BBC NEWS

Ice deposits found at Moon's pole

By Paul Rincon
Science reporter, BBC News, The Woodlands, Texas

A radar experiment aboard India's Chandrayaan-1 lunar spacecraft has identified thick deposits of water-ice near the Moon's north pole.

The US space agency's (Nasa) Mini-Sar experiment found more than 40 small craters containing water-ice.

But other compounds - such as hydrocarbons - are mixed up in lunar ice, according to new results from another Moon mission called LCROSS.

The findings were presented at a major planetary science conference in Texas.

The craters with ice range from 2km to 15km (one to nine miles) in diameter; how much there is depends on its thickness in each crater. But Nasa says the ice must be at least a couple of metres thick to give the signature seen by Chandrayaan-1.

Dr Paul Spudis, from the Lunar and Planetary Institute in Houston, estimated there was at least 600 million metric tonnes of water-ice held within these impact craters.

The equivalent amount, expressed as rocket fuel, would be enough to launch one space shuttle per day for 2,200 years, he told journalists at the 41st Lunar and Planetary Science Conference.

What all these craters have in common are large areas of their interiors that never see sunlight.

Extreme cold

Temperatures in some of these permanently darkened craters can drop as low as 25 Kelvin (-248C; -415F) - colder than the surface of Pluto - allowing water-ice to remain stable.

"It is mostly pure water-ice," said Dr Spudis. "It could be under a few tens of centimetres of dry regolith (lunar soil)."

This protective layer of soil could prevent blocks of pure ice from vaporising even in some areas which are exposed to sunlight, he explained.

In February, President Barack Obama cancelled the programme designed to return Americans to the Moon by 2020.

However, Dr Spudis said: "Now we can say with a fair degree of confidence that a sustainable human presence on the Moon is possible. It's possible using the resources we find there.

"The results from these missions, that we have seen in the last few months, are totally revolutionising our view of the Moon."

Chandrayaan-1 was India's contribution to the armada of unmanned spacecraft to have been launched to the Moon in recent years. Japan, Europe, China and the US have all sent missions packed with instruments to explore Earth's satellite in unprecedented detail.

In Nasa's LCROSS mission, a rocket and a probe were smashed into a large crater at the lunar south

pole, kicking up water-ice and water vapour.

Spectral measurements of material thrown up by the LCROSS impact indicate some of the water-ice was in a crystalline form, rather than the "amorphous" form in which the water molecules are randomly arranged.

Water source

"There's not one flavour of water on the Moon; there's a range of everything from relatively pure ice all the way to adsorbed water," said the mission's chief scientist Anthony Colaprete, from Nasa's Ames Research Center.

"And here is an instance inside Cabeus crater where it appears we threw up a range of fine-grained particulates of near pure crystalline water-ice."

Overall, results from recent missions suggest there could be several sources for lunar ice.

One important way for water to form is through an interaction with the solar wind, the fast-moving stream of particles that constantly billows away from the Sun.

Space radiation triggers a chemical reaction in which oxygen atoms already in the soil acquire hydrogen nuclei to make water molecules and the simpler hydrogen-oxygen (OH) molecule. This "adsorbed" water may be present as fine films coating particles of lunar soil.

In a cold sink effect, water from elsewhere on the lunar surface may migrate to the slightly cooler poles, where it is retained in permanently shadowed craters.

Scientists have also reported the presence of hydrocarbons, such as ethylene, in the LCROSS impact plume. Dr Colaprete said any hydrocarbons were likely to have been delivered to the lunar surface by comets and asteroids - another vital source of lunar water.

However, he added, some of these chemical species could arise through "cold chemistry" on interstellar dust grains accumulated on the Moon.

In addition to water, researchers have seen a range of other "volatiles" (compounds with low boiling points) in the impact plume, including sulphur dioxide (SO2) and carbon dioxide (CO2).

The results from the Mini-Sar instrument are due to be published in the journal Geophysical Research Letters. The team is currently analysing results for craters at the Moon's south pole.

Paul.Rincon-INTERNET@bbc.co.uk

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/8544635.stm

Published: 2010/03/02 05:10:11 GMT