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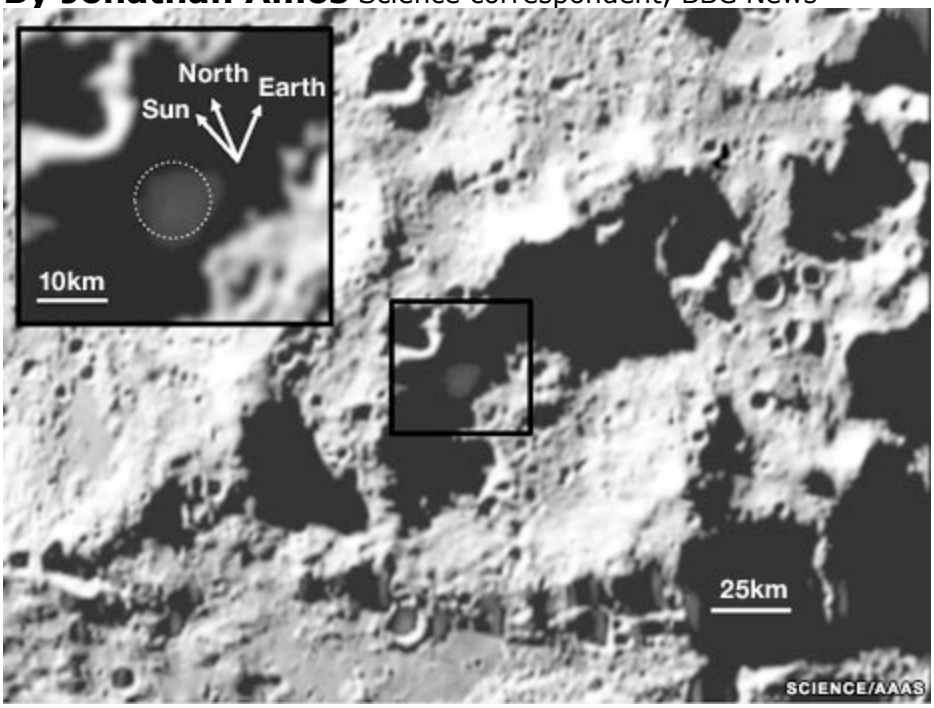
Moon's water is useful resource, says Nasa

By Jonathan Amos Science correspondent, BBC News



An image of debris ejected from Cabeus Crater and into the sunlight, about 20 seconds after the LCROSS impact. The inset shows a close-up with the direction of the Sun and the Earth

There are oases of water-rich soil that could sustain astronauts on the Moon, according to Nasa.

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"Start Quote

We've opened this lunar closet and discovered things we just didn't expect"

End Quote Peter Schultz Brown University

Scientists studied the full results of an experiment that smashed a rocket and a probe into a lunar crater last year.

The impacts kicked up large amounts of rock and dust, revealing a suite of fascinating chemical compounds and far more water than anyone had imagined.

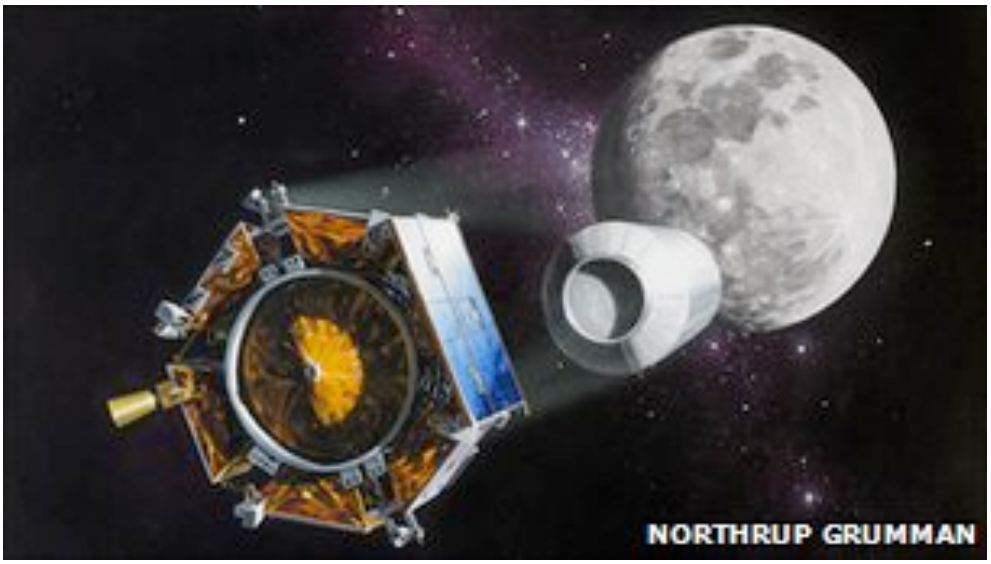
A Nasa-led team tells Science magazine that about 155kg of water vapour and water-ice were blown out of the crater.

The researchers' analysis suggests the lunar regolith, or soil, at the impact site contains 5.6% by weight of water-ice.

"That's a significant amount of water," said Anthony Colaprete, from the US space agency's Ames research centre.

"And it's in the form of water-ice grains. That's good news because water-ice is very much a friendly resource to work with. You don't have to warm it very much; you just have to bring it up to room temperature to pull it out of the dirt real easy."

And he added: "If you took just the 10km region around the impact site and say it had 5% water - that would be equivalent to about a billion gallons of water. I'm not saying that's what's there, but it just shows you that even at these small concentrations there's potential for lots of water."



The LCROSS spacecraft followed closely behind the spent rocket stage

The Nasa-led team has **published six papers in the American journal** describing the findings of the 9 October, 2009, **impacts of the LCROSS spacecraft and its companion rocket stage**.

The pair was targeted at the Moon's southern pole - at Cabeus Crater, a depression so deep and dark that the odds of disturbing ice were thought to be very good.

The rocket stage went in first, followed a few minutes later by the LCROSS probe which gathered imagery and other data just before it too slammed into the surface.

Another spacecraft, Nasa's Lunar Reconnaissance Orbiter (LRO), was passing close by. It also was able to study the plume of material ejected into sunlight more than 15km above the rim of Cabeus.

Moon's 'archive'

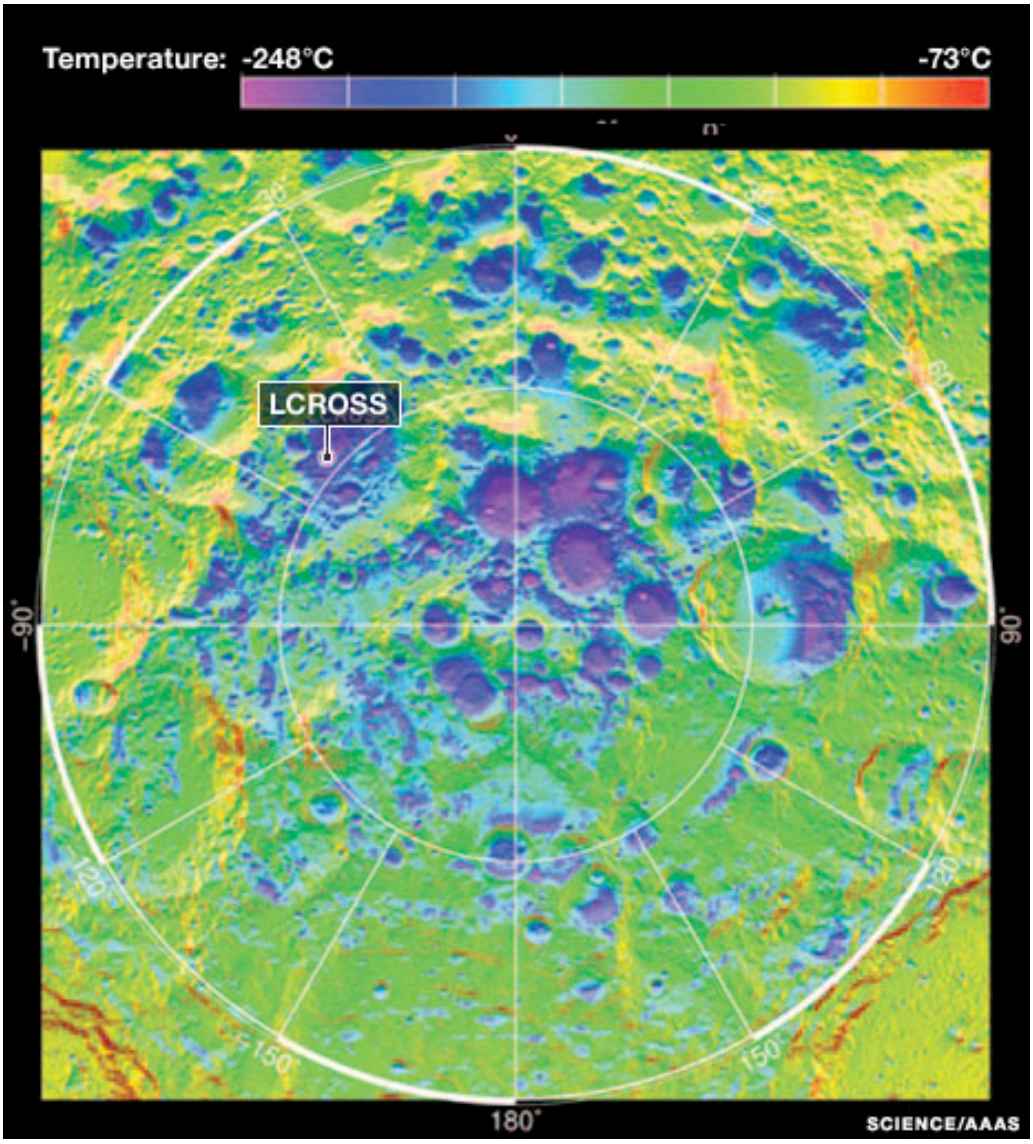
The suite of instruments deployed on that day has determined as much as 20% of this dust plume was made up of volatile compounds, including methane, ammonia, hydrogen gas, carbon dioxide and carbon monoxide.

In addition, the instruments saw relatively large amounts of some metals, such as sodium, and mercury. There was even a signature of silver, but this was tiny.

Scientists say the water and mix of volatiles could be remnants of comet or asteroid impacts through the eons, but they reckon a number of quite complex chemical and physical processes are also working to cycle and migrate these substances around the Moon.

"The LCORSS mission provided some surprises with significant implications for the creation, transport, collection and archiving of volatiles below the shadows of the south pole," said team-member Peter Schultz from Brown University.

"We've opened this lunar closet and discovered things we just didn't expect. And just as the Earth holds its clues to the past climates in the ices at its poles, the Moon also holds clues to past impacts and perhaps even the last stages of lunar volcanism."



Daytime temperatures at the Moon's southern pole. The shadowed parts of some craters are among the coldest places in the Solar System

The water-ice is not uniformly distributed across the southern pole. Rather, it is held in pockets.

Some of these oases are, like in Cabeus, to be found in shadows where LRO's Diviner instrument has sensed temperatures down to minus 244C. Under such conditions, ices will stay fixed for billions of years.

But the research indicates there is probably water-ice even in areas which receive some sunlight through the year, provided it is buried in the soil.

"We've dubbed these newly discovered regions 'lunar permafrost areas'; and they're very extensive," said David Paige, Diviner's principal investigator.

"This could facilitate future human and robotic explorers in their quest for understanding of the lunar ice, as well as its potential use as resource; because rather than having to brave the cold and dark conditions inside permanent shadow, they could land much more conventionally in areas where the sunlight is shining -

at least for part of the year - and then dig a small distance below the surface and access the ice."

Jonathan.Amos-INTERNET@bbc.co.uk