



SHIFT OF THE MAGNETIC NORTH POLE - GEOGRAPHY

NEWS: Recently, scientists have released a new model tracking the position of the magnetic north pole, revealing it is now closer to Siberia than it was five years ago and is continuing to drift toward Russia.

WHAT'S IN THE NEWS?

About the Earth's Magnetic Poles

- These are dynamic features of earth's geomagnetic field, generated by forces at the Earth's core.
- These are the points on Earth's surface where the planet's magnetic field points vertically downward.

Shift of the Magnetic North Pole

- **Magnetic North Pole** was first located in 1831 by explorer James Clark Ross. At that time, it was near Canada's Arctic islands.
 - It constantly shifts due to changes in Earth's molten core, unlike the geographic North Pole, which remains fixed.
- Over the past century, the magnetic North Pole has moved over 400 kilometers from Canada towards Russia.
- This movement is tracked using the **World Magnetic Model (WMM)**, which is updated every five years to ensure accurate navigation systems.

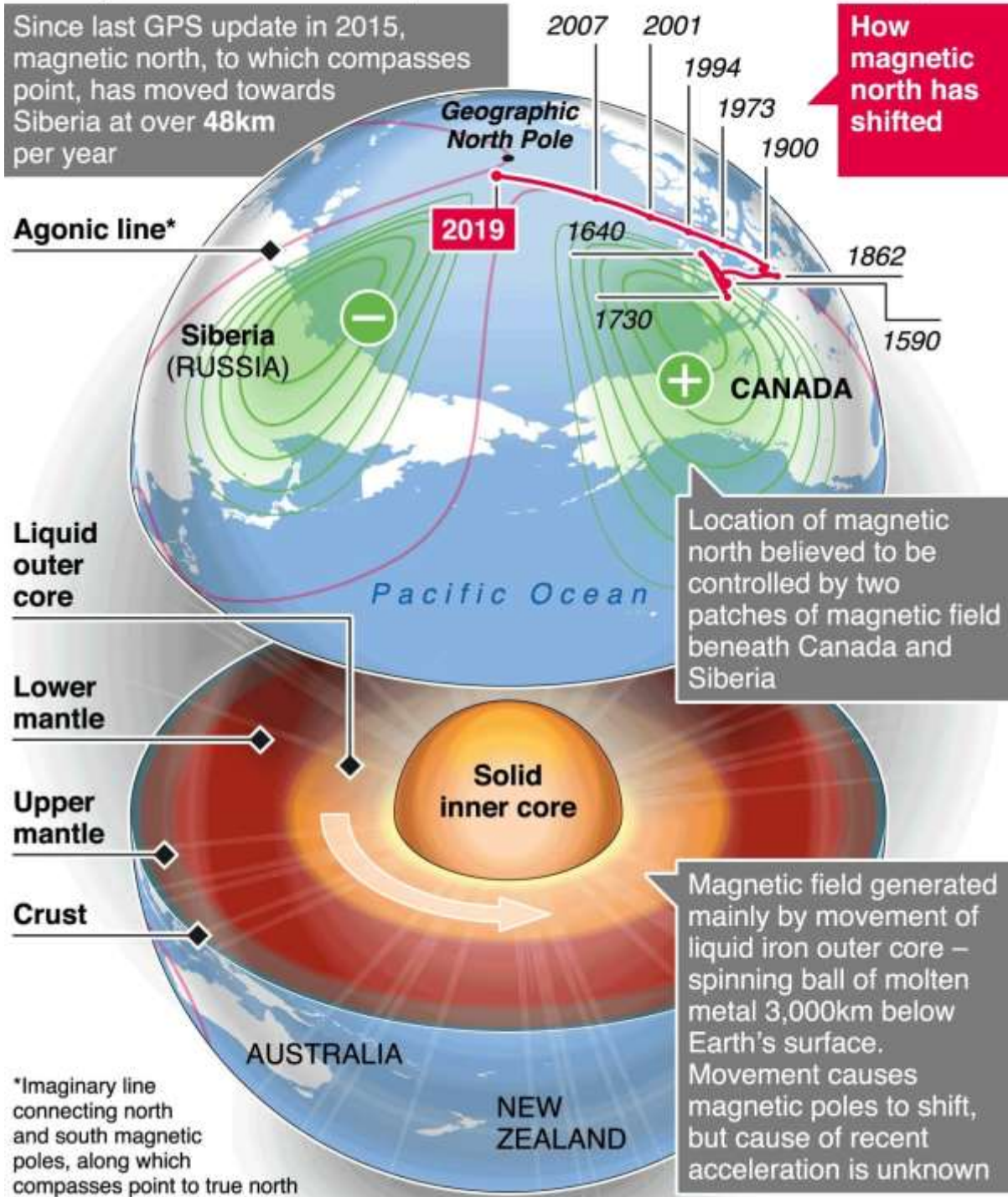
Causes of the Pole's Shift

- **Core Fluid Dynamics:** The molten iron and nickel in the Earth's outer core move in turbulent patterns, driven by heat escaping from the planet's inner core.
 - These fluid motions generate the Earth's magnetic field and influence the pole's location.
- **Geomagnetic Anomalies:** Variations in the magnetic field, such as the weakening of the South Atlantic Anomaly, suggest instability in the magnetic field, contributing to pole movement.
- **Earth's Magnetic Reversal Cycle:** Though not directly indicative of an imminent reversal, the pole's movement may signal long-term changes in the geomagnetic field, which naturally undergoes reversals every few hundred thousand years.



Earth's shifting magnetic north pole

Magnetic north is on the move, forcing an emergency update for GPS systems which need its precise location to function accurately





Earth's Magnetic Field

It is **generated by the movement of molten iron and nickel** in its outer core. It forms a protective shield (*magnetosphere*), which **deflects harmful solar radiation and cosmic rays** (high-energy particles).

Magnetosphere (Earth's Protective Shield):

It is **Earth's first line of defense against solar wind and cosmic radiation**.

It plays a vital role in protecting the planet by **trapping charged particles in the Van Allen Belts**, doughnut-shaped zones around Earth.

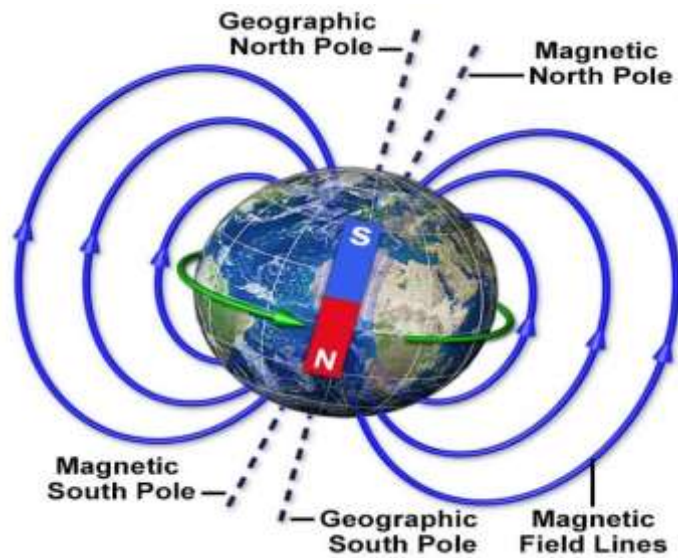
Variations in the solar wind can lead to **geomagnetic storms**, influencing everything from satellite operations to power grids on Earth.

Magnetic Reversal (aka Geomagnetic Reversal): It is when the Earth's magnetic field reverses polarity.

While reversals have occurred **approximately every 200,000 to 300,000 years** in Earth's history, the last one, the **Brunhes-Matuyama reversal**, occurred about 780,000 years ago.

Implications of the Pole's Shift

- **Navigation Systems:** Magnetic navigation systems, such as those used in aviation and maritime operations, rely on precise magnetic models.
 - The accelerated shift necessitates frequent updates to the **World Magnetic Model (WMM)** to ensure accuracy.
- **Animal Migration:** Many migratory species, including birds and marine animals, rely on the Earth's magnetic field for navigation.
 - Changes in the field could disrupt their natural patterns.
- **Communication and Satellites:** The weakening of the magnetic field associated with pole movement increases the planet's vulnerability to solar storms, potentially disrupting communication, GPS systems, and power grids.
- **Scientific Research:** The shifting pole provides scientists with an opportunity to better understand the **geodynamo processes** and to predict long-term changes in the Earth's magnetic field.



Geographical Poles vs. Magnetic Poles

▪ Geographic Poles

- The Earth rotates on the geographic north and south poles. The geographic north and south poles are where lines of longitude (meridians) converge in the north. The south and north pole are directly opposite to one another.

▪ Magnetic North Pole

The Earth acts as one big magnet.

- The Earth consists of a solid iron core. Surrounding the iron core is an ocean of hot, liquid metal.
- The liquid metal that flows in Earth's core creates electrical currents, which in turn creates our magnetic field.
- The Magnetic North Pole (also known as the North Dip Pole) is a point on Ellesmere Island in Northern Canada where the northern lines of attraction enter the Earth.
- This means that a compass needle point to the Magnetic North Pole – which is different from the geographic north.

International Hydrographic Organization

- The International Hydrographic Organization is an **intergovernmental consultative and technical organization** that was **established in 1921** to support the safety of navigation and the protection of the marine environment.
- India is also a member of IHO.
- The objective of the Organization is to bring about:
 - The coordination of the activities of national hydrographic offices

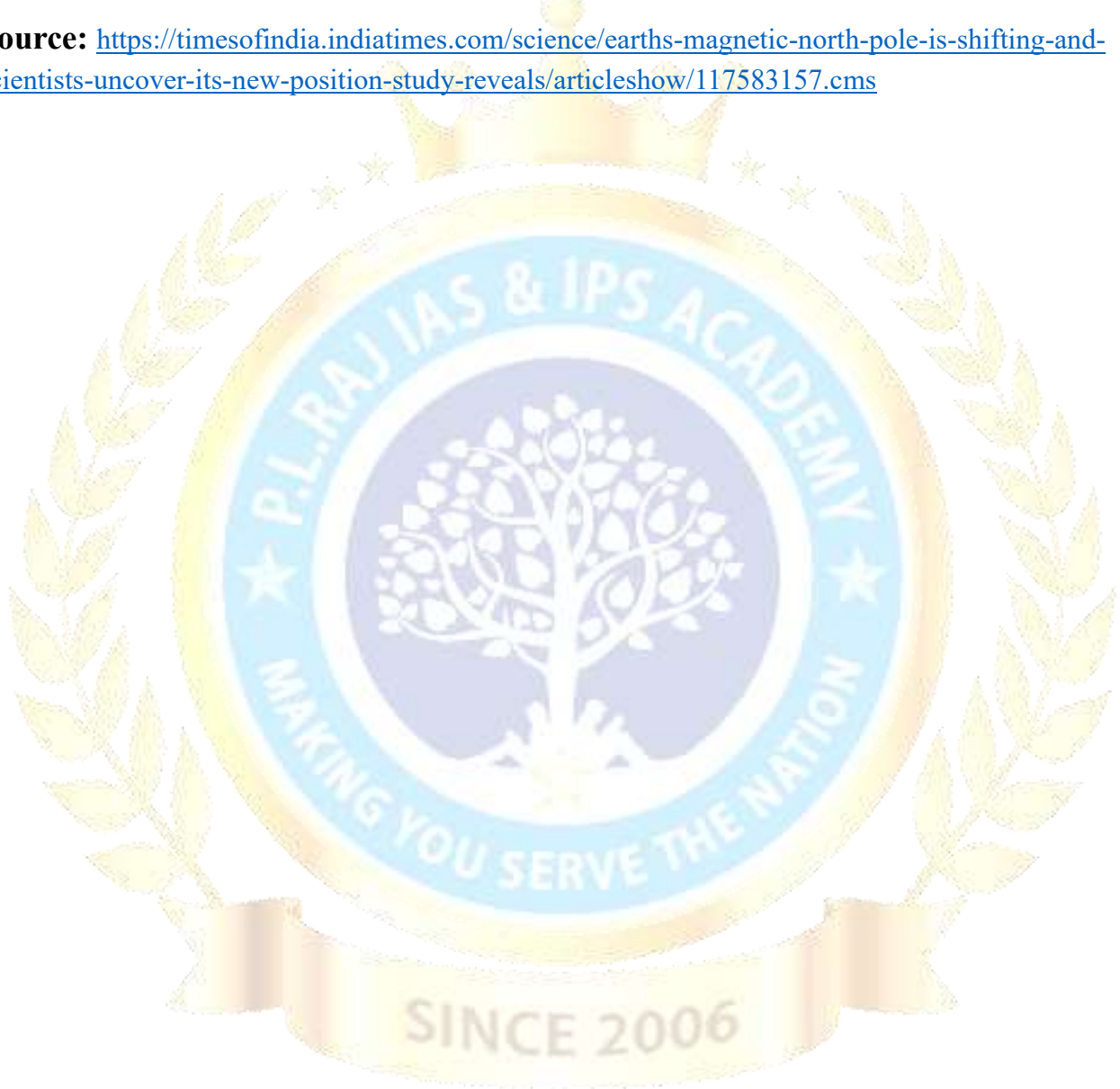


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- The greatest possible uniformity in nautical charts and documents
- The adoption of reliable and efficient methods of carrying out and exploiting hydrographic surveys
- The development of the sciences in the field of hydrography and the techniques employed in descriptive oceanography

Source: <https://timesofindia.indiatimes.com/science/earths-magnetic-north-pole-is-shifting-and-scientists-uncover-its-new-position-study-reveals/articleshow/117583157.cms>



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