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## Caves spotted on Mars

**Dark 'skylights' could be openings to martian shelters.**

**Katharine Sanderson**

Some underground martian caves may have been spotted, thanks to 'skylight' holes into the caverns that have been photographed from above.

Glen Cushing, from the US Geological Survey (USGS) in Flagstaff, Arizona, got his first hint of the underground cave system from THEMIS (Mars Odyssey's Thermal Emission Imaging System) images of the Arsia Mons region near the equator of Mars. He spotted a system of pit craters, indicative of collapsed areas, and nestled among them half a dozen dark spots ranging in diameter from 100 to 252 metres.

Two of the seven possible openings found by Cushing have been probed using thermal infrared imaging, which shows that their temperature is pretty constant at any time of day: in daylight, the spots are cooler than the rest of the surface, but not as cool as shadowed areas, and at night the spots are warmer than their surroundings.

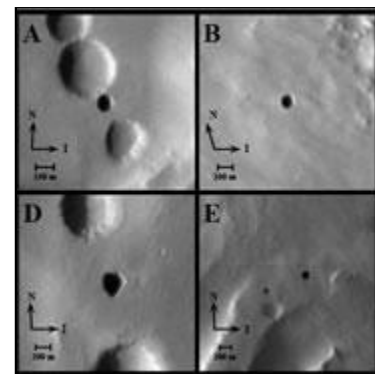
That helps to confirm his suspicion that they are indeed holes or 'skylights' in the ceilings of underground caverns, Cushing says. The holes don't have sunlit walls or floors, so they aren't simply collapsed pits. And they don't have the rims or sprays of surrounding dust that impact craters have, he notes. The data suggest that the holes are at least 80 metres deep, Cushing told the Lunar and Planetary Science Conference in League City, Texas, this week.

### Out of the rain

Finding such caverns on Mars is important for researchers keen to find a place for humans to build a base on the planet, or for those looking for signs of ancient life. Just as on Earth, caves provide shelter from the elements, particularly dust storms and temperature extremes. On the red planet, they also protect from the rain of micro-meteorites, solar flares, ultraviolet radiation and high-energy particles from space.

Such underground caverns might also harbour stable water ice, Cushing suggests.

It's quite plausible that caves do exist on the red planet, says Alfred McEwen, principal investigator on HiRISE (NASA's High-Resolution Imaging Science Experiment, on board Mars Reconnaissance Orbiter). There are volcanoes on Mars, and flowing lava would likely have formed a crust before draining away, creating a network of 'lava tube' tunnels or caves.



The seven sister cave holes have been named Dena, Chloë, Wendy, Annie, Abbey, Nikki and Jeanne.

*NASA/JPL/Arizona State University.*

But McEwen remains less convinced by the water-ice theory. "Ice is not stable in contact with the martian atmosphere," he says. "It's possible to have ice in the subsurface, but not in a cave."

Randy Kirk, also at the USGS, who has been responsible for producing some of the most impressive images to come from HiRISE, thinks it might be possible to peek into the caves at an angle using Mars Reconnaissance Orbiter. This would be an improvement on THEMIS, which can only look straight down.

HiRISE does provide the best bet of validating the cave theory, Cushing says. "When HiRISE looks from the side it will be able to see how thick the ceiling of the cave is, and whether it's a hole at all."

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