

第五套

Milankovitch Cycles and Glaciation

Paragraph 1

Although the history of glaciation during the Pleistocene epoch (2 million to 10,000 years ago) is well established, we do not know with complete certainty why glaciation takes place. For over a century, geologists and climatologists have struggled with this problem, but it remains unsolved.

Paragraph 2

It is long known that Earth's orbit around the Sun changes periodically, cyclically affecting the way solar radiation strikes the Earth, but the idea that these changes affect climate was first advanced by James Croll in the late 1800s. Later, Milutin Milankovitch elaborated the theory with calculations that convincingly argued that the cycles, now known as Milankovitch cycles, could cause climatic variations.

1. The word “elaborated” in the passage is closest in meaning to D

- A. corrected
- B. defended
- C. studied
- D. developed

2. According to paragraph 2, Milankovitch was the first to do which of the following? C

- A. Introduce the idea that periodic changes in Earth's orbit could influence Earth's climate
- B. Show that periodic changes in Earth's orbit could be mathematically calculated
- C. Provide calculations to show that periodic changes in Earth's orbit could affect Earth's climate
- D. Propose that Earth's orbit is not fixed but undergoes periodic changes

Paragraph 3

The Milankovitch cycles emerge from the way three cyclic changes in Earth's orbit combine. One characteristic of Earth's orbit is its eccentricity, the degree to which the orbit is an ellipse rather than a circle. Changes in the eccentricity of Earth's orbit occur in a cycle of about 96,000 years. The inclination, or tilt, of Earth's axis also varies periodically, moving between 22 degrees and 24.5 degrees. The tilt of Earth's axis, toward the Sun at some times of the year and away from the Sun at other times, is responsible for the annual cycle of seasons. The greater the tilt, the greater the contrast between summer and winter temperatures. Changes in the tilt occur in a cycle 41,000 years long. Also, Earth wobbles as it spins, like a slightly unsteady top. The wobble cycle is completed once every 21,700 years. Changes in eccentricity, tilt and wobble do not affect the total amount of solar radiation Earth receives in a year, but they do affect how evenly or unevenly this radiation is disturbed over the course of a year. According to the Milankovitch theory, about every 40,000 years the three separate cycles combine in such a way that the difference between summer and winter temperatures is at a minimum. At this point winter temperatures are milder but so too are summer temperatures. As a result, less ice is melted in the summer than is formed in the winter, so glaciers build up and a period of glaciation results.

3. According to paragraph 3, Milankovitch's theory holds that periods of glaciation result from a particular combination of changes in all the following **EXCEPT**

- A. the shape of Earth's orbit
- B. the inclination of Earth's axis
- C. the wobble of Earth as it spins
- D. the amount of time required for Earth's rotation around the Sun

4. According to paragraph 3, Milankovitch's theory predicts that glaciers build up most when

- A. the least amount of solar heat is being delivered to Earth
- B. winter temperatures are lowest
- C. the difference between winter temperatures and summer temperatures is greatest
- D. both winter temperatures and summer temperatures are relatively mild

Paragraph 4

Milankovitch worked out the ideas of climatic cycles in the 1920s and 1930s, but it was not until the 1970s that a detailed **chronology** of the Pleistocene temperature changes was determined that could test the predictions of this theory. A correspondence between **Milankovitch cycles and climate fluctuations** of the last 65 million years seems clear. **Furthermore**, studies of rock samples drilled from the deep-sea floor and the fossils contained in them indicate that the fluctuation of climate during the past few hundred thousand years is remarkably close to that predicted by Milankovitch.

5. Which of the following can be inferred from paragraph 4 about rock samples taken from the sea floor and the fossils they contain?

- A. There is a correspondence between the fossils in the samples and climate fluctuations.
- B. Milankovitch's theory predicts when the samples will contain fossils.
- C. It was not known until the 1970s that fossils were present in rocks taken from the sea floor.
- D. There is no fossil record in the samples older than a few hundred thousand years.

Paragraph 5

A problem with Milankovitch's explanation of glaciation arises from the fact that the variations in Earth's orbit, and hence the Milankovitch cycles, have existed for billions of years. Thus we might expect that glaciation would **have been a cyclic event throughout geologic time**. In fact, periods of glaciation are rare. So there must be another factor acting together with the Milankovitch cycles that causes periods of glaciation. Once this additional factor makes the temperature low enough, the cyclic variations of the Milankovitch cycles will force the planet into and out of glacial epochs with a fixed regularity.

6. According to paragraph 5, which of the following is a problem with Milankovitch's theory? B

- A. It assures that the astronomical cycles have been in existence for billions of years.
- B. It cannot explain why glaciation has been a relatively rare occurrence in Earth's history.
- C. It cannot predict periods of glaciation in Earth's distant past.
- D. It assures that astronomical cycles have an effect on Earth's climate even during periods when there is no glaciation.

Paragraph 6

Many hypotheses have been proposed for the additional cooling factor. Some suggest that variations in the Sun's energy output could account for the ice ages. However, our present understanding of the Sun's luminosity holds that it should have progressively increased, not decreased, over the course of Earth's history. Still others argue that volcanic dust injected into the atmosphere shields Earth from the Sun's rays and initiates an ice age. However, no correlation has been found between volcanic activity and the start of the last ice age. An increasingly attractive theory holds that decreases in atmospheric carbon dioxide starts the cooling trend that leads to glaciation. Carbon dioxide traps solar energy reflected from the Earth's surface. If carbon dioxide levels decrease, less heat is trapped and Earth's surface cools. Recent studies of the carbon dioxide content of gas bubbles preserved in the Greenland ice cap do in fact show that high carbon dioxide levels are associated with warm interglacial periods, and low levels with cold glacial periods.

7. According to paragraph 6, in addition to Milankovitch cycles, each of the following has been proposed as a contributing cause of ice ages **EXCEPT** A

- A. variations in the composition of the Greenland ice cap
- B. variations in the Sun's energy output
- C. volcanic dust injected into the atmosphere
- D. decreases in atmospheric carbon dioxide

8. It follows from the theory of the role of carbon dioxide discussed in paragraph 6, that C

- A. the decrease in temperature during the last ice age caused a decrease in atmospheric carbon dioxide
- B. the atmosphere had higher carbon dioxide content during the last ice age than it had during the warm period immediately before it
- C. the cooling of temperatures that led to the last ice age was brought about by a decrease in atmospheric carbon dioxide
- D. there was less carbon dioxide in the atmosphere toward the end of the last ice age than there was at the beginning

Paragraph 5

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

This factor must precede an ice age and have the effect of slightly lowering Earth's temperature.

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 answer choices 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.

In the 1920s and 1930s, Milutin Milankovitch worked out an account of the cause of Earth's glaciations. ABF

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Answer Choices

- A. Milankovitch argued that glaciations would result when three cycles that affect characteristics of Earth's orbit combined in a certain way.
- B. Milankovitch's predictions have been shown to be in agreement with periods of glaciation over the past 65 million years.
- C. Since ice ages are much less frequent than Milankovitch's explanation predicts, some factor, such

- as low levels of atmospheric carbon dioxide, must also be involved in triggering glaciation.
- D. Milankovitch showed that changes in Earth's orbit periodically lengthen cold seasons and shorten warm ones so that more ice forms than melts and glaciers build up.
- E. Dust from volcanic eruptions that blocks the Sun's warming radiation has been proposed as an explanation alternative to Milankovitch cycles for the cause of ice ages.
- F. Studies of gas bubbles preserved in the Greenland ice cap strongly suggest that Milankovitch cycles may also influence atmospheric carbon dioxide levels.

词汇伴侣

第一段

glaciation n.冰川	Pleistocene adj.更新世的（地球上大约两百万年前至一万年前的一个时期，那时地球表面大部分被冰覆盖）
epoch n.时期	well established adj.成熟的；确定的
climatologist n.气候学家	

第二段

orbit n.轨道	cyclically adv.周期性地
solar radiation 太阳辐射	advance v.提出
elaborated v.详细阐述	convincingly adv.令人信服地
variation n.变化	

第三段

eccentricity n.反常行为	inclination n.倾斜
tilt n.倾斜	axis n.轴
annual adj.每年的	wobble v.摇晃；摇摆
spin v.旋转	slightly adv.轻微地
unsteady adj.不稳定的	evenly adv.均匀地
disturb v.扰乱	minimum n.最低值

第四段

chronology n.年代顺序；年表	correspondence n.对应；相似；相关
fluctuation n.波动	drill v.钻井；打钻

第五段

arise from 源自于	hence conj.因此
cyclic adj.周期性的	variation n.变化

epoch n.时期	fixed adj.固定的
regularity n.规律性	

第六段

hypothesis n.假设	output n.产量；输出
account for 导致	present adj.目前的
luminosity n.光度	progressively adv.逐步地
inject v.注射	shield v.遮蔽
initiate v.开始	correlation n.关系；联系
trap v.困住	reflect v.反射
bubble n.泡泡	preserve v.保存
ice cap 冰盖	be associated with 与..相关
interglacial adj.间冰期	