

Martian Analogue Sites in Tamil Nadu and Chile

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Why in News?

A recent study highlighted that Indian scientists successfully identified and characterized unique terrestrial geological formations in Tamil Nadu (India) and the Atacama Desert (Chile) as prime Martian analogue sites.

Martian Analogue Sites

- Terrestrial environments that replicate geological, physical, chemical, or biological conditions found on Mars (e.g., extreme aridity, high ultraviolet radiation, specific mineral compositions, or volcanic basements).
- They allow space agencies to test rover hardware, drill mechanisms, and astrobiological detection protocols prior to extraterrestrial deployment.
- **The Tamil Nadu Analogue**
 - Features specialized **ultramafic and basaltic rock formations** undergoing extreme weathering, mirroring the iron- and magnesium-rich basaltic crust of Mars.
 - Presence of specific secondary minerals (such as clay minerals and iron oxides) provides a direct parallel to aqueous alteration processes believed to have occurred on early Mars.
- **The Atacama Desert Analogue**
 - One of the driest places on Earth, characterized by hyper-aridity, extreme UV exposure, and perchlorate-bearing soils that closely match Martian regolith chemistry.

Significance for India's Planetary Exploration

- **Mission Preparation & Rover Testing**
 - Facilitates rigorous field-testing for India's future planetary rover concepts, autonomous navigation algorithms, and drill assemblies under rugged, unpaved conditions.
- **Astrobiology & Biosignature Detection**
 - Enables scientists to study extremophiles (microorganisms surviving in extreme environments) hidden within rocks and soils, refining protocols for detecting microbial life or past biosignatures on Mars.
- **Indigenous Planetary Science Capacity**
 - Strengthens collaborative research among Indian scientific institutions (such as ISRO, PRL, and academic institutes) in comparative planetology and astrogeology.

> Martian Analogue Sites <

in Tamil Nadu, India and the Atacama Desert, Chile

Earth's clues to Mars

UPSC Science & Technology | Current Affairs 2026

1

Neyveli

Tamil Nadu, India



Mineral

Melanterite

A hydrated iron sulphate relevant to studying mineral formation and water-related processes on Mars.

2

Tiruchirappalli Badlands

Tamil Nadu, India



Mineral

Gypsum

A semi-arid geological terrain useful for studying sedimentary environments and past water activity.

3

Atacama Desert

Chile, South America



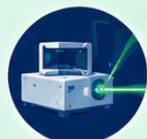
Mineral

Gypsum

Extreme aridity and mineral-rich terrain make it a major Mars-analogue environment.



Similar minerals.
Similar processes.
A closer look at Mars.



How were the minerals identified?

Laser Raman Spectrometer
Identifies minerals using their interaction with laser light.



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of Geology, University of Kerala.



Why does it matter?

Helps scientists interpret Martian minerals, reconstruct past water activity and guide future planetary exploration.



UPSC takeaway:

Neyveli – Melanterite

Tiruchirappalli Badlands – Gypsum

Atacama Desert – Gypsum

Source: PIB, Ministry of Science & Technology, 16 October 2026.

Reference

[PIB | Martian Sites](#)



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