



Lunar Volcanism on the Far Side of the Moon

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Why in News?

A new study published in the journal *Nature and Science* reveals that [volcanic eruptions occurred on the moon's far side](#), based on samples from [China's Chang'e-6 mission](#), shedding light on lunar geology.

What are the Key Findings of the Study?

- The Moon's far side, like the near side, experienced volcanic eruptions billions of years ago, with rock fragments dating back **2.8 to 4.2 billion years**, confirming widespread **lunar volcanism**.
 - Data from the [National Aeronautics and Space Administration \(NASA\) Lunar Reconnaissance Orbiter](#) and prior studies had hinted at **volcanic activity on the far side**, but this study offers the first physical evidence.
- These eruptions lasted over a **billion years**, and future research aims to understand the duration and causes.
- The **far side is less flat and lacks the large lava plains** seen on the near side, which raises questions about why the two sides have such different geological features.
- These findings are significant as they enhance understanding of the Moon's geological history and may explain the **differences between the far side and the near side**.

Far Side of the Moon

- The **moon is tidally locked to Earth**, meaning it takes 27.3 days to rotate once and the same time to orbit Earth. This causes the same side of the Moon to always face Earth, while the other side, known as the far side, remains hidden.


What is China's Chang'e-6 Mission?

- **Chang'e Program:** Named after the Chinese goddess of the moon, the **Chang'e** missions are part of **China's Lunar Exploration Program (CLEP)**, initiated in 2003 by the **China National Space Administration (CNSA)**.
 - The Chang'e series aims to deepen understanding of the moon and its geological history.
- **Mission Phases:**

Mission	Year	Key Achievements
Chang'e 1	2007	Created a comprehensive map of the moon's surface.
Chang'e 2	2010	Launched phase I of the moon missions, equipped with a better camera to support future missions.
Chang'e 3	2013	Successfully landed a rover on the moon's near side, marking the start of phase II.
Chang'e 4	2019	Achieved the first soft landing on the moon's far side , exploring this

		mysterious region.
Chang'e 5	2020	Deployed a lander on the near side , returned lunar soil samples to Earth, marking the start of phase III.
Chang'e 6	2023	Continuing phase III, it returned to Earth with lunar samples from the far side of the moon and it aims to investigate the differences between the near and far sides.

India's Far Side Lunar Plans: India plans to launch the **Chandrayaan-4 lunar sample-return mission in 2028** but has **no current plans to explore the far side of the moon**. However, as a signatory of the **Artemis Accords**, India is expected to collaborate on future lunar exploration missions.



CHANDRAYAAN 3

India's 3rd lunar mission; a successful attempt at achieving a soft landing on lunar south

BRIEF HISTORY

Lunar Mission	Aim	Launch Vehicle	Success
<ul style="list-style-type: none"> Chandrayaan 1 (2008) Chandrayaan 2 (2019) 	<ul style="list-style-type: none"> Create a 3D atlas of moon & Mineralogical mapping Exploring lunar south pole 	<ul style="list-style-type: none"> PSLV – C11 GSLV MkIII-M1 	<ul style="list-style-type: none"> Detection of water and hydroxyl on lunar surface Lander and rover crashed but orbiter successfully collected data

COMPONENTS

- Lander - **Vikram**; Rover - **Pragyan** (same as Chandrayaan 2)
 - Both designed to last for 14 days; not supposed to come back to the earth
- Spectro-polarimetry of Habitable Planet Earth (**SHAPE**)
 - An experimental payload in propulsion module
 - Study spectro-polarimetric signatures of Earth (near-infrared wavelength range)

ASPECTS TO STUDY

- Lunar quakes
- Thermal properties of lunar surface
- Changes in plasma near the surface
- Accurately measuring distance b/w Earth and the moon

MISSION LIFE

- 1 lunar day (~14 Earth days)

LAUNCH VEHICLE

- LVM3 - M4

India became the 1st country to successfully land on Lunar south pole and 4th to achieve soft-landing on Lunar surface (after US, Russia and China)

Why Chandrayaan 3 Succeeded?

- A "failure-based design", unlike the "success-based design" of Chandrayaan-2
 - Even if all the sensors failed and engines stopped, **Vikram was sure to make the landing**
 - Provision of **multiple attempts** for landing if attempt 1 failed
- Developed accordingly to **rule out the scenario of crash landing**
 - Expanded landing area for more flexibility to land safely
 - Equipped with more fuel to enable longer-distance travel

Importance of Lunar South Pole

- Vastly different, more **challenging terrain** compared to lunar equatorial region
- Potential repositories of valuable **information about early Solar System**
- Impact **future deep space exploration** significantly
- Water may be concentrated** in the moon's southern hemisphere






Drishti IAS

UPSC Civil Service Examination, Previous Year Questions(PYQs)

Q. Selene-1, the lunar orbiter mission belongs to which one of the following? (2008)

- (a) China
- (b) European Union
- (c) Japan
- (d) USA

Ans: (c)

Q.2 What is the purpose of the US Space Agency's Themis Mission, which was recently in the news? (2008)

- (a) To study the possibility of life on Mars
- (b) To study the satellites of Saturn
- (c) To study the colourful display of high latitude skies
- (d) To build a space laboratory to study the stellar explosions

Ans: (c)

Which one of the following planets has largest number of natural satellites or moons? (2009)

- (a) Jupiter
- (b) Mars
- (c) Saturn
- (d) Venus

Ans: (a)

Q. Tides occur in the oceans and seas due to which among the following? (2015)

1. Gravitational force of the Sun
2. Gravitational force of the Moon
3. Centrifugal force of the Earth

Select the correct answer using the code given below:

- (a) 1 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

Ans: (d)