3 Distinct Layers in Lunar Soil by Chandrayaan-3 Data

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Why in News?

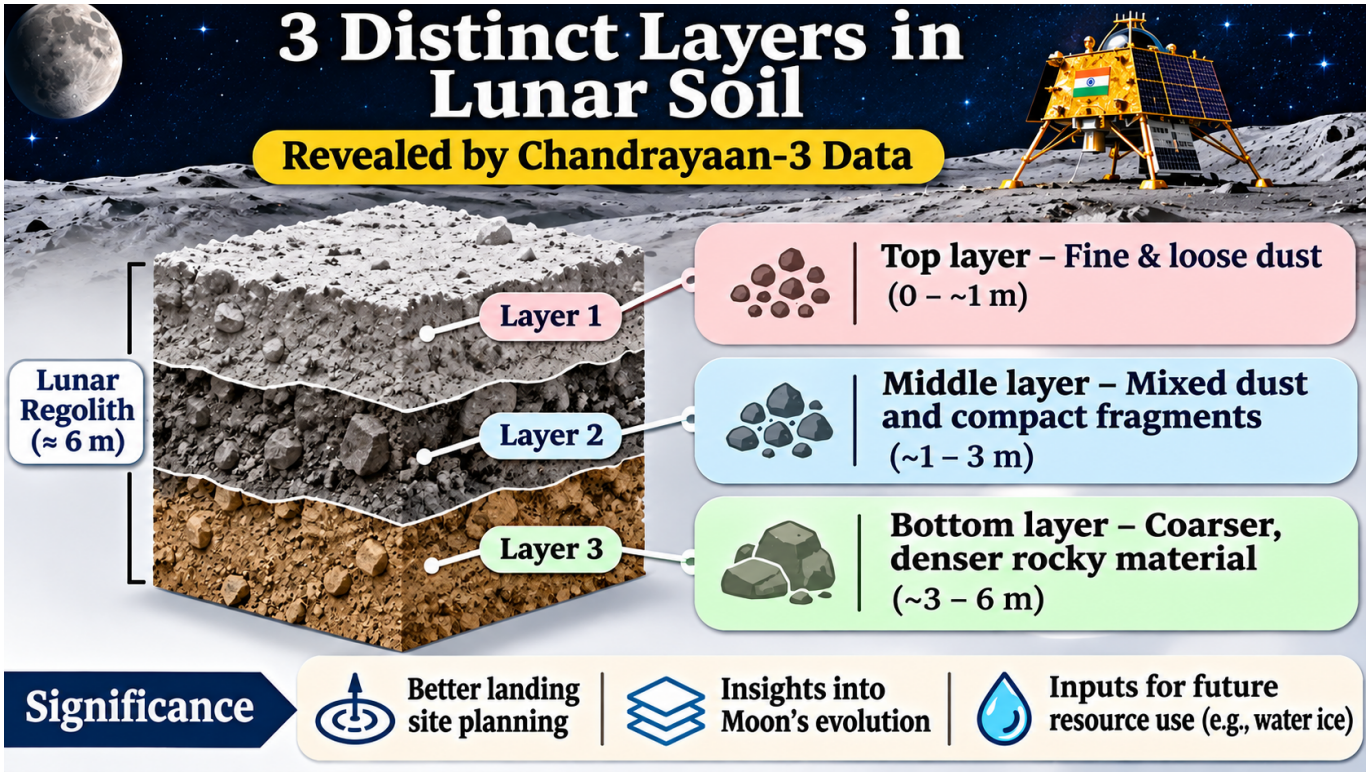
A study led by researchers has identified three distinct layers with differing physical and thermal properties within the top 10 cm of lunar soil (regolith) near the Moon's South Pole (Shiv Shakti Point).

- The findings challenge the long-held assumption of a uniform shallow regolith layer and provide critical ground-truth data for future lunar missions.
- **Payload - ChaSTE (Chandra's Surface Thermophysical Experiment)**.
- **Lead Institution-** Physical Research Laboratory (PRL), Ahmedabad (an autonomous unit of the Department of Space / ISRO), led by K. Durga Prasad.

Key Highlights

- **Methodology -** The study utilized data from the **ChaSTE** payload onboard the Vikram lander, integrating measurements from both the initial landing site and the post-hop location.
- **Role of the "Hop" Experiment-** During Vikram's hop maneuver on **September 3, 2023**, engine firing displaced the uppermost ~2–3 cm of dust at the new spot, exposing underlying strata.
- Combining those observations with baseline data from the original landing site resolved the complete three-layer vertical profile.
- **Steep Thermal Gradient-** At local lunar noon, the temperature gradient across just the top 10 cm measured roughly **73 kelvin**, with individual layers responding differently to solar heating.
- **Geological Formation Mechanism -** Researchers attribute the stratification to impact-driven processes where ejecta from surrounding craters and micrometeorite impacts deposited materials with distinct compaction, grain size, and thermal characteristics over time.

Soil Layer (Depth)	Key Physical Characteristics
Upper Layer (0 – 3 cm)	Highly porous (~80% estimated porosity) with a low bulk density of ~600 kg/m^3
Middle Layer (3 – 6 cm)	Exhibits higher thermal conductivity compared to the porous top layer
Lower / Denser Layer (6 – 10 cm)	Denser and more cohesive, with intermediate thermal conductivity; bulk density reaches ~1,500 kg/m^3 at 10 cm depth (cohesion reaching ~1,350 Pa at 10 cm)



Reference

Times of India | 3 distinct layers in Moon's soil

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