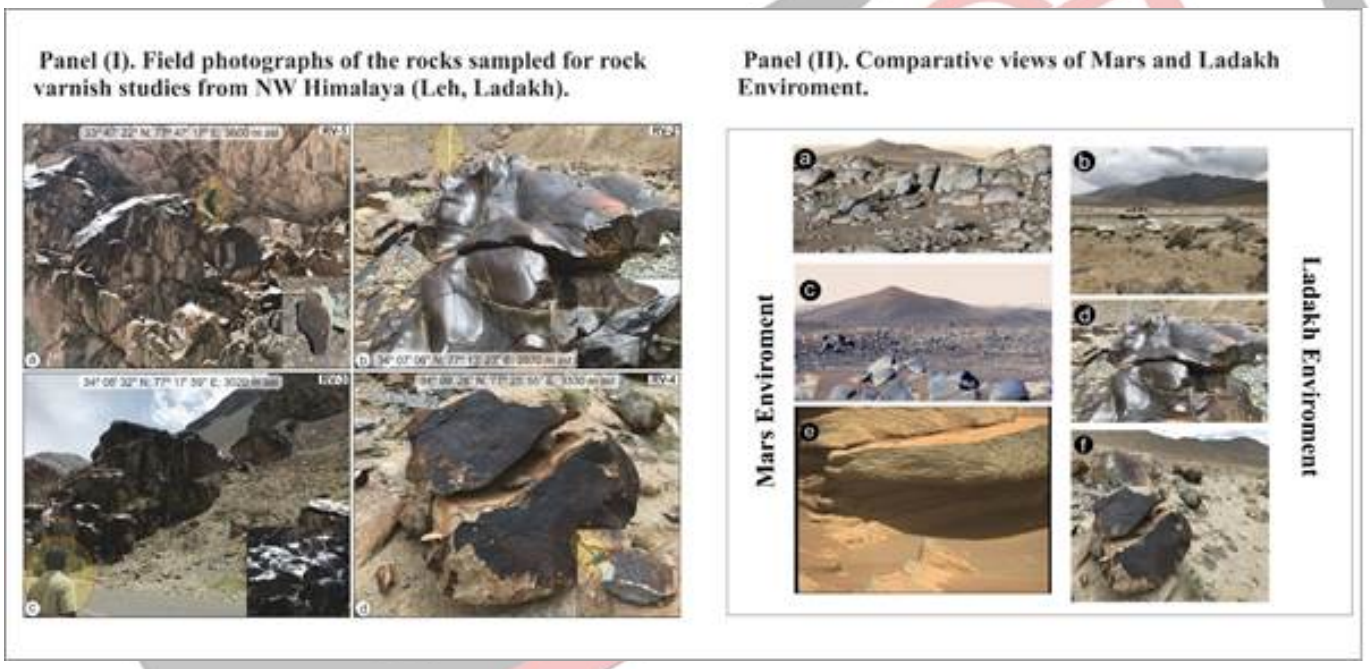
Ladakh's Rock Varnish

Source: PIB

Why in News?

Recently, **Magnetofossils**, fossilised magnetic particles from magnetotactic bacteria, have been **discovered in rock varnish layers in Ladakh**.

- Rock varnish is a **dark brown to black coating** that covers stable, subaerially exposed rock surfaces in arid and semiarid regions.



What are the Key Highlights of the Study?

- **Findings:**
  - The analysis of the rock varnish samples from Ladakh revealed higher concentrations of **oxidized manganese (Mn4+)** and **carboxylic acid** functionality, indicating organic signatures.
  - These findings suggest that the rock varnish in Ladakh, a **potential Martian analogue site**, contains enriched **concentrations of magnetic minerals likely derived from biotic sources.**
    - Magnetic minerals are those **that preserve a record of the Earth's magnetic field from when they formed** and can be found in rocks, sediments, and soils.
- **Significance:**
  - The study offer**s valuable insights for astrobiology** by demonstrating how life can thrive in extreme environments, **such as Ladakh, the "cold desert of India."**
  - The findings are crucial for planning future space missions by **Indian Space Research**

Organisation (ISRO) and other space agencies, including **Mars exploration**, where **identifying habitable environments is a primary goal.**

- Identifying biotic signatures in rock varnish **helps scientists target potential biosignatures on Mars and other planets,** supporting the search for extraterrestrial life
    - A biosignature is **any characteristic, element, molecule, substance, or feature** that can be **used as evidence for past or present life.**

Magentofossils

- **About:**
    - **Magnetofossils** 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.**

UPSC Civil Services Examination, Previous Year Question (PYQ)

Q. Consider the following: (2021)

1. Bacteria
2. Fungi
3. Virus

Which of the above can be cultured in an artificial/synthetic medium?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

Ans: (a)

Q. Consider the following statements: (2018)

1. The Earth's magnetic field has reversed every few hundred thousand years.
2. When the Earth was created more than 4000 million years ago, there was 54% oxygen and no carbon dioxide.
3. When living organisms originated, they modified the early atmosphere of the Earth.

Which of the statements given above is/are correct?

(a) 1 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

Ans: (c)