

UZUME: A Lunar Lava Tube Exploration of Japan

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In this century, huge vertical holes with a diameter and depth of several tens of meters have been discovered on the Moon by the Japanese lunar explorer SELENE (Kaguya). From the US Lunar Reconnaissance Orbiter (LRO) high-resolution images revealed that the floors of the holes are not bowl-shaped like a normal craters.

It is reasonable to think that such a vertical hole formed when a meteorite collided with an underground space such as a lava tube. In fact, data from oblique observations by LRO showed that there are deep spaces at the bottom of the vertical holes. In addition, in the US gravity field observation satellite GRAIL data, large mass deficits were found along a rille (lava river) in the Marius Hills, at the middle of which a vertical hole exists. In addition, along the rille, specific underground echoes implying the existence of a lava tube were also identified in SELENE Lunar Radar Sounder data. The existence of lava tubes on the Moon becomes more certain.

Lava tubes will be effective shelters from meteorites and radiation on the Moon, making them the best lunar base construction sites. Exploration of lava tubes is therefore the most important topic of international space exploration programs. In the third edition of the Global Exploration Roadmap (GER) submitted by the International Space Exploration Coordination Group (ISECG), which aims to create an international space exploration framework led by national space agencies.

On the other hand, exploration of the lava tube on the moon provides various scientifically important information. We are examining a plan to explore lunar vertical holes and associated lava tubes, with naming it as "UZUME"(Unprecedented Zipangu Underworld of the Moon Exploration).

In this presentation, we will explain how the UZUME will contribute on planetary science, the main purposes of it are

- (1) Increasing knowledge about how habitable regions that nurtured life formed, evolved and maintained and then life was born in the past,
- (2) Increasing knowledge of the universe which is necessary for us humans to expand our habitable regions from the Earth to the space.

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