Rover to probe whether Mars was life-friendly in the past

Irene Klotz, Reuters

(Reuters) - NASA plans to follow up a decade-long search for Mars' lost water with a mission to learn whether the Red Planet once harbored other ingredients necessary for life.

The astrobiological hunt begins once the $2.5 billion Mars Science Lab rover Curiosity lands itself beside a towering mountain that rises from the floor of a vast, ancient impact basin called Gale Crater.

Touchdown, monitored from mission control at NASA's Jet Propulsion Laboratory in California, is scheduled for 10:31 p.m. Sunday Pacific time (1:31 a.m. EDT on Monday).

"It's a big science goal. We're not just looking for water anymore," said California Institute of Technology geologist John Grotzinger, the lead mission scientist.

"The expectations go up. The scientific challenge is much greater. It's just going to be harder to address this question of habitability," he told Reuters.

Scientists considered hundreds of landing sites before choosing Gale Crater, which probably formed when an asteroid or comet crashed into the planet some 3.5 billion to 4 billion years ago.

From high-resolution images taken by orbiting satellites, Gale Crater's central mound, known as Mount Sharp, appears to consist of layers of sediment rising like a stack of cards 3 miles into the sky, taller than the crater's rim.

The most likely origin of the mountain is that it formed from the remains of whatever material filled up the basin long ago. How it was left standing in the middle of Gale Crater, a 96-mile-(154-km)wide bowl located near the planet's equator, is a mystery, one of many scientists hope to answer during Curiosity's two-year science mission.

Regardless of how it formed, scientists consider Mount Sharp a gift of time.

Nothing like it exists on Earth, where plate tectonics, erosion and other natural phenomena constantly reshape the planet's surface.

"We have the opportunity to start in the past, rove up the surface of Mount Sharp and come through time to see how the environments have changed," said Michael Meyer, NASA's Mars exploration program scientist.

WARMER, WETTER MARTIAN PAST

A succession of previous rovers, landers and orbiting spacecraft have gathered compelling evidence that Mars, which is about half the size of Earth and 50 percent farther away from the sun, was not always the dry, acidic, cold desert that appears today.

NASA's strategy since resuming Mars exploration following the 1970s-era Viking missions there has been to look for the chemical and physical fingerprints of water, which is necessary for life - at least as it has evolved on Earth.

The second ingredient in the recipe for life is carbon, which provides organic structure. Carbon will be far more difficult to detect on Mars, if it exists, because the same processes that produce rock tend to destroy organics.

The planet's harsh radiation environment doesn't help either.

"We have a radiation-rich environment on Mars that can destroy organics, so even if it was there, it may be hard to find a place where it's been preserved," Meyer said.

On Earth, the oldest evidence for life dates back about 3.5 billion years. Fossilized remains of single-celled microorganisms were found in 1958 inside a type of rock known as chert. This glass-like rock may exist on Mars as well, and it is not the only material that can preserve organics like a time capsule.

"The challenge for Mars exploration is to first try to identify environments that might have been habitable and then ask, 'Is this the kind of place where organic carbon could have been preserved?'" Grotzinger said.

"With Curiosity, we don't have the ability to look for life, or even fossil life, but we do have the ability to look for organic carbon, so we try to find those environments conducive for preservation. That's the hard part," he said.

The oldest sections of Mount Sharp may overlap the window when life emerged on Earth, a time when Mars is believed to have been warm and wet.

Curiosity's landing site inside Gale Crater is one of the lowest regions on Mars, stacking the odds that water, if it existed there, flowed down to the basin's floor. Mount Sharp may be the remains of this ancient lake bed and perhaps a place that life once called home.

(Editing by Cynthia Johnston, Steve Gorman [1] and Jackie Frank [2])

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