**Sedimentary Mars**

**New Mars Global Surveyor images reveal sedimentary rock layers on the Red Planet that may have formed underwater in the distant martian past.**

**December 4, 2000** -- In what ultimately may be their most significant discovery yet, Mars scientists say high-resolution pictures showing layers of sedimentary rock paint a portrait of ancient Mars that long ago may have featured numerous lakes and shallow seas.

"We see distinct, thick layers of rock within craters and other depressions for which a number of lines of evidence indicate that they may have formed in lakes or shallow seas. We have never before had this type of irrefutable evidence that sedimentary rocks are widespread on Mars," said Dr. Michael Malin, principal investigator for the Mars Orbiter Camera on NASA's Mars Global Surveyor spacecraft at Malin Space Science Systems (MSSS), San Diego, CA. "These images tell us that early Mars was very dynamic and may have been a lot more like Earth than many of us had been thinking."

Such layered rock structures where there were once lakes are common on Earth. The pancake-like layers of sediment compressed and cemented to form a rock record of the planet's history.

The regions of sedimentary layers on Mars are spread out and scattered around the planet. They are most common within impact craters of Western Arabia Terra, the inter-crater plains of northern Terra Meridiani, the chasms of the Valles Marineris, and parts of the northeastern Hellas Basin rim. The scientists compare the rock layers on Mars to features seen in the American Southwest, such as the Grand Canyon and the Painted Desert of Arizona.

"We caution that the Mars images tell us that the story is actually quite complicated and yet the implications are tremendous. Mars has preserved for us, in its sedimentary rocks, a record of events unlike any that occur on the planet today," said Dr. Ken Edgett, staff scientist at MSSS. "This is changing the way we think about the early history of Mars -- a time perhaps more than 3.5 billion years ago."

"On Earth, sedimentary rocks preserve the surface history of our planet, and within that history, the fossil record of life. It is reasonable to look for evidence of past life on Mars in these remarkably similar sedimentary layers," said Malin. "What is new in our work is that Mars has shown us that there are many more places in which to look, and that these materials may date back to the earliest times of Martian history."

Malin added, "I have not previously been a vocal advocate of the theory that Mars was wet and warm in its early history. But my earlier view of Mars was really shaken when I saw our first high-resolution pictures of Candor Chasma. The nearly identically thick layers would be almost impossible to create without water."

As an alternative to lakes, Malin and Edgett suggest that a denser atmosphere on early Mars could have allowed greater amounts of windborne dust to settle out on the surface in ways that would have created the sedimentary rock.

"We have only solved one little piece of a tremendous puzzle," Malin said. "There is no illustration on the box to show us what it is supposed to look like when it is completed and we are sure most of the pieces are missing."

"These latest findings from the Mars Global Surveyor tell us that more study both from orbit and at the surface is needed to decipher the tantalizing history of water on Mars," said Dr. Jim Garvin, Mars Exploration Program Scientist at NASA Headquarters. "Our scientific strategy of following the water by seeking, conducting in situ studies, and ultimately sampling will follow up on these latest discoveries about Mars, and adapt to the new understanding."

"Mars seems to continually amaze us with unexpected discoveries," said Dr. Edward Weiler, Associate Administrator for Space Science at NASA Headquarters. "This finding just might be the key to solving some of the biggest mysteries on Mars, and it also tells us that our new Mars exploration program needs the flexibility to follow up in a carefully thought-out manner."

"The finding of layered sedimentary deposits is something that biologists have been hoping for," said Dr. Ken Nealson, director of the Center for Life Detection at NASA's Jet Propulsion Laboratory (JPL), Pasadena, CA. "Perhaps the favorite sites for biologists to search for fossils or evidence of past life on Earth are layered lake or oceanic sediments such as in these sites Malin and Edgett describe."