# Mars volcanic deposit tells of warm and wet environment

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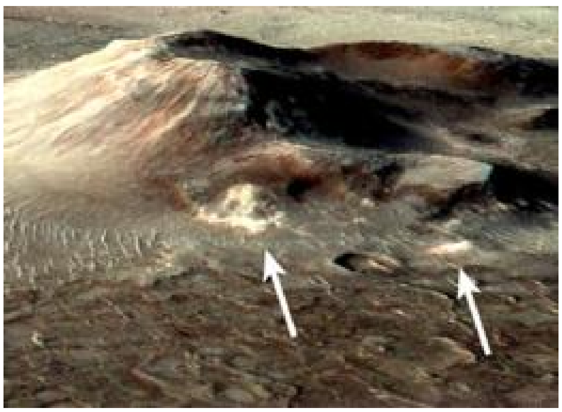

Volcanic deposits on Mars may preserve evidence of one of the planet's most recent habitable microenvironments. The deposits, shown in white (arrows), are located in Nili Patera, a degraded volcanic cone in Syrtis Major of equatorial Mars. Credit: J.R. Skok / Brown University

(PhysOrg.com) -- Roughly 3.5 billion years ago, the first epoch on Mars ended. The climate on the red planet then shifted dramatically from a relatively warm, wet period to one that was arid and cold. Yet there was at least one outpost that scientists think bucked the trend.

A team led by planetary geologists at Brown University has discovered mounds of a mineral deposited on a volcanic cone less than 3.5 billion years ago that speak of a warm and wet past and may preserve evidence of one of the most recent habitable microenvironments on Mars.

Observations by NASA's Mars Reconnaissance Orbiter enabled researchers to identify the mineral as hydrated silica, a dead ringer that water was present at some time. That fact and the mounds' location on the flanks of a volcanic cone provide the best evidence yet found on Mars for an intact deposit from a hydrothermal environment — a steam fumarole or a hot spring. Such environments may have provided habitats for some of Earth's earliest life forms.

"The heat and water required to create this deposit probably made this a habitable zone," said J.R. Skok, a graduate student at Brown and lead author of the paper in Nature Geoscience. "If life did exist there, this would be a promising spot where it would have been entombed — a microbial mortuary, so to speak."

No studies have determined whether Mars has ever supported life, but this finding adds to accumulating evidence that at some times and in some places, Mars hosted favorable environments for microbial life. The deposit is located in the sprawling, flat volcanic zone known as Syrtis Major and was believed to have been left during the early Hesperian period, when most of Mars was already turning chilly and arid.

"Mars is just drying out," Skok said, "and this is one last hospitable spot in a cooling, drying Mars."

Concentrations of hydrated silica have been identified on Mars previously, including a nearly pure patch found by NASA's Mars Exploration Rover Spirit in 2007. However, this is the first found in an intact setting that clearly signals the mineral's origin.

"You have spectacular context for this deposit," Skok said. "It's right on the flank of a volcano. The setting remains essentially the same as it was when the silica was deposited."

The small, degraded cone rises about 100 meters from the floor of a shallow bowl named Nili Patera. The patera spans about 50 kilometers (30 miles) in Syrtis Major of equatorial Mars. Before the cone formed, free-flowing lava blanketed nearby plains. The collapse of an underground magma chamber from which lava had emanated created the bowl. Subsequent lava flows, still with a runny texture, coated the floor of Nili Patera. The cone grew from even later flows, apparently after evolution of the underground magma had thickened its texture so that the erupted lava would mound up.

"We can read a series of chapters in this history book and know that the cone grew from the last gasp of a giant volcanic system," said John "Jack" Mustard, professor of geological sciences and a co-author of the paper, who is Skok's thesis adviser at Brown. "The cooling and solidification of most of the magma concentrated its silica and water content."

Observations by cameras on the Mars Reconnaissance Orbiter revealed patches of bright deposits near the summit of the cone, fanning down its flank, and on flatter ground in the vicinity. The Brown researchers partnered with Scott Murchie of Johns Hopkins University Applied Physics Laboratory to analyze the bright exposures with the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) instrument on the orbiter.

Silica can be dissolved, transported and concentrated by hot water or steam. Hydrated silica identified by the spectrometer in uphill locations — confirmed by stereo imaging — indicates that hot springs or fumaroles fed by underground heating created these deposits. Silica deposits around hydrothermal vents in Iceland are among the best parallels on Earth.

"The habitable zone would have been within and alongside the conduits carrying the heated water," Murchie said.

Provided by Brown University

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