tpo_44_passage_1

One of the most significant evolutionary events that occurred on Earth was the transition of water-dwelling fish to terrestrial tetrapods (four-limbed organisms with backbones). Fish probably originated in the oceans, and our first records of them are in marine rocks. However, by the Devonian Period (408 million to 362 million years ago), they had radiated into almost all available aquatic habitats, including freshwater settings. One of the groups whose fossils are especially common in rocks deposited in fresh water is the lobe-finned fish. The freshwater Devonian lobe-finned fish rhipidistian crossopterygian is of particular interest to biologists studying tetrapod evolution. These fish lived in river channels and lakes on large deltas. The delta rocks in which these fossils are found are commonly red due to oxidized iron minerals, indicating that the deltas formed in a climate that had alternate wet and dry periods. If there were periods of drought, any adaptations allowing the fish to survive the dry conditions would have been advantageous. In these rhipidistians, several such adaptations existed. It is known that they had lungs as well as gills for breathing. Cross sections cut through some of the fossils reveal that the mud filling the interior of the carcass differed in consistency and texture depending on its location inside the fish. These differences suggest a saclike cavity below the front end of the gut that can only be interpreted as a lung. Gills were undoubtedly the main source of oxygen for these fish, but the lungs served as an auxiliary breathing device for gulping air when the water became oxygen depleted, such as during extended periods of drought. So, these fish had already evolved one of the prime requisites for living on land: the ability to use air as a source of oxygen. A second adaptation of these fish was in the structure of the lobe fins. The fins were thick, fleshy, and quite sturdy, with a median axis of bone down the center. They could have been used as feeble locomotor devices on land, perhaps good enough to allow a fish to flop its way from one pool of water that was almost dry to an adjacent pond that had enough water and oxygen for survival. These fins eventually changed into short, stubby legs. The bones of the fins of a Devonian rhipidistian exactly match in number and position the limb bones of the earliest known tetrapods, the amphibians. It should be emphasized that the evolution of lungs and limbs was in no sense an anticipation of future life on land. These adaptations developed because they helped fish to survive in their existing aquatic environment. What ecological pressures might have caused fishes to gradually abandon their watery habitat and become increasingly land-dwelling creatures? Changes in climate during the Devonian may have had something to do with this if freshwater areas became progressively more restricted. Another impetus may have been new sources of food. The edges of ponds and streams surely had scattered dead fish and other water-dwelling creatures. In addition, plants had emerged into terrestrial habitats in areas near streams and ponds, and crabs and other arthropods were also members of this earliest terrestrial community. Thus, by the Devonian the land habitat marginal to freshwater was probably a rich source of protein that could be exploited by an animal that could easily climb out of water. Evidence from teeth suggests that these earliest tetrapods did not utilize land plants as food; they were presumably carnivorous and had not developed the ability to feed on plants. How did the first tetrapods make the transition to a terrestrial habitat? Like early land plants such as rhyniophytes, they made only a partial transition; they were still quite tied to water. However, many problems that faced early land plants were not applicable to the first tetrapods. The ancestors of these animals already had a circulation system, and they were mobile, so that

they could move to water to drink. Furthermore, they already had lungs, which rhipidistians presumably used for auxiliary breathing. The principal changes for the earliest tetrapods were in the skeletal system-changes in the bones of the fins, the vertebral column, pelvic girdle, and pectoral girdle.

question 1

Paragraph 1 supports which of the following statements about fish evolution?

A Lobe-finned fish were among the earliest types of fish to appear.

B Fish began living in freshwater habitats only after originating elsewhere.

C Lobe-finned fish radiated into almost all available aquatic habitats.

D During the Devonian, lobe-finned fish were more common in marine than in freshwater habitats.

question 2

According to paragraph 2, what do the minerals in the delta rocks containing rhipidistian crossopterygian fossils reveal?

A These deltas formed in dry periods but gradually became wetter.

B These deltas contain different types of iron minerals than do the surrounding areas.

C Most rhipidistian crossopterygian fish died when the climate became dry.

D Rhipidistian crossopterygian fish lived in areas that experienced alternate dry and wet periods.

question 3

In paragraph 2, why does the author include the information that mud inside rhipidistian crossopterygian fossils differed in consistency and texture depending on where the mud was located?

A To provide evidence that rhipidistian crossopterygian lived in river channels and lakes on large deltas

B To identify an effect of the oxidation of iron minerals on the evolution of rhipidistian crossopterygian

C To help explain why scientists have concluded that rhipidistian crossopterygian probably had lungs

D To explain why scientists decided to cut cross sections through some fossils of rhipidistian crossopterygian

question 4

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 Because the lungs of these fish were able to provide only a small amount of oxygen, these fish obtained most of their oxygen through their gills during periods of drought.

B During periods of extended drought, these fish used their lungs to increase their intake of oxygen beyond the levels absorbed by the gills in normal times.

C Although these fish primarily used their gills to obtain oxygen, they used their lungs to obtain oxygen from the air when there was not enough in the water.

D During periods of extended drought, the gills became an auxiliary breathing device and the lungs became the main source of oxygen for these fish.

question 5

According to paragraph 3, the structure of the fins of rhipidistian crossopterygian may have allowed these fish to

A reduce the amount of oxygen needed for survival

B develop thick, sturdy bones

C move more efficiently in water

D move short distances over areas that were mostly dry

question 6

The word “progressively” in the passage is closest in meaning to

A increasingly

B noticeably

C occasionally

D rapidly

question 7

According to paragraph 4, teeth of the earliest tetrapods suggest that these tetrapods

A competed with other animals for protein

B were probably carnivores

C could easily climb out of water

D were able to eat plants

question 8

According to paragraph 5, which of the following was true of the first tetrapods?

A They became dependent for food on organisms already living on land.

B They needed to develop new mechanisms for obtaining nutrients.

C They continued to live in close association with aquatic environments.

D They were evolutionarily far removed from their rhipidistian ancestors.

question 9

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

One of the most significant evolutionary events that occurred on Earth was the transition of water-dwelling fish to terrestrial tetrapods (four-limbed organisms with backbones). Fish probably originated in the oceans, and our first records of

them are in marine rocks. However, by the Devonian Period (408 million to 362 million years ago), they had radiated into almost all available aquatic habitats, including freshwater settings. One of the groups whose fossils are especially common in rocks deposited in fresh water is the lobe-finned fish. The freshwater Devonian lobe-finned fish rhipidistian crossopterygian is of particular interest to biologists studying tetrapod evolution. These fish lived in river channels and lakes on large deltas. The delta rocks in which these fossils are found are commonly red due to oxidized iron minerals, indicating that the deltas formed in a climate that had alternate wet and dry periods. If there were periods of drought, any adaptations allowing the fish to survive the dry conditions would have been advantageous. In these rhipidistians, several such adaptations existed. It is known that they had lungs as well as gills for breathing. Cross sections cut through some of the fossils reveal that the mud filling the interior of the carcass differed in consistency and texture depending on its location inside the fish. These differences suggest a saclike cavity below the front end of the gut that can only be interpreted as a lung. Gills were undoubtedly the main source of oxygen for these fish, but the lungs served as an auxiliary breathing device for gulping air when the water became oxygen depleted, such as during extended periods of drought. So, these fish had already evolved one of the prime requisites for living on land: the ability to use air as a source of oxygen. A second adaptation of these fish was in the structure of the lobe fins. The fins were thick, fleshy, and quite sturdy, with a median axis of bone down the center. They could have been used as feeble locomotor devices on land, perhaps good enough to allow a fish to flop its way from one pool of water that was almost dry to an adjacent pond that had enough water and oxygen for survival. These fins eventually changed into short, stubby legs. The bones of the fins of a Devonian rhipidistian exactly match in number and position the limb bones of the earliest known tetrapods, the amphibians. It should be emphasized that the evolution of lungs and limbs was in no sense an anticipation of future life on land. These adaptations developed because they helped fish to survive in their existing aquatic environment. What ecological pressures might have caused fishes to gradually abandon their watery habitat and become increasingly land-dwelling creatures? Changes in climate during the Devonian may have had something to do with this if freshwater areas became progressively more restricted. Another impetus may have been new sources of food. The edges of ponds and streams surely had scattered dead fish and other water-dwelling creatures. [] In addition, plants had emerged into terrestrial habitats in areas near streams and ponds, and crabs and other arthropods were also members of this earliest terrestrial community. [] Thus, by the Devonian the land habitat marginal to freshwater was probably a rich source of protein that could be exploited by an animal that could easily climb out of water. [] Evidence from teeth suggests that these earliest tetrapods did not utilize land plants as food; they were presumably carnivorous and had not developed the ability to feed on plants. [] How did the first tetrapods make the transition to a terrestrial habitat? Like early land plants such as rhyniophytes, they made only a partial transition; they were still quite tied to water. However, many problems that faced early land plants were not applicable to the first tetrapods. The ancestors of these animals already had a circulation system, and they were mobile, so that they could move to water to drink. Furthermore, they already had lungs, which rhipidistians presumably used for auxiliary breathing. The principal changes for the earliest tetrapods were in the skeletal system-changes in the bones of the fins, the vertebral column, pelvic girdle, and pectoral girdle.

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. Rhipidistian crossopterygian had features such as primitive lungs and thick fins that could have helped it survive dry periods.

B. By the Devonian period, lobe-finned fish preferred freshwater habitats to life in the ocean.

C. During the Devonian, the number of bones increased in the fins of rhipidistians, improving such animals' ability to swim and move over land.

D. A drier climate and new sources of food on land may have encouraged the lobe-finned fish' s move to a terrestrial existence.

E. Shortly after the earliest tetrapods developed lungs, plants and other animals began to flourish on land.

F. Early tetrapods remained closely connected to water, but several of their body structures were adapted for life on land.