

Layers Within Layers Hint at a Wobbly Martian Climate

Like Earth, Mars has a layered geology, but the martian version can have a particularly rhythmic regularity; scientists are finally getting a handle on the mechanism driving it.

For decades, planetary scientists assumed that the stunning layering of Mars goes back to the planet's innate unsteadiness. The planet wobbles and wanders in its orbit, changing the climate rhythmically. What else could shape the cyclic-looking layering in everything from icy polar deposits to crater fill? But without a time scale, researchers were long stymied in linking particular layering to any particular orbital variation. That left the door open for nonorbital explanations.

Now, new studies are tentatively tying layering to orbital variations. Across the polar caps of Mars and in impact craters, within the past few million years and several billion years ago, new observations and analyses are revealing periodic groupings of layers of the sort that-orbitally driven climate change could have laid down. Martian layer counting is all the rage now, says planetary geophysicist Roger Phillips of the Southwest Research Institute in Boulder, Colorado, and colleagues analyzed data from SHARAD (SHAllow RADar) onboard the Mars Reconnaissance Orbiter. They found periodic layering on two scales within broad reaches of the NPLD. SHARAD bombards the martian surface with high-frequency radio waves that easily penetrate pure ice but reflect back off dirty ice. The radar sounded out 45 to 50 thin layers beneath the ice's surface, divided into four packets by distinctive zones of low reflection.

So far, the group has two possible interpretations. The low-reflection regions could represent times when Mars's orbit grew rounder and less elliptical, causing storms loading the ice with dust to become less common. Or they could mark times of relatively small axial tilt over many tilt cycles. In either case, the researchers say, the entire NPLD probably formed over roughly the past 5 million years.

LPSC attendees also heard the first quantitative evidence that orbital variations drove climate and geology much earlier in martian history. Planetary scientists Kevin Lewis of Caltech and Aharonson reported their analysis of layering in the low-latitude Arabia Terra region of Mars. They found rhythmic bedding at several locations, all dating to roughly 4 billion years ago. In Bequerel crater, 3.5-meter layers were bundled into packets that average 36 meters in thickness. Lewis and Aharonson have not publicly linked that 10:1 bedding ratio to any particular orbital variations, but they noted in their LPSC talk that Mars's thin atmosphere and lack of oceans make cyclic climate change driven by internal, El Niño–like processes much less likely there than it is on Earth. Nailing down periodic layering on Mars will no doubt require a lot more layer counting and perhaps a better sense of martian time.

—RICHARD A. KERR