

Exploration of Lava tube of the Moon and Mars

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On the moon, huge vertical holes with diameter and depth of several tens of meters were discovered by Japanese lunar explorer SELENE (Kaguya). Higher-resolution images of their bottoms have been taken by Lunar Reconnaissance Orbiter (LRO), showing that they are not bowl-shaped, different from normal impact craters. It is possible that such vertical holes were formed by impacts of meteorites on roofs of subsurface voids like lava tubes. In fact, oblique observations, gravitational field data, and even Radar Sounder echo data indicate that the presence of lava tubes on the Moon is almost certain.

Larger vertical holes which are very similar to those on the Moon have been found on Mars. These Martian vertical holes of Mars are also thought to be skylights opened on subsurface voids such as lava tubes.

More than 50 holes have been discovered on Mars, many at the foot of Arsia Mons, where the seven holes were first discovered, and at Elysium that was thought to be once surrounded by an ocean. We have recently confirmed the presence of intact lava tubes on the basis of the MRO radar sounder data.

Many Japanese scientists are considering direct expeditions of lunar and Martian lava tubes with naming as Unprecedented Zipangu Underworld of the Moon/Mars Explorations (UZUME). We believe the explorations will provide a lot of information to understand igneous activities of the celestial bodies.

Whether lava tubes formed or not are essential to understand what kind of lava flows and how lavas replaced the surfaces of the bodies. Various physical quantities of lava flows can be obtained from the size and shape of the lava tube, and these can be clues to information on eruption such as the temperature of the lava flow.

In this talk, we will introduce our recent knowledge of the lava tubes on the Moon and Mars and discuss the significance of the exploration for Earth planetary science.

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