Passage V

Scientists discuss 2 possible causes of an event 250 million years ago (Ma) in which 90% of all marine species became extinct.

Scientist 1

The extinctions were caused by *continental flood vulcanism*, a massive volcanic eruption lasting 1 million years that produced 2 million km^3 of lava. The eruption sent large amounts of sulfate-containing (SO_4) aerosols into the air. The aerosols combined with water vapor in the air to produce acid rain that fell worldwide and poisoned many bodies of water. SO_4-containing aerosols also helped break down ozone in the atmosphere, permitting high levels of ultraviolet light to reach the surface.

The eruption also released large amounts of carbon dioxide (CO_2) into the air. The higher-than-typical CO_2 levels in the air raised the CO_2 content of ocean surface waters to levels that were toxic to many marine organisms. The increased levels of CO_2 also caused climatic warming that decreased the temperature difference between the poles and the equator, thus slowing ocean circulation and causing ocean water to become oxygen-poor.

Scientist 2

The extinctions were caused by an overturning of deep, CO_2-rich ocean waters.

No continental ice sheets were present on Earth just prior to 250 Ma. Today, continental ice sheets help cool ocean surface waters, which then sink and drive the ocean's vertical circulation. Since this circulation was absent 250 Ma, the ocean water was stagnant and oxygen-poor.

Photosynthetic organisms living in ocean surface waters removed CO_2 from the atmosphere, converting it to organic matter. This organic matter sank to the ocean bottom, where it was oxidized to CO_2. As a result, the CO_2 levels in the deep ocean waters rose dramatically, while atmospheric CO_2 levels continued to drop, causing climatic cooling. Glaciers and ice sheets grew rapidly, cooling the ocean surface waters such that vertical circulation of the ocean began. Deep ocean water was brought to the surface, where it released the accumulated CO_2, dramatically increasing atmospheric and surface water concentrations of CO_2. This excess CO_2 was toxic to many marine organisms.

23. Which of the following statements best explains why Scientist 1 mentioned ultraviolet light?

- **A.** High levels of ultraviolet light are beneficial to many living things.
- **B.** High levels of ultraviolet light are harmful to many living things.
- **C.** Ultraviolet light helps create ozone in the atmosphere.
- **D.** Ultraviolet light helps create CO_2 in the atmosphere.

24. Large amounts of SO_4-containing aerosols in the atmosphere are known to reflect some of the incoming solar radiation back into space, which results in a lowering of the surface temperature. Based on the information provided, this finding would most likely *weaken* the viewpoint(s) of:

- **F.** Scientist 1 only.
- **G.** Scientist 2 only.
- **H.** both Scientist 1 and Scientist 2.
- **J.** neither Scientist 1 nor Scientist 2.

25. Scientist 2 would most likely state that the vertical circulation that is present in most of the oceans today is maintained, at least in part, by the presence of:

- **A.** high levels of CO_2 in the air.
- **B.** active volcanoes around the Pacific Ocean rim.
- **C.** ice sheets in Earth's polar regions.
- **D.** marine organisms in deep ocean waters.

26. Both scientists would most likely agree that the ocean water was, or became, oxygen-poor when which of the following events occurred?

- **F.** Ocean water circulation reversed its usual direction.
- **G.** Ocean water circulation slowed, stopped, or was absent.
- **H.** Oceanic organisms dramatically increased the available oxygen in the ocean water.
- **J.** Oceanic organisms used up all the available CO_2 in the ocean water.

27. According to the information provided, radioactive dating of volcanic rocks created during the continental flood vulcanism described by Scientist 1 would show the rocks to be about how many million years old?

- **A.** 1
- **B.** 50
- **C.** 100
- **D.** 250

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