tpo_20_passage_3

When one considers the many ways by which organisms are completely destroyed after death, it is remarkable that fossils are as common as they are. Attack by scavengers and bacteria, chemical decay, and destruction by erosion and other geologic agencies make the odds against preservation very high. However, the chances of escaping complete destruction are vastly improved if the organism happens to have a mineralized skeleton and dies in a place where it can be quickly buried by sediment. Both of these conditions are often found on the ocean floors, where shelled invertebrates (organisms without spines) flourish and are covered by the continuous rain of sedimentary particles. Although most fossils are found in marine sedimentary rocks, they also are found in terrestrial deposits left by streams and lakes. On occasion, animals and plants have been preserved after becoming immersed in tar or quicksand, trapped in ice or lava flows, or engulfed by rapid falls of volcanic ash. The term "fossil" often implies petrifaction, literally a transformation into stone. After the death of an organism, the soft tissue is ordinarily consumed by scavengers and bacteria. The empty shell of a snail or clam may be left behind, and if it is sufficiently durable and resistant to dissolution, it may remain basically unchanged for a long period of time. Indeed, unaltered shells of marine invertebrates are known from deposits over 100 million years old. In many marine creatures, however, the skeleton is composed of a mineral variety of calcium carbonate called aragonite. Although aragonite has the same composition as the more familiar mineral known as calcite, it has a different crystal form, is relatively unstable, and in time changes to the more stable calcite. Many other processes may alter the shell of a clam or snail and enhance its chances for preservation. Water containing dissolved silica, calcium carbonate, or iron may circulate through the enclosing sediment and be deposited in cavities such as marrow cavities and canals in bone once occupied by blood vessels and nerves. In such cases, the original composition of the bone or shell remains, but the fossil is made harder and more durable. This addition of a chemically precipitated substance into pore spaces is termed "permineralization." Petrifaction may also involve a simultaneous exchange of the original substance of a dead plant or animal with mineral matter of a different composition. This process is termed "replacement" because solutions have dissolved the original material and replaced it with an equal volume of the new substance. Replacement can be a marvelously precise process, so that details of shell ornamentation, tree rings in wood, and delicate structures in bone are accurately preserved. Another type of fossilization, known as carbonization, occurs when soft tissues are preserved as thin films of carbon. Leaves and tissue of soft-bodied organisms such as jellyfish or worms may accumulate, become buried and compressed, and lose their volatile constituents. The carbon often remains behind as a blackened silhouette. Although it is certainly true that the possession of hard parts enhances the prospect of preservation, organisms having soft tissues and organs are also occasionally preserved. Insects and even small invertebrates have been found preserved in the hardened resins of conifers and certain other trees. X-ray examination of thin slabs of rock sometimes reveals the ghostly outlines of tentacles, digestive tracts, and visual organs of a variety of marine creatures. Soft parts, including skin, hair, and viscera of ice age mammoths, have been preserved in frozen soil or in the oozing tar of oil seeps. The probability that actual remains of soft tissue will be preserved is improved if the organism dies in an environment of rapid deposition and oxygen deprivation. Under such conditions, the destructive effects of bacteria are diminished. The

Middle Eocene Messel Shale (from about 48 million years ago) of Germany accumulated in such an environment. The shale was deposited in an oxygen-deficient lake where lethal gases sometimes bubbled up and killed animals. Their remains accumulated on the floor of the lake and were then covered by clay and silt. Among the superbly preserved Messel fossils are insects with iridescent exoskeletons (hard outer coverings), frogs with skin and blood vessels intact, and even entire small mammals with preserved fur and soft tissue.

question 1

The word "agencies" in the passage is closest in meaning to

A combinations

B problems

C forces

D changes

question 2

In paragraph 1, what is the author's purpose in providing examples of how organisms are destroyed?

A To emphasize how surprising it is that so many fossils exist

B To introduce a new geologic theory of fossil preservation

C To explain why the fossil record until now has remained incomplete

D To compare how fossils form on land and in water

question 3

Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

A When snail or clam shells are left behind, they must be empty in order to remain durable and resist dissolution.

B Although snail and clam shells are durable and resist dissolving, over time they slowly begin to change.

C Although the soft parts of snails or clams dissolve quickly, their hard shells resist dissolution for a long time.

D Empty snail or clam shells that are strong enough not to dissolve may stay in their original state for a long time.

question 4

Why does the author mention “aragonite” in the passage?

A To emphasize that some fossils remain unaltered for millions of years

B To contrast fossil formation in organisms with soft tissue and in organisms with hard shells

C To explain that some marine organisms must undergo chemical changes in order to fossilize

D To explain why fossil shells are more likely to survive than are fossil skeletons

question 5

Which of the following best explains the process of permineralization mentioned in paragraph 3?

A Water containing calcium carbonate circulates through a shell and deposits sediment.

B Liquid containing chemicals hardens an already existing fossil structure.

C Water passes through sediment surrounding a fossil and removes its chemical content.

D A chemical substance enters a fossil and changes its shape.

question 6

Paragraph 5 suggests which of the following about the carbonization process?

A It is completed soon after an organism dies.

B It does not occur in hard-shell organisms.

C It sometimes allows soft-tissued organisms to be preserved with all their parts.

D It is a more precise process of preservation than is replacement.

question 7

According to paragraph 7, how do environments containing oxygen affect fossil preservation?

A They increase the probability that soft-tissued organisms will become fossils.

B They lead to more bacteria production.

C They slow the rate at which clay and silt are deposited.

D They reduce the chance that animal remains will be preserved.

question 8

According to the passage, all of the following assist in fossil preservation EXCEPT

A the presence of calcite in an organism’ s skeleton

B the presence of large open areas along an ocean floor

C the deposition of a fossil in sticky substances such as sap or tar

D the rapid burial of an organism under layers of silt

question 9

Look at the four squares [ ] that indicate where the following sentence could be added to the passage.

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the organism happens to have a mineralized skeleton and dies in a place where it can be quickly buried by sediment. Both of these conditions are often found on the ocean floors, where shelled invertebrates (organisms without spines) flourish and are covered by the continuous rain of sedimentary particles. Although most fossils are found in marine sedimentary rocks, they also are found in terrestrial deposits left by streams and lakes. On occasion, animals and plants have been preserved after becoming immersed in tar or quicksand, trapped in ice or lava flows, or engulfed by rapid falls of volcanic ash. The term "fossil" often implies petrifaction, literally a transformation into stone. After the death of an organism, the soft tissue is ordinarily consumed by scavengers and bacteria. The empty shell of a snail or clam may be left behind, and if it is sufficiently durable and resistant to dissolution, it may remain basically unchanged for a long period of time. Indeed, unaltered shells of marine invertebrates are known from deposits over 100 million years old. In many marine creatures, however, the skeleton is composed of a mineral variety of calcium carbonate called aragonite. Although aragonite has the same composition as the more familiar mineral known as calcite, it has a different crystal form, is relatively unstable, and in time changes to the more stable calcite. Many other processes may alter the shell of a clam or snail and enhance its chances for preservation. Water containing dissolved silica, calcium carbonate, or iron may circulate through the enclosing sediment and be deposited in cavities such as marrow cavities and canals in bone once occupied by blood vessels and nerves. In such cases, the original composition of the bone or shell remains, but the fossil is made harder and more durable. This addition of a chemically precipitated substance into pore spaces is termed "permineralization." Petrifaction may also involve a simultaneous exchange of the original substance of a dead plant or animal with mineral matter of a different composition. This process is termed "replacement" because solutions have dissolved the original material and replaced it with an equal volume of the new substance. Replacement can be a marvelously precise process, so that details of shell ornamentation, tree rings in wood, and delicate structures in bone are accurately preserved. [] Another type of fossilization, known as carbonization, occurs when soft tissues are preserved as thin films of carbon. [] Leaves and tissue of soft-bodied organisms such as jellyfish or worms may accumulate, become buried and compressed, and lose their volatile constituents. [] The carbon often remains behind as a blackened silhouette. [] Although it is certainly true that the possession of hard parts enhances the prospect of preservation, organisms having soft tissues and organs are also occasionally preserved. Insects and even small invertebrates have been found preserved in the hardened resins of conifers and certain other trees. X-ray examination of thin slabs of rock sometimes reveals the ghostly outlines of tentacles, digestive tracts, and visual organs of a variety of marine creatures. Soft parts, including skin, hair, and viscera of ice age mammoths, have been preserved in frozen soil or in the oozing tar of oil seeps. The probability that actual remains of soft tissue will be preserved is improved if the organism dies in an environment of rapid deposition and oxygen deprivation. Under such conditions, the destructive effects of bacteria are diminished. The Middle Eocene Messel Shale (from about 48 million years ago) of Germany accumulated in such an environment. The shale was deposited in an oxygen-deficient lake where lethal gases sometimes bubbled up and killed animals. Their remains accumulated on the floor of the lake and were then covered by clay and silt. Among the superbly preserved Messel fossils are insects with iridescent exoskeletons (hard outer coverings), frogs with skin and blood vessels intact, and even entire small mammals with preserved fur and soft tissue.

question 10

Directions: An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

A. Environmental characteristics like those present on ocean floors increase the likelihood that plant and animal fossils will occur.

B. Fossils are more likely to be preserved in shale deposits than in deposits of clay and silt.

C. The shells of organisms can be preserved by processes of chemical precipitation or mineral exchange.

D. Freezing enables the soft parts of organisms to survive longer than the hard parts.

E. Comparatively few fossils are found in the terrestrial deposits of streams and lakes.

F. Thin films of carbon may remain as an indication of soft tissue or actual tissue may be preserved if exposure to bacteria is limited.