Buried Carbonates at Mars

- Infrared observations from spacecraft orbiting Mars are used to determine the composition of minerals on the surface
- Impacts expose material previously buried below the surface
- Observations from the center of one Martian crater show carbonate rocks (containing CO$_3$), which have been detected only in restricted areas elsewhere on Mars
- The most likely explanation implies the carbonates formed in an ancient body of water in contact with Mars’ carbon dioxide (CO$_2$) atmosphere

Martian Climate and Volcanism

Carbonates require liquid water and CO$_2$ to form. The observations reveal the end of a multi-stage process:

1. Carbonates form at the surface in the presence of liquid water, possibly in a denser ancient atmosphere
2. The atmosphere changed and/or liquid surface water disappeared - surface carbonates stopped forming
3. Subsequent volcanic activity buried the carbonates, altering them
4. Impacts exposed the carbonates in some places, including tell-tale signatures of their alteration

The Big Picture

- We can find the past history of water on a planet by looking in craters or valleys at exposed rocks laid down over history
- The observations suggest that more carbonates could have formed on Mars than have been observed so far, but they may have been buried by volcanism
- On Earth, waters where carbonates form (like the oceans) provide ideal habitats for life. Carbonate areas may be a good place to look for evidence of life on Mars
- The observations of carbonates have scientists asking how widespread they are, how much Martian atmosphere they trapped, and whether they preserve evidence for life

For More Information...

Press

- Universe Today - 10/11/10 - “Habitable Environments Could Exist Underground on Mars”
  http://www.universetoday.com/75511/habitable-environments-could-exist-underground-on-mars/
- MSNBC.com - 10/12/10 - “Deep hotspots on ancient Mars looked habitable”
  http://www.msnbc.msn.com/id/39639281/ns/technology_and_science-space/
- JHUAPL - 12/18/08 - “Scientists Find “Missing” Mineral and New Mars Mysteries”
  http://www.jhuapl.edu/newscenter/pressreleases/20081218.asp

Images

- Slide 1 image courtesy NASA / JPL / U. Arizona
- Slide 3 image courtesy Ittiz

Source Articles (on-campus login may be required to access journals)

  http://www.sciencemag.org/content/322/5909/1828

Prepared for the Division for Planetary Sciences of the American Astronomical Society by David Brain and Nick Schneider
dpsdisc@aas.org - http://dps.aas.org/education/dpsdisc/ - Released 15 April, 2011