# Phoenix Close-Up Images of 'Snow Queen' Show Changes

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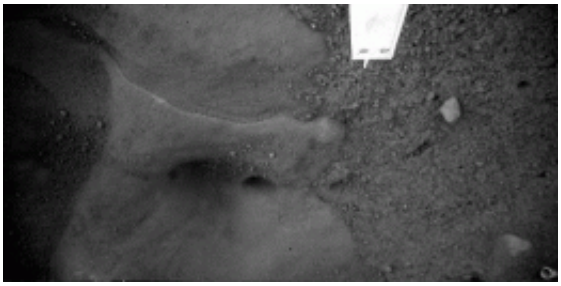

This animation consists of two close-up images of "Snow Queen," taken several days apart, by the Robotic Arm Camera (RAC) aboard NASA's Phoenix Mars Lander. Snow Queen is the informal name for a patch of bright-toned material underneath the lander. Image Credit: NASA/JPL-Caltech/University of Arizona/Max Planck Institute

(PhysOrg.com) -- A distinctive hard-surface feature called "Snow Queen" beneath NASA's Phoenix Mars Lander visibly changed sometime between mid-June and mid-July, close-up images from the Robotic Arm Camera show.

Cracks as long as 10 centimeters, or about four inches, have appeared. A seven-millimeter (less than one-third inch) pebble or clod not seen there before has popped up on the surface. And some smooth texture on Snow Queen has subtly roughened.

Phoenix's Robotic Arm Camera, or RAC, took its first close-up image of

Snow Queen on May 31, 2008, the sixth Martian day, or sol, after the May 25 landing. Thruster exhaust blew away surface soil covering Snow Queen as Phoenix landed, exposing a hard layer comprising several smooth, rounded cavities.

"Images taken since landing showed these fractures didn't form in the first 20 sols of the mission," Phoenix co-investigator Mike Mellon of the University of Colorado, Boulder, said. "We might expect to see additional changes in the next 20 sols."

Mellon, who has spent most of his career studying permafrost, said long-term monitoring of Snow Queen and other icy soil cleared by Phoenix landing and trenching operations is unprecedented for science. It's the first chance to see visible changes in Martian ice at a place where temperatures are cold enough that the ice doesn't immediately sublimate, or vaporize, away. Phoenix scientists discovered that centimeter-sized chunks of ice scraped up in the Dodo-Goldilocks trench lasted several days before vanishing.

The Phoenix team has been watching ice in the Dodo-Goldilocks and Snow White trenches in views from the lander's Surface Stereo Imager as well as RAC, but only RAC can view Snow Queen near a strut under the lander.

The fact that RAC is attached to the robotic arm is both an advantage and a disadvantage. The advantage is that RAC can take close-ups of Snow Queen, while the Surface Stereo Imager can't see Snow Queen at all from the topside of the spacecraft. The disadvantage is that the robotic arm has so many tasks to perform that RAC can't be used for monitoring trench ice at some opportune times. Also, RAC hasn't been used to take up-close images of other icy places under the spacecraft cleared on landing because it would require the robotic arm to make a difficult and complex series of moves.

"I've made a list of hypotheses about what could be forming cracks in Snow Queen, and there are difficulties with all of them," Mellon said.

One possibility is that temperature changes over many sols, or Martian days, have expanded and contracted the surface enough to create stress cracks. It would take a fairly rapid temperature change to form fractures like this in ice, Mellon said.

Another possibility is the exposed layer has undergone a phase change that has caused it to shrink. An example of a phase change could be a hydrated salt losing its water after days of surface exposure, causing the hard layer to shrink and crack. "I don't think that's the best explanation because dehydration of salt would first form a thin rind and finer cracks," Mellon said.

"Another possibility is that these fractures were already there, and they appeared because ice sublimed off the surface and revealed them," he said.

As for the small pebble that popped up on Snow Queen after 21 sols -- it might be a piece that broke free from the original surface or it might be a piece that fell down from somewhere else. "We have to study the shadows a little more to understand what's happening," Mellon said.

Provided by NASA