New high-res map suggests little water inside moon

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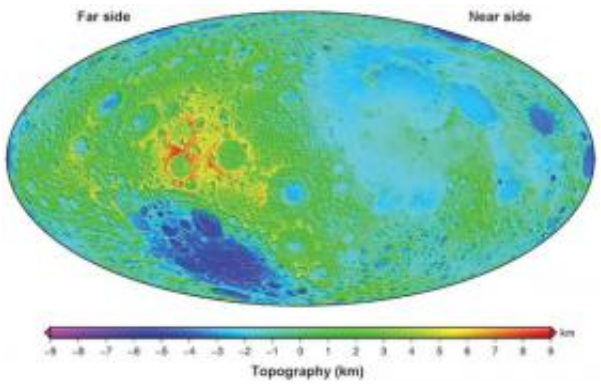

An international team of researchers has created the most detailed map of the Moon yet, using the laser altimeter (LALT) instrument on board the Japanese Selenological and Engineering Explorer satellite. C.K. Shum, professor of earth sciences at Ohio State University, is a member of the LALT science team and a co-author of a paper appearing in the February 13 issue of the journal Science. Image © Science/AAAS

The image of the moon is courtesy of NASA.

(PhysOrg.com) -- The most detailed map of the Moon ever created has revealed never-before-seen craters at the lunar poles. The map is also revealing secrets about the Moon's interior -- and hinting about Mars's interior as well. C.K. Shum, professor of earth sciences at Ohio State University, is part of the international research team that published the map in the February 13 issue of the journal *Science*.

"The surface can tell us a lot about what's happening inside the Moon, but until now mapping has been very limited," Shum said. "For instance, with this new high-resolution map, we can confirm that there is very little water on the Moon today, even deep in the interior. And we can use that information to think about water on other planets, including Mars."

Using the laser altimeter (LALT) instrument on board the Japanese Selenological and Engineering Explorer (SELENE) satellite, the researchers mapped the Moon at an unprecedented 15-kilometer (9-mile) resolution.

The principal investigator of the LALT instrument is Hiroshi Araki of the National Astronomical Observatory of Japan, and he is the lead author of the study. Shum is a member of the LALT science team.

The map is the first to cover the Moon from pole to pole, with detailed measures of surface topography, on the dark side of the moon as well as the near side. The highest point -- on the rim of the Dririchlet-Jackson basin near the equator -- rises 11 kilometers (more than 6.5 miles) high, while the lowest point -- the bottom of Antoniadi crater near the south pole -- rests 9 kilometers (more than 5.5 miles) deep.

In part, the new map will serve as a guide for future lunar rovers, which will scour the surface for geological resources.

But Araki and his colleagues did something more with the map: they measured the roughness of the lunar surface, and used that information to calculate the stiffness of the crust.

If water flowed beneath the lunar surface, the crust would be somewhat flexible, but it wasn't. The surface was too rigid to allow for any liquid water, even deep within the Moon.

Earth's surface is more flexible, by contrast, with the surface rising or falling as water flows above or below ground. Even our planet's plate tectonics is due in part to water lubricating the crust.

And Mars? On a scale of surface roughness, it falls somewhere between the Earth and the Moon, which indicates that there may have once been liquid water, but that the surface is now very dry.

No surprise there.

But Mars' roughness coupled with the complete absence of plate

tectonics suggests that if there is water in the red planet's interior, it is not located near the surface, where it could lubricate the crust, Shum explained.

The LALT map is the most detailed lunar map ever created. The last three Apollo missions mapped part of the surface in the early 1970s, and the 1994 Clementine mission in offered a resolution between 20-60 kilometers in certain locations, but not the entire surface.

The SELENE mission offers 15-kilometer resolution consistently over the entire surface, because it features two smaller sub-satellites which closely track the main satellite.

"This design significantly improved our ability to model gravity fields on the moon, and let us compute the main satellite's orbit more accurately than was possible before, especially over the far side the Moon. That led to more accurate measurement of the lunar topography using LALT," Shum said.

The map revealed several small craters at the north and south poles that hadn't been seen before. For example, a 15-kilometer-wide crater can be seen inside the much larger de Gerlache crater at the south pole.

Source: Ohio State University