A group of ancient lunar basaltic meteorites discovered

February 20, 2023

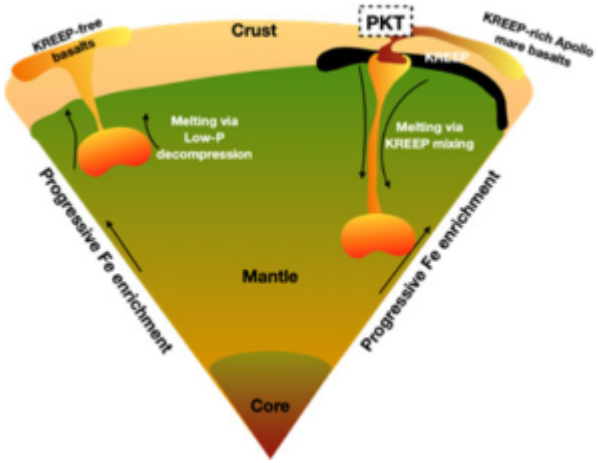
In news- A team of scientists from Ahmedabad-based Physical Research Laboratory (PRL), the United States and Japan has found a unique group of ancient lunar basaltic meteorites, suggesting a new scenario for the origin of lunar basalts.

Key findings-

- They found signs of a fundamental shift in the melting process on the Moon between 3.9 to 3.3 billion years ago.
- The new evidence points to the thermal evolution of the Moon as its interior melted in the form of basalt magmatism.
- The new findings challenge currently proposed scenarios for the generation of basalts on the surface, which were found in the samples returned to the Earth by Apollo missions.
- A team of scientists have **studied samples from lunar meteorite Asuka-881757**, which was found in 1988 in Antarctica, lunar meteorite Kalahari 009 found in 1999 at the Kalahari Desert in South Africa, and samples collected by the Russian Luna-24 mission.
- **They found the unique group of ancient lunar basaltic meteorites had a very low abundance of KREEP (potassium, rare-earth elements, and phosphorus)**.
- This suggests that these meteorites must have come from a region different from the Procellarum KREEP Terrane (PKT) on the Moon and that there could be alternative ways of melting on the Moon.
- The study states that **sample return missions have**

provided the basis for understanding the thermochemical evolution of the Moon.

- **Mare basalt sources are likely to have originated from the partial melting of the lunar magma ocean** and then cumulating after solidification from an initially molten state.
- Analysis of the samples demonstrated tha**t these basalts were generated at lower temperatures and shallower depths than typical Apollo mare basalts.**
- The Indian Space Research Organisation said that these basalts must be a result of low-pressure melting in the Moon, similar to those in other terrestrial bodies, such as Earth and Mars.
- This finding suggests that the Moon's interior melted in the form of basalt magmatism from as early as 4.3–3.9 billion years globally to a more localized scenario in the PKT region later around 3.8–3.0 billion years ago.



- ISRO said that the **Moon's dark regions that are visible to the naked eye, known as the 'mare'**, are remnants of a violent history of the Solar System. **There are no records, though, of these frenzied events on Earth.**
- The large mare regions on the near side of the Moon, that can be seen from Earth, mainly consists of basalts comprising volcanic rocks.
- **These regions hold the key to how the Moon cooled and evolved besides providing information on what were the**

sources of heat that melted and crystallised the material to the present day rocks.

- The Apollo, Luna, and Chang’E-5 missions have brought to Earth an extensive collection of mare basalts.

Note: Physical Research Laboratory (PRL) which is a unit of the Department of Space, carries out fundamental research in select areas of physics, space and atmospheric sciences, astronomy, astrophysics and solar physics, and planetary and geo-Sciences.