

Reading Text 3 – The Cambrian Explosion

About 542 million years ago, a large diversity of animal phyla appeared. This spurt of evolution is called The Cambrian Explosion and is backed up by further fossil evidence. Over the course of the first ten million years, marine animals developed the basic body forms now seen in modern groups. The record includes fossils of crustaceans, molluscs, sponges, algae, and starfish. However, animal fossils from the Precambrian era have been found, indicating that many animal phyla actually developed prior to the Cambrian explosion. In fact, plants fossils have been found dating back to 1400 million years ago in Montana, USA, and China. These fossils represent organisms that do not resemble any modern organism yet prove that animal life did exist.

The Cambrian Explosion lasted for about 20 to 25 million years, resulting in the divergence of most modern metazoan phyla. Prior to the Cambrian Explosion, many animals were unicellular organisms. Over the course of the explosion, the rate of diversification accelerated, resulting in many of the phyla we have today.

The appearance of Cambrian fauna provokes several questions. These questions include: why was there such a huge diversification of complex organisms over a specific period of time? What is the source of this change and what does it suggest about the origin of animal life? Trilobites were the first fossils of the Cambrian Explosion to be discovered. In his book, *On the Origin of Species*, Charles Darwin names this appearance of trilobites as troubling to his theory of natural selection, because this group has no apparent antecedents.

Palaeontologist Charles Walcott suggests that an interval of time he calls the "Lipalian Era," actually existed but is not proven by a fossil record, and the predecessors of Cambrian animals lived during this time. Harry B. Whittington did a new analysis of Burgess Shale fossils in the 1970s with the conclusion that many were complex but different to modern animals. For example, the spiny slug-like *Wiwaxia* were different to any modern animal. Whittington and other researchers suggested that modern animal phyla developed at the same time during a specific period of time. This idea led to the theory of punctuated equilibrium. This theory develops Darwin's theory of evolution as a series of long intervals, punctuated by short periods of fast change. Another theory suggests these unique animals such as the *Wiwaxia* evolved prior to the Cambrian era.

When examining fossils, it is important to remember that two-thirds of fossils of living fossils have never been found; therefore, the fossil record of animal phyla is incomplete. It is rare to find fossils of soft-tissue animals. However, the Cambrian fossil record includes many lagerstätten fossils, which preserved soft tissues. These permit palaeontologists to study the internal anatomy of animals. Trace fossils are made up of tracks and burrows and marks left by feeding. These types of fossils represent another source that is not limited to animals with hard parts. We can also study the behaviour of organisms from these fossils. These trace fossils might supply the earliest physical proof of the appearance of complex animals.

Around the start of the Cambrian Explosions, many chemical markers point to a huge change in the environment. These markers are consistent with a mass extinction or warming resulting from the release of methane ice. Indeed, this sudden change could have been a cause of the Cambrian Explosion. This evidence encourages scientists to concentrate on theories consistent with an environmental change, although there are uncertainties.

Cladistics is a technique in biological classification in which animals are grouped together based on whether or not they have one or more shared, unique set of traits that are inherited from the group's last common ancestor. This technique results in a set or group of clades. This technique helps to ascertain the date that these lineages first appeared. We can also guess how long two living clades had diverged from the last ancestor. This results in an approximate dating of the lineages.

Questions

1. The word spurt in paragraph A is closest in meaning to:

- A. Burst
- B. Bump
- C. Process
- D. Stream

2. In paragraph B, what happened after the beginning of the Cambrian Explosion?

- A. There was a slow rate of diversification over millions of years
- B. There was a development of unicellular organisms
- C. There was a rapid rate of diversification
- D. There was a sudden burst of diversification of unicellular organisms

3. According to paragraph C, why did Charles Darwin find the appearance of trilobites troubling?

- A. Because they had no predecessors and therefore, posed a flaw in this theory of evolution
- B. Because trilobites had no descendants and therefore no fossil record to track their evolution
- C. Because trilobites did not evolve in the way Darwin suggested animals developed in his book, *On the Origin of the Species*
- D. Because trilobites were the first fossils discovered and therefore, difficult to examine

4. The word accelerated in paragraph B is closest in meaning to:

- A. Slowed down
- B. Increased
- C. Sped up
- D. Decreased

5. The word troubling in paragraph C is closest in meaning to:

- A. Annoying
- B. Hurtful
- C. Difficult
- D. Problematic

6. According to paragraph D, all the following statements are true about animal phyla evolution, EXCEPT:

- A. It is possible that the ancestors of Cambrian animal phyla existed during the 'Lipalian Era'
- B. Charles Walcott proved the idea of the 'Lipalian Era' with the fossil record
- C. Harry Whittington noted that Burgess Shale fossils were those of animals not existing in modern times
- D. Modern animals developed during a specific period in evolution

7. The word punctuated in paragraph D is closest in meaning to:

- A. Interspersed
- B. Regulated
- C. Controlled
- D. Managed

8. Paragraph D supports which of the following statements about a "punctuated equilibrium":

- A. The theory of a punctuated equilibrium suggests that evolution occurred over short periods of time, interspersed with moments of slow change
- B. The theory of a punctuated equilibrium suggests that evolution occurred over periods of time and equal length
- C. The theory of a punctuated equilibrium suggests that evolution occurred during the 'Lipalian Era' when most animal phyla developed
- D. The theory of a punctuated equilibrium suggests that evolution occurred over extended periods of time, interspersed with short moments of rapid change

9. The word common in paragraph G is closest in meaning to:

- A. Regular
- B. Routine
- C. Mutual
- D. Ordinary

10. Which of the sentences below best expresses the essential information in the following sentence? *When examining fossils, it is important to remember that two-thirds of living fossils have never been found; therefore, the fossil record of animal phyla is incomplete.*

- A. As we study fossils, we should remember that more than half of living fossils have been discovered; so, the fossil record is sufficient to fully understand the range of animal phyla
- B. As we study fossils, it is possible that one third of living fossils have never been discovered; so, the fossil record is insufficient to fully understand the range of animal phyla.
- C. As we study fossils, we should remember that less than half of living fossils have never been discovered; so, the fossil record is sufficient to fully understand the range of animal phyla
- D. As we study fossils, we should remember that more than half of living fossils have never been discovered; so, the fossil record is insufficient to fully understand the range of animal phyla

11. Which of the following is true, according to the passage? (Make sure to read the WHOLE PASSAGE)

- A. There is a unified consensus among scientists regarding the cause of Cambrian Explosion
- B. There are theories regarding the cause of Cambrian Explosion and some suggestions for flaws in these theories
- C. The cause of the Cambrian Explosion was a mass extinction or warming resulting from the release of methane ice
- D. The cause of the Cambrian Explosion was global warming

12. Which of the following can be inferred from paragraph A about animal phyla?

- A. Fossil records indicate animal phyla began to exist during the Cambrian Explosion
- B. Fossil records indicate animal phyla existed prior to the Cambrian Explosion
- C. Fossil records indicate animal phyla began to exist during the Precambrian Era
- D. Fossil records indicate animal phyla never existed at all

Questions 13-15

Do the following statements agree with the claims of the writer in the Reading

Passage? Select TRUE, FALSE, or NOT GIVEN based on each statement.

- TRUE: if the statement agrees with the views of the writer
- FALSE: if the statement contradicts the views of the writer
- NOT GIVEN: if it is impossible to say what the writer thinks about this

13. Methane level indicate significant change in the environment
14. Scientists are still unsure as to what caused the Cambrian explosion
15. Animals contributed significantly to the levels of methane found by chemical markers