Mars rover's search for signs of life may come up dry

Scientists say lake muds unlikely to have created mountain at the heart of Curiosity's mission.

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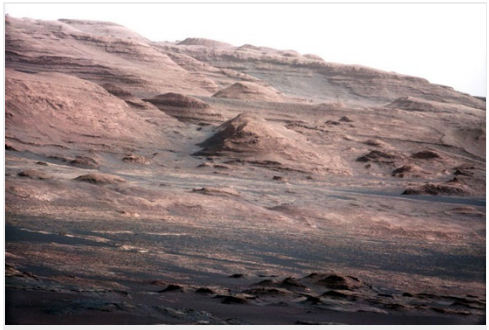

NASA/JPL-Caltech/MSSS

The layered rocks of Mount Sharp may have been formed by wind-blown dust.

Wind, not water, deposited most of the sediments in the layered Martian mountain NASA's Curiosity rover was sent to study, suggests an analysis of observations from orbit. If the rover confirms this scenario when it reaches the mountain next year, it could spell trouble for its chances of finding organic material there.

Last August, Curiosity landed inside the 154-kilometre-wide Gale Crater. Its primary goal is to reach and analyse the 5-kilometre-high sedimentary mound, Aeolis Mons, informally called Mount Sharp, which rises from the crater centre. Some researchers suspect that much of the mound — which at its base contains clay and sulphate minerals that require water to form — was laid down as lake sediments. "If there were lake deposits on Mars, this would be one of the best places to look," says Dawn Sumner, a Curiosity mission member at the University of California, Davis, who advocated sending the rover to Gale in part because of the possibility that it once contained a lake.

But a study by Edwin Kite of the California Institute of Technology in Pasadena and his colleagues, published on 26 March, paints a much drier picture of the mountain's formation[1]. The researchers used high-resolution images taken from NASA's Mars Reconnaissance Orbiter to measure the orientation of rock layers exposed at a handful of locations around the mountain's base. Instead of the flat layers expected from lake deposits, they found layers that were tilted outwards by about 3 degrees. The team's calculations show that this is consistent with the layers being formed by dust blown into the crater by wind.

If so, this would likely limit the number of ancient, life-friendly environments for Curiosity to study. "If you're looking for an environment that could support life, more water is good," says Sumner.

Curiosity's mission of finding preserved organic material — the building blocks of life — would also be more difficult. Wind-deposited sediments can accumulate more slowly than lake sediments, leaving them exposed for longer periods of time to radiation and oxidizing chemicals, which can destroy organic molecules. If the dust accumulated at today's slow rates, "organic material would be exposed to the surface for quite a long time", says study co-author Kevin Lewis of Princeton University in New Jersey.

But Sumner says that the tilted rock layers do not rule out their formation in a lake. For example, the asteroid that created Gale Crater may have also formed a small central mound due to the ground rebounding after impact. Lake sediments would have flowed down the peak and become thicker at its base compared with sediments deposited on top, Sumner says. These thicker layers could then become more compacted with time, caused the layers to tilt away from the centre. Gary Kocurek, a Curiosity team member and sedimentologist at the University of Texas at Austin, agrees. "There are other ways of explaining why the strata dip away from the mound," he says.

Curiosity will try to test these hypotheses when it reaches the base of Mount Sharp in 2014 after a 10-kilometre drive (see 'Mars rover under pressure to reach mountain goal'). Its cameras will image the mound up close to see if it shows the fine, straight layers expected from deposition in standing water, or the tilted cross-bedding that might be expected from wind-blown deposition.

Even if Mount Sharp turns out to have been mainly formed by wind, Sumner will be content to learn the mound's true story. "We have our desires for what the environment was like on Mars, but the most important thing is that those rocks actually record the history of what happened."

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References

1. Kite, E. S., Lewis, K. W., Lamb, M. P., Newman, C. E. & Richardson, M. I. *Geology* http://dx.doi.org/10.1130/G33909.1 (2013).