



Magnetic Fossils in Bay of Bengal

For Prelims: Magento Fossils, Magnetotactic bacteria, [Earth's magnetic field](#), Paleocene-Eocene Thermal Maximum, [Middle Eocene Climatic Optimum](#), [Bay of Bengal](#), [Council of Scientific and Industrial Research](#), [National Institute of Oceanography](#), [Electron Microscopy](#)

For Mains: Significance of Study of Magneto Fossils.

[Source: TH](#)

Why in News?

Recently, scientists have unearthed a **50,000-year-old sediment**, a massive **magneto fossil** found deep in the **Bay of Bengal**, marking one of the youngest discoveries of its kind.

- Scientists at [CSIR-National Institute of Oceanography](#), used **magnetic analyses** and [electron microscopy](#) to study a sediment sample from the southwestern Bay of Bengal.

What are the Key Findings of the Study?

- **Monsoon Fluctuations:** Analysis of sediment samples indicated fluctuations in monsoon strength during the last **Glacial Maximum-Holocene period**, impacting weathering and sedimentation.
- **Optimal Conditions for Magnetic Fossil Growth:** The study suggests that **warming events are not necessary for giant magneto fossil formation**; instead, an optimal balance of **iron, organic carbon, and suboxic conditions** is crucial.
- **Information Encoded by Magnetofossils:** Magnetofossils encode information about **past environmental conditions, including nutrient availability**, oxygen levels, and water stratification in ancient aquatic environments.
 - Rivers like [Godavari](#), [Mahanadi](#), [Ganga-Brahmaputra](#), [Cauvery](#), and **Penner**, discharging into the **Bay of Bengal**, contributed to magneto fossil formation by providing **nutrient-rich sediment** and reactive iron.

What are Magento Fossils?

- **About:**
 - "**Magneto Fossils**" refer to fossilised remains of **magnetotactic bacteria** that contain magnetic minerals.
 - **Magnetotactic bacteria** leave **fossilised magnetic particles** in geological records.
- **Magnetotactic Bacteria:**
 - Magnetotactic bacteria **are mostly prokaryotic organisms** that arrange themselves along the [earth's magnetic field](#). It was discovered by **Salvatore Bellini in 1963**.
 - These organisms follow **the magnetic field to reach places that had optimal oxygen concentration**. This process is facilitated by the presence of iron-rich crystals within their cells.
 - Magnetotactic bacteria create **tiny crystals of magnetite** or **greigite** within their

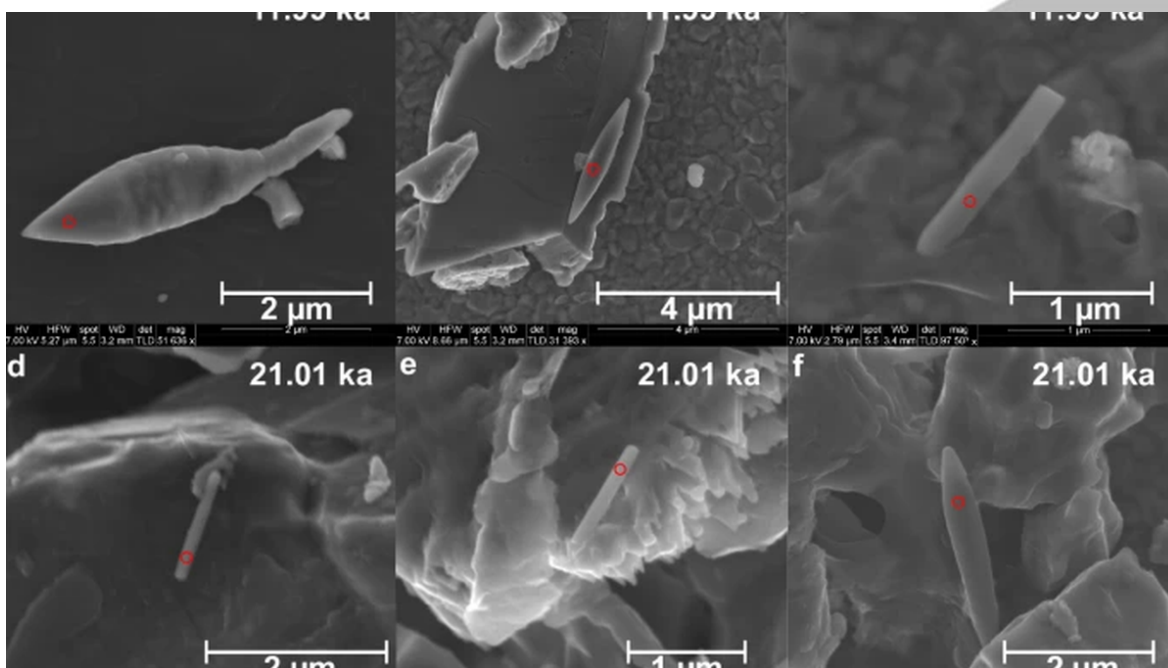
cells to navigate **changing oxygen levels** and **sediment saturation** in water bodies.

- Crystals within magnetotactic bacteria are arranged in a **chain configuration** through **magnetotaxis**.

- Rare **giant magneto fossils are less common** than conventional magnetic fossils, these are likely **produced by [eukaryotes](#) rather than bacteria**.

▪ **Origin of Magnetofossils:**

- Most giant magnetofossils have been found in sediments dating to two geological time periods — **Paleocen-Eocene Thermal Maximum (roughly 56,000 million years ago)** and **Middle Eocene Climatic Optimum (about 40 million years ago)** — both of which were **known for a rise in global temperature**.
 - It suggested that the magnetofossils formed only during periods of extreme warming.
- Discovery of giant magneto fossils from the Bay of Bengal were determined to be from the **[late Quaternary period](#)**, approximately **50,000 years ago**, making them the **youngest giant magneto fossils discovered to date**.
 - The present study challenges the assumption that the magnetofossils formed only during periods of extreme warming.

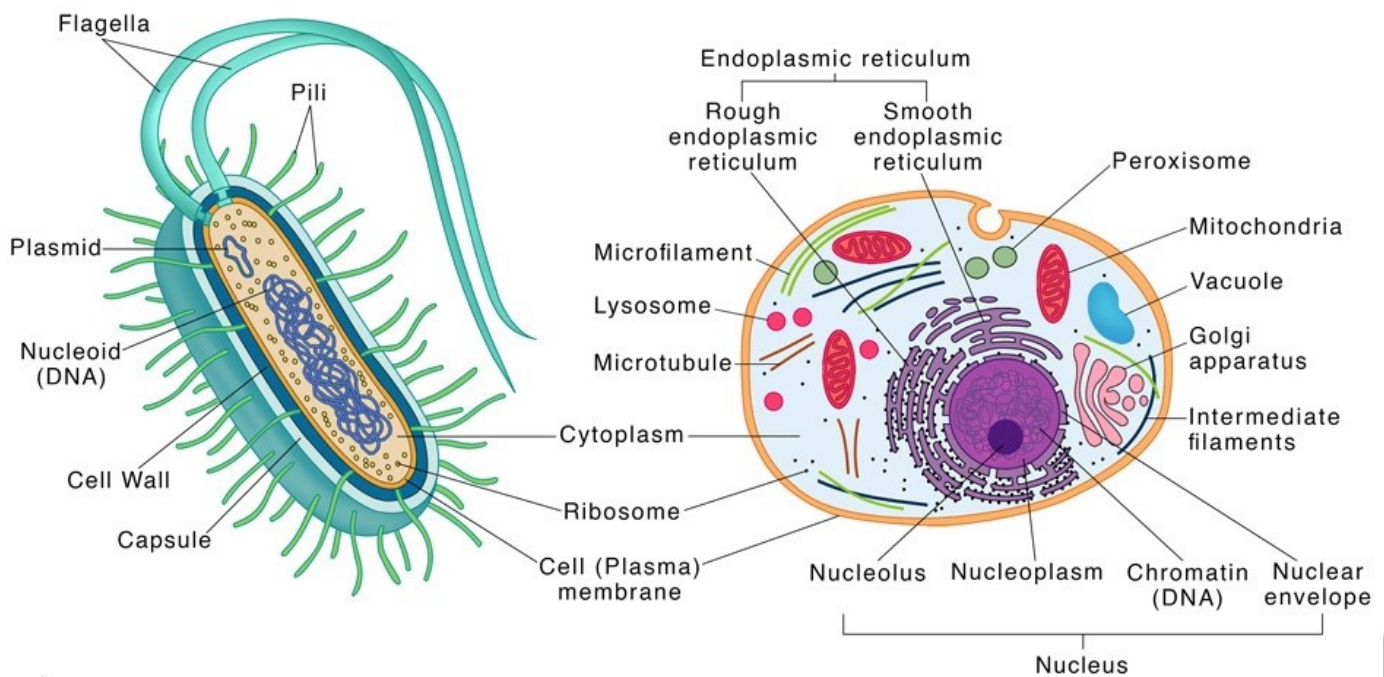


Prokaryotes	Eukaryotes
▪ Prokaryotes are organisms that lack a true nucleus and membrane-bound organelles. ◦ Their genetic material, typically a circular DNA molecule, is present in the cytoplasm without being enclosed within a nuclear membrane. ▪ Prokaryotes include bacteria and archaea. ▪ Key features include small, simple cells without a nucleus or organelles.	▪ Eukaryotes are organisms that have cells containing a well-defined nucleus enclosed within a membrane. ◦ Eukaryotic cells have a variety of membrane-bound organelles such as mitochondria, endoplasmic reticulum, Golgi apparatus, and a complex network of internal membranes. ▪ Eukaryotes include all types of animals, plants and fungi. ▪ Key features include large, complex cells with a nucleus and various organelles.

Prokaryotic Cells



Eukaryotic Cells



Drishti Mains Question:

Q. Discuss the Magento Fossils and the role of magnetotactic bacteria in their formation.

UPSC Civil Services Examination, Previous Year Question (PYQ)

Prelims:

Q. The word 'Denisovan' is sometimes mentioned in media in reference to (2019)

- (a) fossils of a kind of dinosaurs
- (b) an early human species
- (c) a cave system found in North-East India
- (d) a geological period in the history of Indian subcontinent

Ans: (b)