



# More Metallic Moon: NASA

## Why in News

Recently, the [National Aeronautics and Space Administration](#) (NASA) has found evidence of **greater quantities of metals** such as iron and titanium on the **Moon's subsurface**.

- The metallic distribution was observed by the **Miniature Radio Frequency (Mini-RF) instrument** aboard the [Lunar Reconnaissance Orbiter](#) (LRO) spacecraft.

## Lunar Reconnaissance Orbiter

- It is a NASA moon mission that has been in **operation since 2009**.
- The mission particularly focuses on the moon's poles to **search for water or ice** that could **exist in permanently shadowed craters**.

## Miniature Radio Frequency Instrument

- It is one of the two radar instruments launched to the moon to **map the lunar poles, search for water and ice** and **to demonstrate future NASA communication technologies**, under the **Mini-RF project**.
  - The first instrument, launched on the [Indian Space Research Organisation](#) (ISRO) [Chandrayaan-1](#) spacecraft, mapped both polar regions of the Moon.
  - The second instrument, currently flying on NASA's LRO, has been mapping the **different geologic units of the lunar surface**.

## Key Points

- The LRO's Mini-RF instrument was measuring **dielectric constant** within lunar soil in crater floors in the Moon's northern hemisphere.
  - **Dielectric constant**, an **electrical property**, is the **ratio of the electric permeability of a material to the electric permeability of a vacuum**.
  - Dielectric properties are **directly linked to the concentration of metal minerals**.
- The level of this property increased while surveying larger craters and kept rising in crater sizes up to 5 km in diameter. Beyond that size, the value of the dielectric constant leveled off.
- It raised the possibility that the dielectric constant increased in larger craters because the meteors that created them dug up dust containing iron and titanium oxides from beneath the Moon's surface.
- The Mini-RF findings were backed by **metal oxide maps** from the **LRO Wide-Angle Camera**, **Japan's Kaguya mission** and **NASA's Lunar Prospector spacecraft**, which showed that larger craters with their increased dielectric material were also richer in metals.
  - The metal oxide maps suggested that more quantities of iron and titanium oxides were dug

up from 0.5 to 2 km below the Moon's surface as compared from the first 0.2 to 0.5 km.

▪ **Significance:**

- If the findings are proven to be true, it would imply that there are **large quantities of iron and titanium oxides** beyond a few meters of the Moon's upper surface.
- The finding could **aid in drawing a clearer connection between Earth and the Moon.**
- NASA has now undertaken further research to find whether the **same relation between metal deposits and crater size holds true on the southern hemisphere** of the Moon.

## **Connection with Moon Formation**

- A **Mars-sized protoplanet collided** with the **newly formed Earth** around **4.5 billion years ago**, breaking off its piece that went on to become a satellite.
- The hypothesis is backed by substantial evidence, such as the **close resemblance between the Moon's bulk chemical composition with that of Earth.**
- However, scientists have been trying to explain **how Earth's crust has fewer amounts of iron oxide than the Moon.** Now, the new discovery of even greater quantities of metal on the Moon makes the process more difficult.
- A possible reason could be that the Moon was **created from a material much deeper beneath Earth's surface** than was believed before, or that the **newly found metal presence could be the result of molten lunar surface cooling down** gradually.

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