



Organic Matter on Mars

For Prelims: [Perseverance rover](#), Jezero Crater, [Meteorites](#), [Multi-Mission Radioisotope Thermoelectric Generator](#), Mars Phoenix Lander, Curiosity Rover, [Mangalyaan \(2013\)](#)

For Mains: [NASA's Mars 2020 mission](#), [Scanning Habitable Environments with Raman and Luminescence for Organics and Chemicals \(SHERLOC\)](#).

Source: DTE

Why in News?

The [United States National Aeronautics and Space Administration's \(NASA\) Perseverance rover](#) has **uncovered evidence of organic compounds in a Martian crater.**

- The rover's landing site in Jezero Crater shows a high possibility for past habitability. The presence of various minerals, including **carbonates, clays, and sulphates**, indicates its history as an **ancient lake basin**.

What are Organic Compounds?

- **Organic compounds** are molecules that primarily contain **carbon and hydrogen**, and often other elements such as **oxygen, nitrogen, phosphorus and sulfur**.
- They are the key **building blocks of life on Earth**, as they form the basis of **proteins, nucleic acids, carbohydrates, lipids and other biomolecules**.
 - They can also be **produced by non-biological processes**, such as **volcanic activity, meteorite impacts, lightning strikes and cosmic radiation**.

What are the Major Findings Related to Presence of Organic Matter in Mars?

- Earlier missions had already identified organic chemicals with Martian origin in [meteorites](#) and the **Gale Crater**.
 - Only the **Mars Phoenix lander and the Curiosity rover had previously detected organic carbon on Mars** using advanced techniques such as evolved gas analysis and **gas chromatography-mass spectrometry**.
- The latest research through Perseverance Rover introduces a novel instrument, the [Scanning Habitable Environments with Raman and Luminescence for Organics and Chemicals \(SHERLOC\) instrument](#), which helps locate basic chemical compounds on Mars.
 - It reveals that **Mars possesses a more intricate organic geochemical cycle**.
 - Multiple reservoirs of potential organic molecules are suggested to exist on the planet, expanding the possibilities for habitability.
 - The study also found molecules associated with aqueous processes, indicating that

water may have played a significant role in **Mars's range of organic matter**.

- The extended presence of key building blocks necessary for life implies that **Mars may have been habitable for longer periods** than previously assumed.

Note:

- SHERLOC is the first instrument on Mars that can **perform fine-scale mapping and analysis of organic molecules**.
- It uses a **laser to illuminate the surface of rocks and soils**, and **measures the fluorescence** or glow emitted by organic compounds when exposed to ultraviolet light.
- SHERLOC can also **identify the minerals associated with organic compounds**, which can provide clues about their origin and preservation.

What is the Perseverance Rover?

- **About:** Perseverance is a **car-sized Mars rover** designed to explore the **Jezero crater on Mars** as part of [NASA's Mars 2020 mission](#).
 - It was manufactured by the **Jet Propulsion Laboratory** and launched on July 30, 2020.
 - It landed on **Mars on February 18, 2021**, after a seven-month journey.
- **Power Source:** A **Multi-Mission Radioisotope Thermoelectric Generator (MMRTG)** which converts heat from the natural **radioactive decay** of plutonium (Plutonium Dioxide) into electricity.
- **Major Objectives:**
 - Seek signs of ancient life and collect samples of rock and soil for possible return to Earth.
 - Study the geology and climate of Mars and how they have changed over time.
 - Demonstrate technologies that could enable **future human exploration of Mars**, such as **producing oxygen from the Martian atmosphere** and testing a miniature helicopter.

What are the Various Mars Missions?

- [India's Mars Orbiter Mission \(MOM\) or Mangalyaan \(2013\)](#)
- [ExoMars rover \(2021\) \(European Space Agency\)](#)
- [Tianwen-1: China's Mars Mission \(2021\)](#)
- [UAE's Hope Mars Mission \(UAE's first-ever interplanetary mission\) \(2021\)](#)
- **Mars 2 and Mars 3 (1971) (Soviet Union)**

Q. Consider the following statements: (2016)

The Mangalyaan launched by ISRO

1. is also called the Mars Orbiter Mission
2. made India the second country to have a spacecraft orbit the Mars after USA
3. made India the only country to be successful in making its spacecraft orbit the Mars in its very first attempt

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)

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