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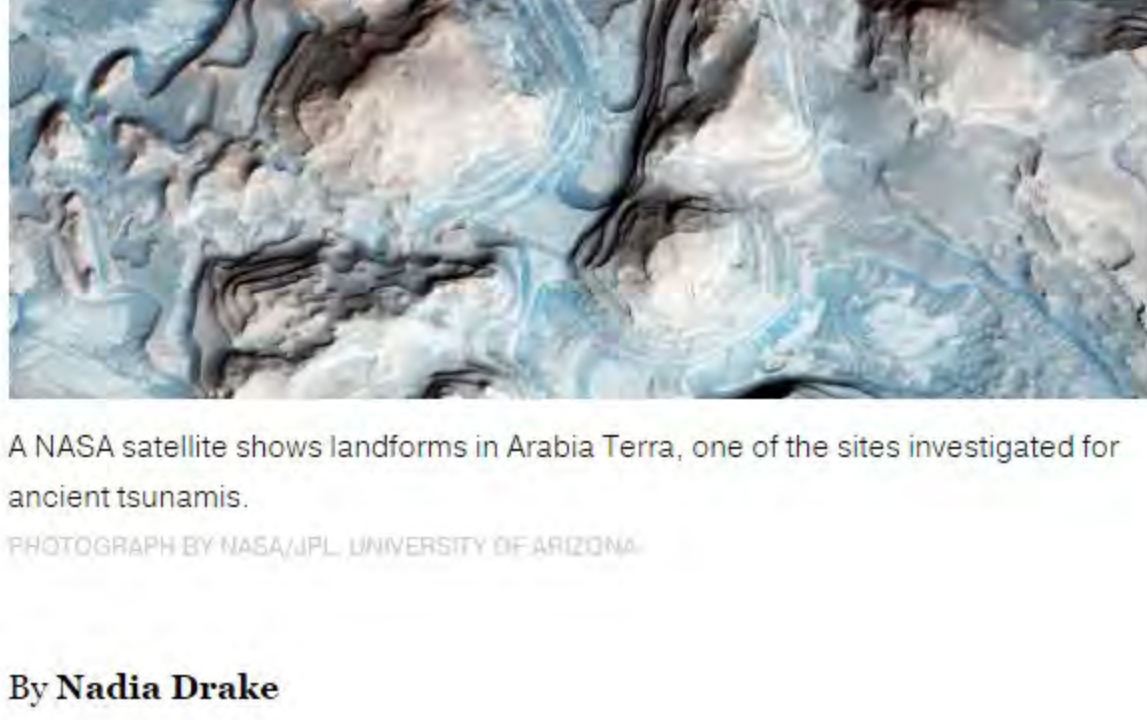
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Tsunamis on Mars? Splashy Claim Raises Eyebrows.

Observations hint at catastrophic waves in the planet's past, but not all experts are convinced that the necessary oceans existed.

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A NASA satellite shows landforms in Arabia Terra, one of the sites investigated for ancient tsunamis.

PHOTOGRAPH BY NASA/JPL, UNIVERSITY OF ARIZONA

By **Nadia Drake**

PUBLISHED MAY 20, 2016

On our planet, earthquake-triggered tsunamis can be catastrophic. But on Mars, meteor strikes may have generated tsunamis 10 times larger than anything seen here—behemoth waves of destruction capable of submerging the Statue of Liberty and the Capitol Building.

The mega-tsunamis would have occurred about 3.4 billion years ago, when two large space rocks slammed into a chilly sea in the Martian north. The first of these impacts, according to [a study published this week in *Scientific Reports*](#), spawned massive, nearly 400-foot-tall (120-meter-tall) waves that carried bus-size boulders many miles inland. The waves flooded more than 220,000 square miles (570,000 square kilometers), an area larger than many U.S. states.

The next impact, which would have occurred some several million years later, met a Mars that was a bit chillier. Instead of smashing into a watery sea, the meteor collided with a frozen ocean, and instead of flooding the Martian plains and then draining away, those slushy waves spread inland and stuck.

Today, evidence for these ancient cataclysms takes the form of channels carved by the receding waves, lobe-shaped fields strewn with boulders, and craters that appear to have been filled with now evaporated seawater, says study co-author [Alexis Rodriguez](#) of the Planetary Science Institute in Arizona.

It's an interesting story that is consistent with observations gathered by various spacecraft orbiting Mars.

"I think they've done a very nice job of pulling together a story that is self-consistent and well justified by the evidence they highlight," says Cornell University's [Don Banfield](#).

No Ocean, No Tsunami

But Banfield and others say some persnickety details need sorting out before the tale becomes established fact.

First and most important, to have a tsunami, you need an ocean. And it's not clear whether Mars had a northern ocean during the late Hesperian, the period about 3.4 billion years ago, when Rodriguez and his colleagues suggest these tsunamis occurred.

There's strong evidence that water once flowed on the red planet—it left its fingerprints in the valley networks and outflow channels carved into the Martian surface. But those features formed in the Noachian period and so are about 3.8 billion years old, meaning they existed before scientists think Mars lost most of its insulating, water-friendly atmosphere.

As that atmosphere faded away and the planet chilled, its ability to preserve liquid water on its surface evaporated. But there's a lot we don't know about Mars's ancient climate, so though oceans may have sloshed around at one point, it's not clear whether large bodies of water persisted through the Hesperian.

"By this point, Mars's atmosphere had probably eroded significantly compared to the late Noachian, which is when we have the most evidence of erosion by liquid water," says Harvard University's [Robin Wordsworth](#).

That's not necessarily a problem, Rodriguez says. A transient sea could have existed later in Mars's life, perhaps an extremely salty one that resisted freezing. And even if a meteor smashed into an ice-capped ocean, it could still generate a tsunami. But more work is needed to figure out exactly how that would work.

Finding well-preserved shorelines would help back up the idea of oceans on ancient Mars. But that kind of evidence has also been tough to pin down.

"The idea of an ocean is not beyond the realm of possibility," says [Joel Davis](#) of University College London. "However, much of the geology in the northern lowlands has since been obscured by younger material or eroded, so it's difficult to find much direct evidence of a past ocean."

Banfield agrees: "The search for characteristic shorelines of ancient seas on Mars has been tough going. Some believe they've found some, others identify problems with these putative shorelines."

But Rodriguez and his colleagues think their work offers an explanation for why that shoreline is absent: It's been erased and modified by the mega-tsunamis that soaked the planet as meteors pummeled Mars during the Hesperian.

"If there was an ocean, tsunamis are a good explanation for why we don't see much of any shoreline," says Wordsworth.

Glacial Alternative

Some scientists say it's still possible to explain the tsunami-linked features in ways that don't invoke ancient cataclysms. Glacial transport, for instance, could have created some of those boulder fields, says [Edwin Kite](#) of the University of Chicago.

"Bouldery debris is found on top of and at the margins of glaciers on Mars, and there is evidence for past glaciation—and present-day, debris-mantled ice—along the Deuteronilus Mensae," Kite says, referencing the Martian region being studied.

Rodriguez counters that it's unlikely anything else could explain the flows his team observed, which move uphill and flow around small obstacles in ways glaciers wouldn't. And [Brian Hynek](#), of the University of Colorado Boulder, agrees that the tsunami hypothesis is the best explanation for the observations.

Ephemeral Fingerprints

The reality is that even on Earth [it can be incredibly difficult to point to landforms and prove they were the work of a swollen sea](#). It takes a very particular type of coastline to leave behind the unmistakable signature of a tsunami in the first place, says [Ricardo Ramalho](#) of the University of Bristol.

"The coastline has to have the right characteristics for sizeable deposits to be produced—you need a reef or cliff to produce large boulders, for example," Ramalho says. "And this, of course, cannot be safely established in the case of Mars."

Evidence of recent earthly tsunamis, such as the ones triggered by the 2004 and 2011 earthquakes off the Indonesian and Japanese coasts, is already vanishing, says [Pedro Costa](#) of the University of Lisbon.

Mars does a better job of preserving its history than does Earth, where tectonic activity and other processes are continually erasing the fingerprints of past events. But ultimately, only more observations, such as identifying transported ocean sediments, could help convincingly prove that mega-tsunamis sculpted the Martian landscape.

"I hope that the story is true and can prove the ancient ocean hypothesis, because that would be very exciting," says [Francois Forget](#) of the University of Paris. "But I know that more work is needed to confirm the scenario. This is how science works."

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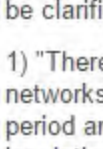
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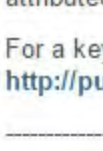


Highland CA Locksmith

21 hours ago

OH MY GODNESS

Like Reply



Alexis Rodriguez

2 days ago

I am Alexis Rodriguez, the lead author of the paper about Martian tsunamis.

There are a couple of inaccurate pieces of information in this press release by National Geographic that should be clarified to the general reader:

1) "There's strong evidence that water once flowed on the red planet—it left its fingerprints in the valley networks and outflow channels carved into the Martian surface. But those features formed in the Noachian period and so are about 3.8 billion years old, meaning they existed before scientists think Mars lost most of its insulating, water-friendly atmosphere."

It is untrue that the outflow channels formed 3.8 billion years ago. The current scientific consensus is that they formed during 3.4 billion years ago, which is also the estimated age of the putative Martian ocean discussed in the investigation. The outflow channels are enormous channels thought to have been excavated by catastrophic floods that sourced from subterranean aquifers. The formation of the investigated ocean is attributed to these floods, and not to the much older 3.8 billion year old valley networks mentioned above.

For a key reference the reader might refer to the latest global geologic map of Mars: http://pubs.usgs.gov/sim/3292/pdf/sim3292_pamphlet.pdf; page 13.

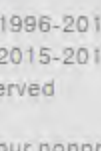
2) "The coastline has to have the right characteristics for sizeable deposits to be produced—you need a reef or cliff to produce large boulders, for example," Ramalho says. "And this, of course, cannot be safely established in the case of Mars."

We actually currently have precise digital topography of Mars that allows us to easily establish and characterize surface topographic features such as cliffs, plains, basins, etc....

For a key reference the reader might refer to:

<http://mola.gsfc.nasa.gov/images.html>

1 Like Reply



Joe Dev

1 day ago

I signed up so I could thank you for taking the time to add to the article and help improve the information available to us readers. All the best to you and I hope that you do this again :)

Like Reply