly as distance from the mid-ocean ridge increases.
- B) The temperature of the basaltic rock increases as distance from the mid-ocean ridge increases.
- C) Heat-flow measurements steadily increase as distance from the mid-ocean ridge increases.
- D) The age of the igneous rock increases as distance from the mid-ocean ridge increases.**

Base your answers to questions 51 and 52 on the diagram below, which shows details of a section of a rift valley in the center of a mid-ocean ridge. The vertical lines in the diagram represent faults and fractures within the ocean floor bedrock.

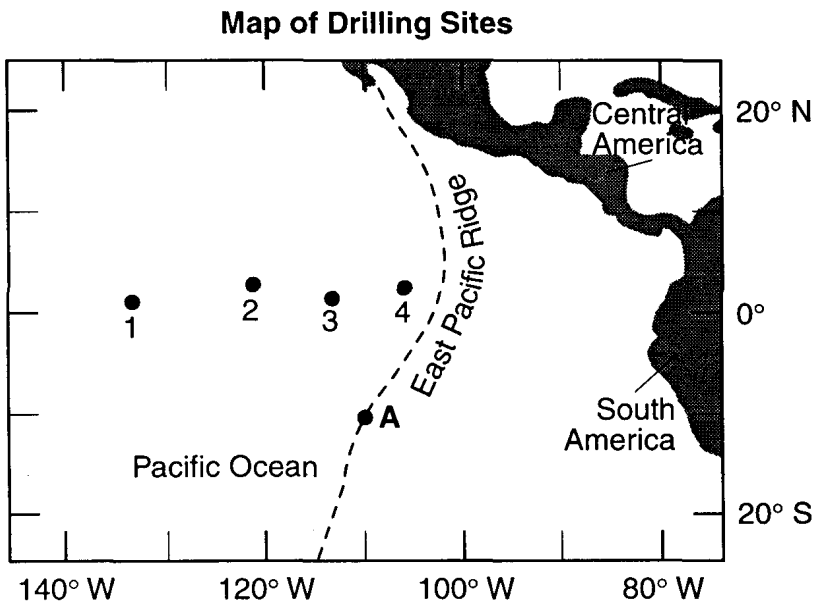


51. What will be the primary result of the continuation of the geologic processes indicated at this location?
- A) Earth's magnetic field will reverse direction.
 - B) Continental crust will be forced downward.
 - C) Earth's circumference will increase.
 - D) New oceanic crust will form.**
52. The dark-colored lava flows shown in the diagram were pushed from the magma chamber onto the surface of the ocean floor. Which characteristics are present in the solid rock that formed when the lava flows cooled?
- A) generally small grain size and mafic composition**
 - B) generally small grain size and felsic composition
 - C) generally large grain size and mafic composition
 - D) generally large grain size and felsic composition

53. Convection currents in the plastic mantle are believed to cause divergence of lithospheric plates at the

- A) Peru-Chile Trench
- B) Mariana Trench
- C) Canary Islands Hot Spot
- D) Iceland Hot Spot**

54. Base your answer to the following question on the map below which shows the locations of deep-sea core drilling sites numbered 1 through 4. The approximate location of the diverging plate at the East Pacific Ridge is shown by a dashed line. Point A is located on the East Pacific Ridge.



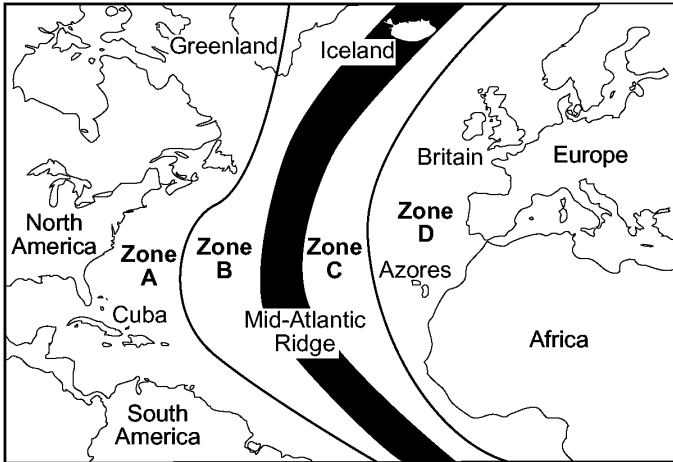
At which drilling site would the oldest igneous bedrock most likely be found?

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

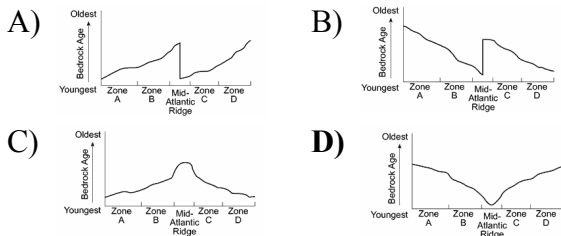
55. The border between the South American plate and the African plate is best described as

- A) converging and located at an oceanic ridge
- B) converging and located at an oceanic trench
- C) diverging and located at an oceanic ridge**
- D) diverging and located at an oceanic trench

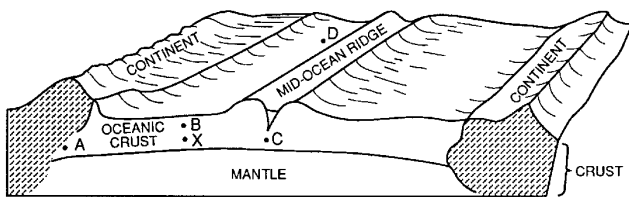
56. The map below shows the Atlantic Ocean divided into zones A, B, C, and D. The Mid-Atlantic Ridge is located between zones B and C.



Which graph best represents the geologic age of the surface bedrock on the ocean bottom?



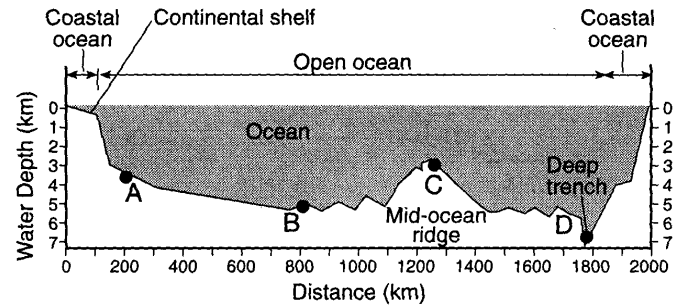
57. The diagram below represents a cross section of a portion of the Earth's crust and mantle. Letters A, B, C, D and X identify locations within the crust.



The age of oceanic crust increases along a line between location X and location

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

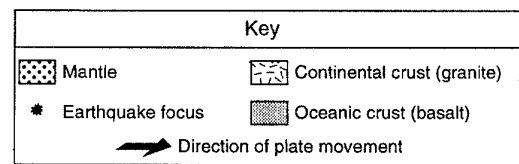
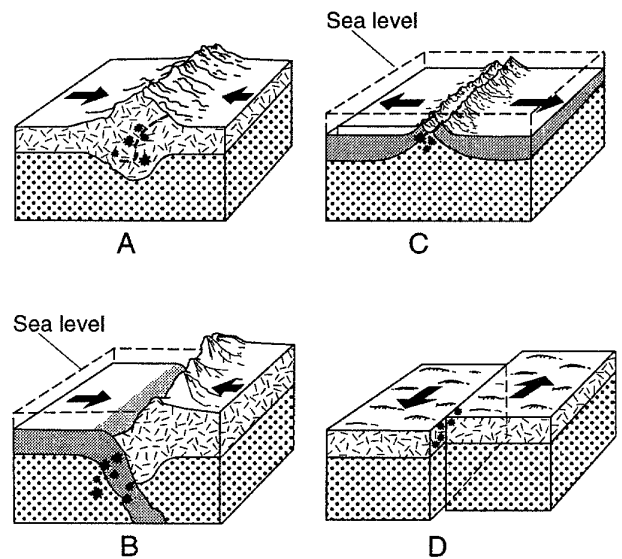
58. The cross section below shows the ocean floor between two continents. Points A through D represent locations on the ocean floor where samples of oceanic crust were collected.



The youngest rock sample most likely was collected from location

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

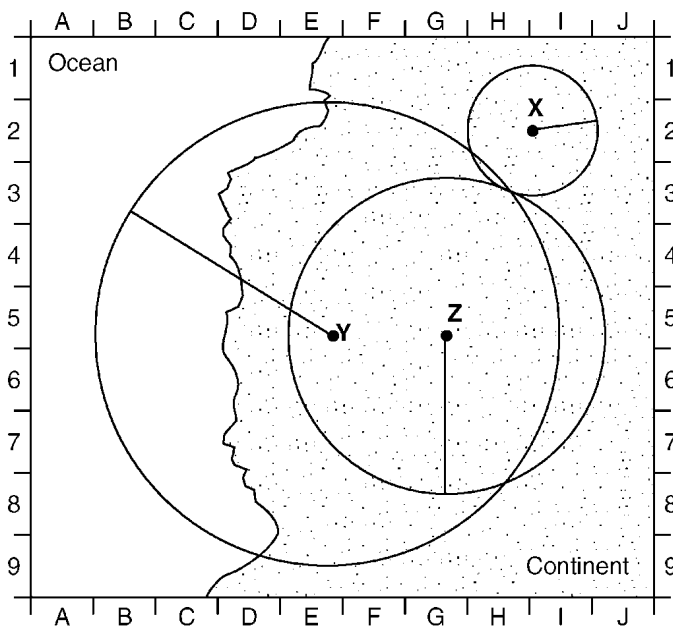
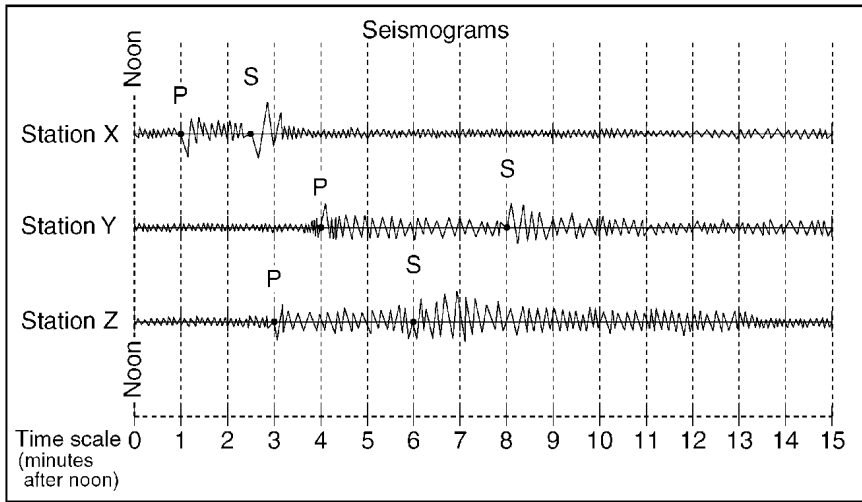
59. Base your answer to the following question on the diagrams below of geologic cross sections of the upper mantle and crust at four different Earth locations, A, B, C, and D. Movement of the crustal sections (plates) is indicated by arrows, and the locations of frequent earthquakes are indicated by *. Diagrams are not drawn to scale.



Which location best represents the boundary between the African plate and the South American plate?

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

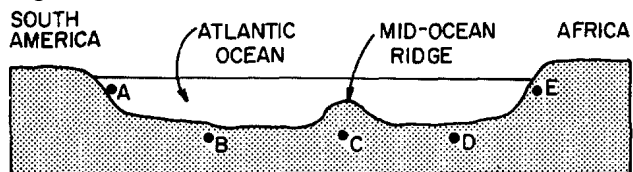
60. Base your answer to the following question on the diagram and map below. The diagram shows three seismograms of the same earthquake recorded at three different seismic stations, X, Y, and Z. The distances from each seismic station to the earthquake epicenter have been drawn on the map. A coordinate system has been placed on the map to describe locations. The map scale has not been included.



The youngest bedrock is most likely found at which location?

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

61. The diagram below represents a cross section of the Atlantic Ocean from the eastern coast of South America to the western coast of Africa along the Equator.



At what point would evidence of a rising convection current in the mantle most likely be found?

- A) *A* B) *B* C) *C* D) *E*
-