The Meandering Channels of Mars

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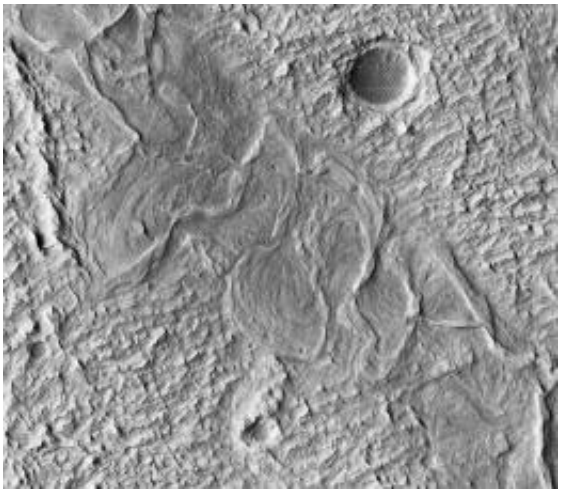
A meandering river in Siberia. Image Credit: Ólafur Ingólfsson, http://www3.hi.is/~oi/

Sinuous channels on the Martian surface may be evidence of relatively recent rainfall. Researchers plan to test this hypothesis by studying sinuous streams on Earth.

The surface of Mars is littered with channels that appear to be the work of ancient water flows. Indeed, some of these channels meander back and forth like slow-moving streams on our planet. Channels can be carved by lava, wind and glaciers, but these processes can't explain all the features on Mars.

"We've gotten over the hump and can now agree that water flowed on the martian surface in the past," says Alan Howard of the University of Virginia.

But how much and when is still unclear. Howard believes the meandering channels on Mars may tell us a lot about the wet history of our planetary neighbor.



A sinuous channel in the Aeolis Planum region of Mars taken by the HiRISE camera on the Mars Reconnaissance Orbiter. Image Credit: NASA/JPL/University of Arizona

Howard and a group of researchers will be tromping into the desert and the arctic to find terrestrial "meanders" that might explain their counterparts on Mars.

On Earth, meandering streams occur where the floodplain is resistant to erosion. Often this is because the stream banks are held firm by grass and tree roots.

"Mars almost certainly didn't have vegetation like that," Howard says.

So what might have kept Martian soil in place? Howard and his colleagues have a list of possible mechanisms: clay, ice, chemical

processes. They will be studying how these mechanisms create sinuous channels on Earth to see if they can pinpoint the best representation for what created similar channels on Mars.

The work is funded by NASA as part of its Mars Fundamental Research program.

Martian hydrology

Channels can be found all over the Martian landscape. Many are braided in a way that resembles river deltas on Earth.

But there are two areas on the red planet -- the Eberswalde Crater delta and the Aeolis/Zephyra Plana region -- where the channels snake their way through the now barren landscape. The channels were most likely carved by runoff from precipitation, Howard says. But that doesn't jive well with their age, which is estimated to be around 2 billion years old or even younger.

"The width and branching character of the channels is consistent with episodes of rain or snow, but it seems difficult to have precipitation that recently," Howard says.

False color image of gully channels in a crater in the southern highlands of Mars, taken by the High Resolution Image Science Experiment (HiRISE) camera on the Mars Reconnaissance Orbiter. The gullies emanating from the rocky cliffs near the crater's rim (upper left) show meandering and braided patterns typical of water-carved channels. North is approximately up and illumination is from the left. The scale is 26 centimeters per pixel. Image credit: NASA/JPL/University of Arizona

Liquid water was thought to have disappeared from the surface of Mars more than 3 billion years ago. However, it's possible that water flowed after that - perhaps due to a large meteor impact or volcanic eruption that melted ice and created a wet micro-climate for a short period of time in the recent past.

But Howard and his colleagues wonder if such a brief wet spell could create meandering rivers in the martian landscape. Are there examples on Earth that could help solve the mystery?

Making hay over clay

Meandering rivers on Earth typically are found where vegetation traps fine sediment to eventually form a layer of cohesive material that is resistant to erosion.

But there are places where streams meander even though there's not much vegetation around. Howard and his group have identified several such sites in the Nevada desert.

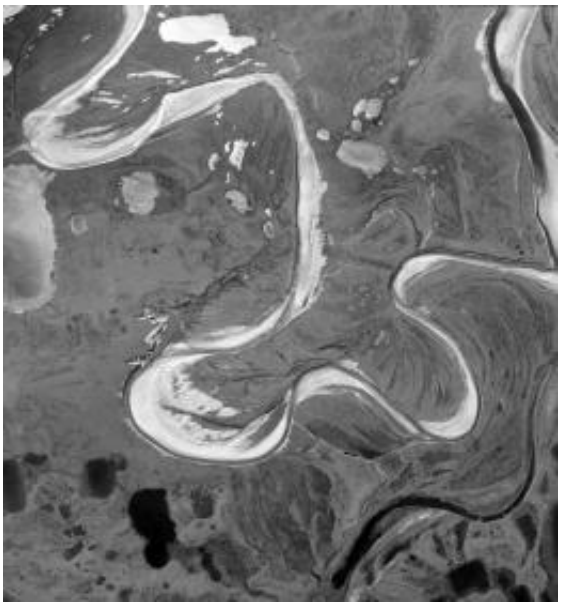
"We suspect clay sediment is providing the necessary cohesion," Howard says of these sites.

In the coming months, the team will visit these desert meanders to study their geology and test whether clay is indeed able to explain the meandering.

Clay has been detected on Mars in various locations, but it's mostly associated with earlier - supposedly wetter - epochs on Mars.

"Clay implies a considerable amount of weathering," Howard explains.

If the meandering channels on Mars formed because of clay in the soil, that would imply an appreciably wetter environment for a longer time and at a later epoch than scientists have imagined.



Aerial photo of a meandering stream near Barrow, Alaska. Image Credit: U.S. Geological Survey

Other possibilities

There may be other ways to make a waterway meander, besides clay.

Ice in the flow of water could hinder erosion of the banks. Howard's team plans to go to Alaska, near the town of Barrow, to see if ice is playing a part in the formation of meanders there.

Another possibility is chemical hardening of the stream bed. In arid environments, minerals deposited in the ground can cement together to form a hard thin layer. So-called "duricrusts" are common on Earth (and have been found on Mars), but the team has yet to find a meandering stream flowing through one. Howard says that the crusts take centuries to form, which is perhaps too long to develop the erosion boundaries needed for meandering.

The situation could, of course, be different on Mars. The climate is cooler, the surface is more iron-rich, and the gravity is just 38 percent that of Earth. This last difference is something that the researchers will be looking at closely to see what effect it has on channel formation.

Lastly, Howard has considered that microbial crusts - the closest that Mars could presumably have gotten to "vegetation" - may have provided soil cohesion.

"It would be obviously revolutionary if organisms were responsible for the meandering on Mars, but we really have to eliminate all other possibilities first," Howard says.

Source: Astrobio.net