

## tpo\_6\_passage\_2

In 1769 in a little town in Oxfordshire, England, a child with the very ordinary name of William Smith was born into the poor family of a village blacksmith. He received rudimentary village schooling, but mostly he roamed his uncle's farm collecting the fossils that were so abundant in the rocks of the Cotswold hills. When he grew older, William Smith taught himself surveying from books he bought with his small savings, and at the age of eighteen he was apprenticed to a surveyor of the local parish. He then proceeded to teach himself geology, and when he was twenty-four, he went to work for the company that was excavating the Somerset Coal Canal in the south of England. This was before the steam locomotive, and canal building was at its height. The companies building the canals to transport coal needed surveyors to help them find the coal deposits worth mining as well as to determine the best courses for the canals. This job gave Smith an opportunity to study the fresh rock outcrops created by the newly dug canal. He later worked on similar jobs across the length and breadth of England, all the while studying the newly revealed strata and collecting all the fossils he could find. Smith used mail coaches to travel as much as 10,000 miles per year. In 1815 he published the first modern geological map, "A Map of the Strata of England and Wales with a Part of Scotland," a map so meticulously researched that it can still be used today. In 1831 when Smith was finally recognized by the Geological Society of London as the "father of English geology," it was not only for his maps but also for something even more important. Ever since people had begun to catalog the strata in particular outcrops, there had been the hope that these could somehow be used to calculate geological time. But as more and more accumulations of strata were cataloged in more and more places, it became clear that the sequences of rocks sometimes differed from region to region and that no rock type was ever going to become a reliable time marker throughout the world. Even without the problem of regional differences, rocks present a difficulty as unique time markers. Quartz is quartz—a silicon ion surrounded by four oxygen ions—there's no difference at all between two-million-year-old Pleistocene quartz and Cambrian quartz created over 500 million years ago. As he collected fossils from strata throughout England, Smith began to see that the fossils told a different story from the rocks. Particularly in the younger strata, the rocks were often so similar that he had trouble distinguishing the strata, but he never had trouble telling the fossils apart. While rock between two consistent strata might in one place be shale and in another sandstone, the fossils in that shale or sandstone were always the same. Some fossils endured through so many millions of years that they appear in many strata, but others occur only in a few strata, and a few species had their births and extinctions within one particular stratum. Fossils are thus identifying markers for particular periods in Earth's history. Not only could Smith identify rock strata by the fossils they contained, he could also see a pattern emerging: certain fossils always appear in more ancient sediments, while others begin to be seen as the strata become more recent. By following the fossils, Smith was able to put all the strata of England's earth into relative temporal sequence. About the same time, Georges Cuvier made the same discovery while studying the rocks around Paris. Soon it was realized that this principle of faunal (animal) succession was valid not only in England or France but virtually everywhere. It was actually a principle of floral succession as well, because plants showed the same transformation through time as did fauna. Limestone may be found in the Cambrian or—300 million years later—in the Jurassic strata, but a

trilobite-the ubiquitous marine arthropod that had its birth in the Cambrian-will never be found in Jurassic strata, nor a dinosaur in the Cambrian.

#### question 1

According to paragraph 1, which of the following statements about William Smith is NOT true?

- A Smith learned surveying by reading and by apprenticing for a local surveyor.
- B Smith's family lived in a small English town and possessed little wealth.
- C Smith learned about fossils from books he borrowed from his uncle.
- D Smith eventually left his village to work on the excavation of an English canal.

#### question 2

Which of the following can be inferred from paragraph 2 about canal building?

- A Canals were built primarily in the south of England rather than in other regions.
- B Canal building decreased after the steam locomotive was invented.
- C Canal building made it difficult to study rock strata which often became damaged in the process.
- D Canal builders hired surveyors like Smith to examine exposed rock strata.

#### question 3

According to paragraph 2, which of the following is true of the map published by William Smith?

- A It indicates the locations of England's major canals.
- B It became most valuable when the steam locomotive made rail travel possible.
- C The data for the map were collected during Smith's work on canals.
- D It is no longer regarded as a geological masterpiece.

#### 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 The discovery of regional differences in the sequences of rocks led geologists to believe that rock types could someday become reliable time markers.

B Careful analysis of strata revealed that rocks cannot establish geological time because the pattern of rock layers varies from place to place.

C Smith's catalogs of rock strata indicated that the sequences of rocks are different from place to place and from region to region.

D Because people did not catalog regional differences in sequences of rocks, it was believed that rocks could never be reliable time markers.

#### question 5

Why does the author use the phrase "Quartz is quartz" ?

A To describe how the differences between Pleistocene and Cambrian quartz reveal information about dating rocks

B To point out that the chemical composition of quartz makes it more difficult to date than other rocks

C To provide an example of how regional differences in rock sequences can make a particular rock difficult to date

D To explain that rocks are difficult to use for dating because their chemical compositions always remain the same over time

#### question 6

According to paragraph 4, it was difficult for Smith to distinguish rock strata because

A the rocks from different strata closely resembled each other

B he was often unable to find fossils in the younger rock strata

C their similarity to each other made it difficult for him to distinguish one rock type from another

D the type of rock between two consistent strata was always the same

#### question 7

Select the TWO answer choices that are true statements based upon the discussion of the principle of faunal succession in paragraph 5. To receive credit, you must select TWO answers.

A It was a principle that applied to fauna but not to flora.

B It was discovered independently by two different geologists.

C It describes how fossils are distributed in rock strata.

D It explains why plants and animals undergo transformations through time.

#### question 8

In mentioning "trilobite" , the author is making which of the following points?

A Fossils cannot be found in more than one rock stratum.

B Faunal succession can help put rock layers in relative temporal sequence.

C Faunal succession cannot be applied to different strata composed of the same kind of rock.

D The presence of trilobite fossils makes it difficult to date a rock.

#### question 9

Look at the four squares [ ] that indicate where the following sentence could be added to the passage. Where would the sentence best fit?

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when he was twenty-four, he went to work for the company that was excavating the Somerset Coal Canal in the south of England. This was before the steam locomotive, and canal building was at its height. The companies building the canals to transport coal needed surveyors to help them find the coal deposits worth mining as well as to determine the best courses for the canals. This job gave Smith an opportunity to study the fresh rock outcrops created by the newly dug canal. He later worked on similar jobs across the length and breadth of England, all the while studying the newly revealed strata and collecting all the fossils he could find. Smith used mail coaches to travel as much as 10,000 miles per year. In 1815 he published the first modern geological map, "A Map of the Strata of England and Wales with a Part of Scotland," a map so meticulously researched that it can still be used today. In 1831 when Smith was finally recognized by the Geological Society of London as the "father of English geology," it was not only for his maps but also for something even more important. Ever since people had begun to catalog the strata in particular outcrops, there had been the hope that these could somehow be used to calculate geological time. But as more and more accumulations of strata were cataloged in more and more places, it became clear that the sequences of rocks sometimes differed from region to region and that no rock type was ever going to become a reliable time marker throughout the world. Even without the problem of regional differences, rocks present a difficulty as unique time markers. Quartz is quartz—a silicon ion surrounded by four oxygen ions—there's no difference at all between two-million-year-old Pleistocene quartz and Cambrian quartz created over 500 million years ago. As he collected fossils from strata throughout England, Smith began to see that the fossils told a different story from the rocks. Particularly in the younger strata, the rocks were often so similar that he had trouble distinguishing the strata, but he never had trouble telling the fossils apart. While rock between two consistent strata might in one place be shale and in another sandstone, the fossils in that shale or sandstone were always the same. Some fossils endured through so many millions of years that they appear in many strata, but others occur only in a few strata, and a few species had their births and extinctions within one particular stratum. Fossils are thus identifying markers for particular periods in Earth's history. Not only could Smith identify rock strata by the fossils they contained, he could also see a pattern emerging: certain fossils always appear in more ancient sediments, while others begin to be seen as the strata become more recent. [] By following the fossils, Smith was able to put all the strata of England's earth into relative temporal sequence. [] About the same time, Georges Cuvier made the same discovery while studying the rocks around Paris. [] Soon it was realized that this principle of faunal (animal) succession was valid not only in England or France but virtually everywhere. [] It was actually a principle of floral succession as well, because plants showed the same transformation through time as did fauna. Limestone may be found in the Cambrian or—300 million years later—in the Jurassic strata, but a trilobite—the ubiquitous marine arthropod that had its birth in the Cambrian—will never be found in Jurassic strata, nor a dinosaur in the Cambrian.

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. Smith found success easily in his profession because he came from a family of geologists and surveyors.
- B. Smith's work on canals allowed him to collect fossils and study rock layers all over England.
- C. Smith found that fossils are much more reliable indicators of geological time than rock strata are.
- D. Smith was named "the father of English geology" for his maps rather than for his other contributions to the field.
- E. Smith and Cuvier discovered that fossil patterns are easier to observe in ancient rock strata than in younger rock strata.
- F. The discovery of the principle of faunal succession allowed geologists to establish the relative age of Earth's rock layers.