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Geomagnetic Reversal

Kerala PSC

This article will discuss the geomagnetic reversal of the magnetic field of Earth. It elucidates the history along with a clear explanation of this phenomenon.

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Geomagnetism is a realm of geophysics. It researches how geomagnetism originated and the nature of the magnetic field on the Earth. The phrase 'Geo' translates to Earth, hence geomagnetism is the magnetism of the magnetic field that is associated with planet Earth. This field uses integral approaches to explain the magnetism of Earth and other planets in the solar system. The phenomenon of switching positions of the planet's magnetic dipoles (north and south) is termed geomagnetic reversal. Statistically, the reversal phenomenon occurs randomly. Until today, there have been about 183 geomagnetic reversals in the course of 83 million years. This narrows it down to one geomagnetic reversal every 200,000 to 300,000 years approximately. It is estimated that the duration of full reversal is between the range of 2000 to 12,000 years. An observation was made by Clement in the year 2004 that the duration of geomagnetic reversal depends on the latitudes – short duration in low latitudes and longer duration in the middle and higher latitudes.

History

A geologist named Bernard Brunhes was the first person to notice that a few volcanic rocks were magnetised in a direction that was opposite to the Earth's local magnetic field at that time.

Motonori Matuyama found evidence of magnetic reversal of Earth by observing rocks from the early Pleistocene age that had reversed magnetic fields. Since the Earth's polarity was poorly known, the possibility of a magnetic reversal intrigued scientists.

✕ After three decades, the magnetic field of Earth was better understood with theories that pointed towards the reversal of the magnetic field of Earth.

The next predominant discovery was made in the 1950s. Two geologists Allan Cox and Richard Doell, along with geochronologist Brent Dalrymple made a joint effort to research whether these reversals have a regular time interval or not. The first-ever magnetic polarity was invented by them in 1959.

Another group that was led by Neil Opdyke and Lamont-Doherty Earth observatory also produced similar patterns of reversals in the deep-sea core sediments.

Frederick Vine along with Drummond Matthews gave an easy elucidation by connecting the theory of seafloor spreading by Harry Hess with the time scale of reversals that was known. It said that the new seafloor would be magnetised in the direction of the magnetic field before the reversal.

The explanation for geomagnetic reversal

Geomagnetic reversal is the phenomenon of switching positions of the planet's magnetic dipoles (north and south).

According to palaeomagnetism, over the past 20 million years, the magnetic poles (north and south) have switched positions once every 200,000 to 300,000 years.

However, the switching of position is not exactly regular or periodic like the Sun, where the magnetic field will reverse once every eleven years.

The time duration between every reversal can be between 10,000 to sometimes 25 million years.

It is observed that the magnetic north pole that is located in the north of Ellesmere Island in Canada is moving towards Siberia.

The magnetic south pole currently lies off the coast of Antarctica.

✕ Researchers have observed that the magnetic north pole moves about 10 kilometres every year. These days, the speed of movement has increased to 50 kilometres every year.

The magnetic poles of the Earth are not antipodal as the magnetic field of Earth is not symmetrical.

The magnetic poles of the Earth, otherwise also known as magnetic dip poles as they have magnetic fields that have a vertical dip at these poles.

The reason behind the reversal of the Earth's magnetic field lines is due to the iron molecules in the core of the Earth.

The magnetic reversal of Earth will happen when the molecules of iron in the outer core of the Earth start moving in the opposite direction to the iron molecules around. As the amount of these opposite moving iron molecules increases, the reversal will take place.

In this course, the magnetic field of Earth that protects the planet from the Sun's hot particles and radiation will become weaker.

Magnetic reversal of Earth: effects

A flip in the magnetic poles of the Earth can set off a cascade of environmental issues.

The magnetic field of Earth is what protects us from the radiation that harms the skin cells and that has the potential to cause cancer. During a geomagnetic reversal, the magnetic field becomes weaker. This exposes every organism to high levels of radiation.

This phenomenon can cause havoc among animals that have internal compasses which are used for navigation.

On an extreme note, it could make the planet a dangerous place to live.

Some studies suggest that magnetic reversal of Earth can cause mass extinction on the Earth.

✕ A simulation team of researchers saw that a weakened magnetic field of the Earth will alter the atmospheric weather of Earth. This could increase the amount of charged particles from the Sun entering Earth which will increase the amount of hydrogen and nitrogen oxides. These oxides consume ozone in the atmosphere. However, not all the effects are known yet. The other extreme effects of geomagnetic reversal are still being intensely researched.

Conclusion

The field of geomagnetism is a realm of geophysics. It researches how geomagnetism originated and the nature of the magnetic field on the Earth. Geomagnetic reversal is the phenomenon of switching positions of the planet's magnetic dipoles (north and south). Until today, there have been about 183 geomagnetic reversals over 83 million years. A geologist named Bernard Brunhes was the first person to notice that a few volcanic rocks were magnetised in a direction that was opposite to the Earth's local magnetic field at that time. The magnetic reversal of Earth will happen when the molecules of iron in the outer core of the Earth start moving in the opposite direction to the iron molecules around. A flip in the magnetic poles of the Earth can set off a cascade of environmental issues.



Frequently asked questions

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How frequently will the geomagnetic reversal take place on Earth?

Ans. According to palaeomagnetism, over the past 20 million years, the magnetic poles (north and south) have switche...[Read full](#)

✕What distance does the magnetic north pole move every year?

Ans. The magnetic north pole moves about 10 kilometres every year. These days, the speed of movement has increased t...Read full

How do the charged particles from the Sun affect Earth during a magnetic reversal?

Ans. A weakened magnetic field of Earth will alter the atmospheric weather of Earth. This could increase the amount ...Read full

What causes the geomagnetic reversal?

Ans. The magnetic reversal of Earth will happen when the molecules of iron in ...Read full



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