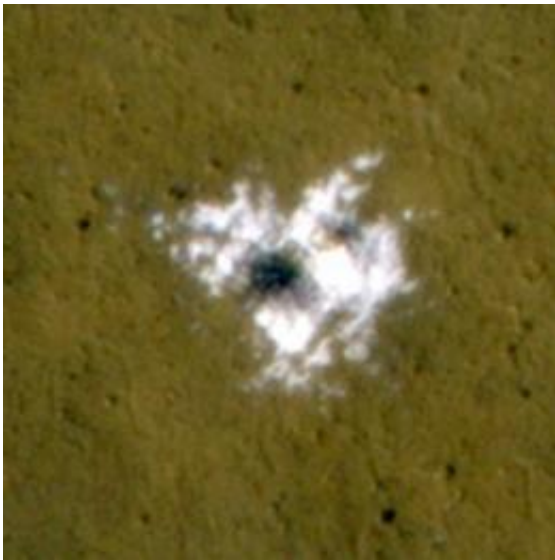


# Scientists see water ice in fresh meteorite craters on Mars

September 24 2009

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The HiRISE camera on NASA's Mars Reconnaissance Orbiter took this image of a new, 8-meter (26-foot)-diameter meteorite impact crater in the topographically flat, dark plains within Vastitas Borealis, Mars, on November 1, 2008. The crater was made sometime after Jan. 26, 2008. Bright water ice was excavated by, and now surrounds, the crater. This entire image is 50 meters (164 feet) across. Credit: NASA/JPL-Caltech/University of Arizona

(PhysOrg.com) -- Scientists are seeing sub-surface water ice that may be 99 percent pure halfway between the north pole and the equator on Mars, thanks to quick-turnaround observations from orbit of fresh meteorite impact craters on the planet.

"We knew there was ice below the surface at high latitudes of [Mars](#), but we find that it extends far closer to the equator than you would think, based on Mars' climate today," said Shane Byrne of the University of Arizona, a member of the [High Resolution Imaging Science Experiment](#), or HiRISE, which runs the high-resolution camera on NASA's [Mars Reconnaissance Orbiter](#).

"The other surprising discovery is that ice exposed at the bottom of these [meteorite](#) impact craters is so pure," Byrne said. "The thinking before was that ice accumulates below the surface between soil grains, so there would be a 50-50 mix of dirt and ice. We were able to figure out, given how long it took that ice to fade from view, that the mixture is about one percent dirt and 99 percent ice."

Scientists used several instruments on the Mars Reconnaissance Orbiter, or MRO, in quick succession in detecting and confirming highly pure, bright ice exposed in new craters, ranging from 1.5 feet to 8 feet deep, at five different Martian sites.

In August 2008, the orbiter's Context camera team examined their images for any dark spots or other changes that weren't visible in earlier images of the same area. Meteorites usually leave dark marks when they crash into dust-covered Mars terrain.

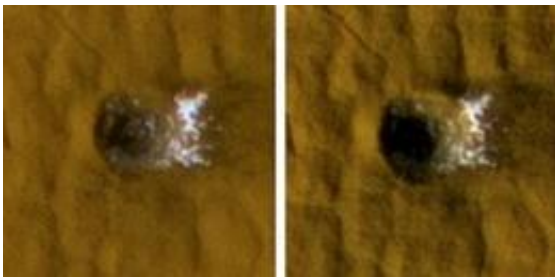
The HiRISE team, which bases its operations at the UA Lunar and Planetary Laboratory, followed up in September 2008 by taking high-resolution images of the dark spots.

"We saw something very unusual when we followed up on the first of these impact craters," Byrne said, "and that was this bright blue material poking up from the bottom of the crater. It looked a lot like water ice. And sure enough, when we started monitoring this material, it faded away like you'd expect water ice to fade, because water ice is unstable on

Mars' surface and turns directly into water vapor in the atmosphere."

A few days later that September, the orbiter's "CRISM" team used their Compact Reconnaissance Imaging Spectrometer for Mars and got the spectral signature of water ice exposed in one of the impact craters, further clinching the discovery.

"All of this had to happen very quickly because 200 days after we first saw the ice, it was gone, it was the color of dirt," Byrne said. "If we had taken HiRISE images just a few months later, we wouldn't have noticed anything unusual. This discovery would have just passed us by."



Earlier and later HiRISE images of a fresh meteorite crater 12 meters, or 40 feet, across located within Arcadia Planitia on Mars show how water ice excavated at the crater faded with time. The images, each 35 meters, or 115 feet across, were taken in November 2008 and January 2009. Credit: NASA/JPL-Caltech/University of Arizona

Byrne and 17 co-authors are reporting the findings in the Sept. 25 edition of the journal *Science*.

How far water ice extends toward the equator depends largely on how much water has been available in the Martian atmosphere in the recent past, Byrne said: "The ice is a relic of a more humid climate not very

long ago, perhaps just several thousand years ago."

The Phoenix Mars Lander mission last year also found clean ice at its landing site on the northern plains of Mars, Byrne noted.

But to find highly pure ice far closer to the equator because of random meteor impacts was unexpected, he said.

There are several theories about how a layer of such pure ice could have formed beneath Mars surface. Byrne said he thinks that one of the most promising ideas is that this ice on Mars formed in the same way that pure ice lenses form beneath the surface of the Earth.

"That's where you have very thin films of liquid water around ice grains and soil grains and they migrate around to form clear ice lenses on top of the ice table, even at temperatures well below zero. This process is called 'frost heave' on Earth, and it's considered a nuisance in most places because it cracks up roads and tilts walls and destroys foundations of houses.

"But on Mars it would be of great interest if we could discover a process that involved liquid water in today's climate, and not just in some of the warmest areas of the planet but in some of the coldest areas of the planet in the high latitude regions," Byrne said.

In the past decade, researchers from UA's Lunar and Planetary Laboratory have played major roles in piecing together the picture of where water is to be found on Mars:

- Professor Alfred McEwen, a co-author on the Sept. 25 *Science* paper, is principal investigator for HiRISE, which began imaging Mars in November 2006. At this time, the HiRISE Web site

features more than 577 processed pictures of Martian water features among thousands of pictures of features on the surface of the planet.

- Professor William Boynton developed the Gamma Ray Spectrometer instrument package on Mars Odyssey that detected [water ice](#) near the Martian poles in 2001.
- Phoenix Mars Lander principal investigator Peter Smith headed the mission that used a long robotic arm to uncover and confirm the shallow ice table at its landing site, and other instruments to document snowfall and ground frost at its high polar latitude. The Phoenix Mars Mission began science operations on the northern plains of Mars after landing May 25, 2008, and lasted five months, until winter arrived.

Source: University of Arizona ([news](#) : [web](#))

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