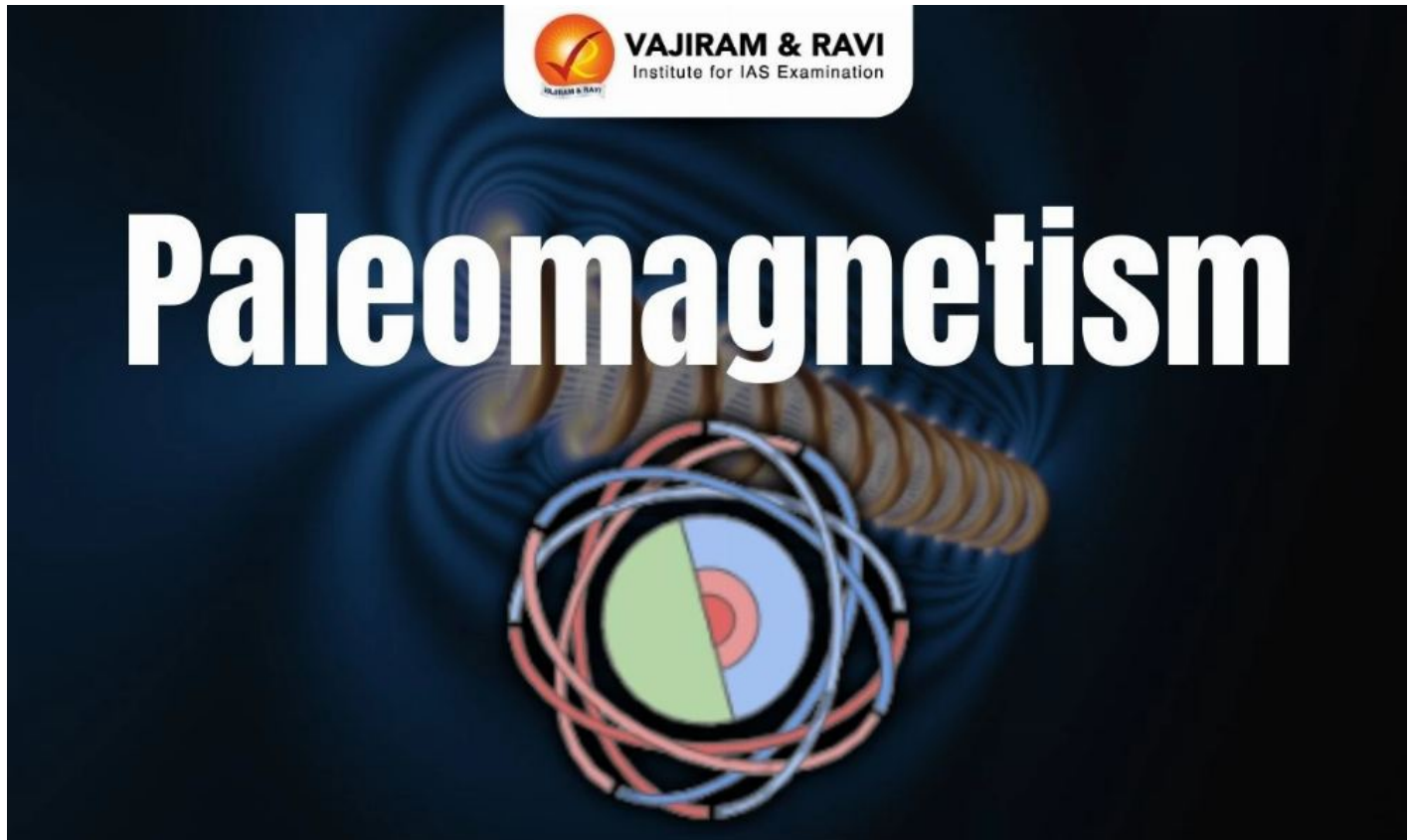


Paleomagnetism, Definition, Working, Significance, Diagram

July 11, 2026 • vajiramandravi.com



The concept of **palaeomagnetism** was first introduced by French physicist **Bernard Brunhes** in 1906 to explore how **volcanic rocks capture Earth's magnetic field** direction upon cooling. The Earth's magnetic field is like a **giant bar magnet** that is slightly tilted from its **rotational axis**. It has **north and south poles** determined by the field line's entry and exit points.

Remarkably, the **polarity of this field can be reversed**, swapping the north and south poles. **Magnetic minerals** in rocks, such as **magnetite**, align with the magnetic field below the **Curie temperature**, causing the field's **direction and intensity** to be preserved at the time of formation.

How Does Paleomagnetism Work?

Palaeomagnetism analyses the **remnant magnetization** of rocks caused by changes in the earth's magnetism over time. This remnant magnetization refers to the **permanent magnetization** that rocks acquire as they **cool and solidify** from molten material or undergo chemical changes at **low temperatures**.

Paleomagnetism Significance

The study of paleomagnetism not only helps us to understand the **various geographical phenomena** that happened in the past but with its study, we can make **certain future geographical predictions**.

- **Predictions about the Earth's magnetic field change:** It helps in understanding the **past variations in Earth's magnetic field**, which include countless reversals and flips (like polar wandering). By studying this, we can make **informed predictions** about the **field's future behaviour**.
- **To understand the earth's evolution:** The study of palaeomagnetism is also known as **fossil magnetism**. It is an important source of information about the earth's evolution over time. Many rocks have kept this record since they were formed.
- **Evidence supporting the plate tectonics theory:** Paleomagnetism provides strong data supporting the **hypothesis of plate tectonics**. It records how magnetic minerals in the oceanic crust, particularly **iron-rich basalt**, align with the magnetic field, particularly along **mid-ocean ridges**, preserving the magnetic field's alignment at the time of formation.
- **Documentation of magnetic field:** It provides a detailed account of the **direction** of the Earth's magnetic field, with many rocks retaining this information since their origin.
- **Dating rocks and fossils:** Paleomagnetism can help date the **origin of rocks**, and magnetic reversals serve as a time scale for dating fossils found in certain rock layers.

Paleomagnetism: Earth's Magnetism, Sea Floor Spreading and Plate Tectonics

Rocks contain **tiny magnetic minerals** that align themselves with the Earth's magnetic field when they form. By studying the orientation of these minerals, scientists can reconstruct the past positions of continents and the history of the Earth's magnetic field. Hence, palaeomagnetism acts as a **proof for theories** like seafloor spreading and plate tectonics.

Concept	Description
Earth magnetism	- Paleomagnetism is crucial for understanding the earth's magnetic field behaviour over geological timelines. • The Earth's core has experienced numerous magnetic field reversals, evidenced by paleomagnetic research.
Sea-floor spreading	- The theory of sea-floor spreading describes how magma rises at mid-ocean ridges, solidifies to form a new oceanic crust and aligns its minerals with the Earth's magnetic field. • This process is proven by using palaeomagnetism. • This serves as strong evidence for continuous crust creation and lateral movement away from the ridges.

Plate tectonics	- Plate tectonics theory, which states that the Earth's outer shell is divided into several plates gliding over the mantle, is supported by palaeomagnetism and sea-floor spreading evidence. • Paleomagnetic data, especially the patterns of magnetic anomalies parallel to mid-ocean ridges, are matched with the geomagnetic reversal time scale to date plate movements and sea-floor spreading rates.
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Paleomagnetism UPSC PYQs

Consider the following:

1. Electromagnetic radiation
2. Geothermal energy
3. Gravitational force
4. Plate movements
5. Rotation of the earth
6. Revolution of the earth

Which of the above are responsible for bringing dynamic changes on the surface of the earth? (**UPSC Prelims 2013**)

1. 1, 2, 3 and 4 only
2. 1, 3, 5 and 6 only
3. 2, 4, 5 and 6 only
4. 1, 2, 3, 4, 5 and 6

Answer: (d)

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