Mars Had an Ocean, Scientists Say, Pointing to New Data

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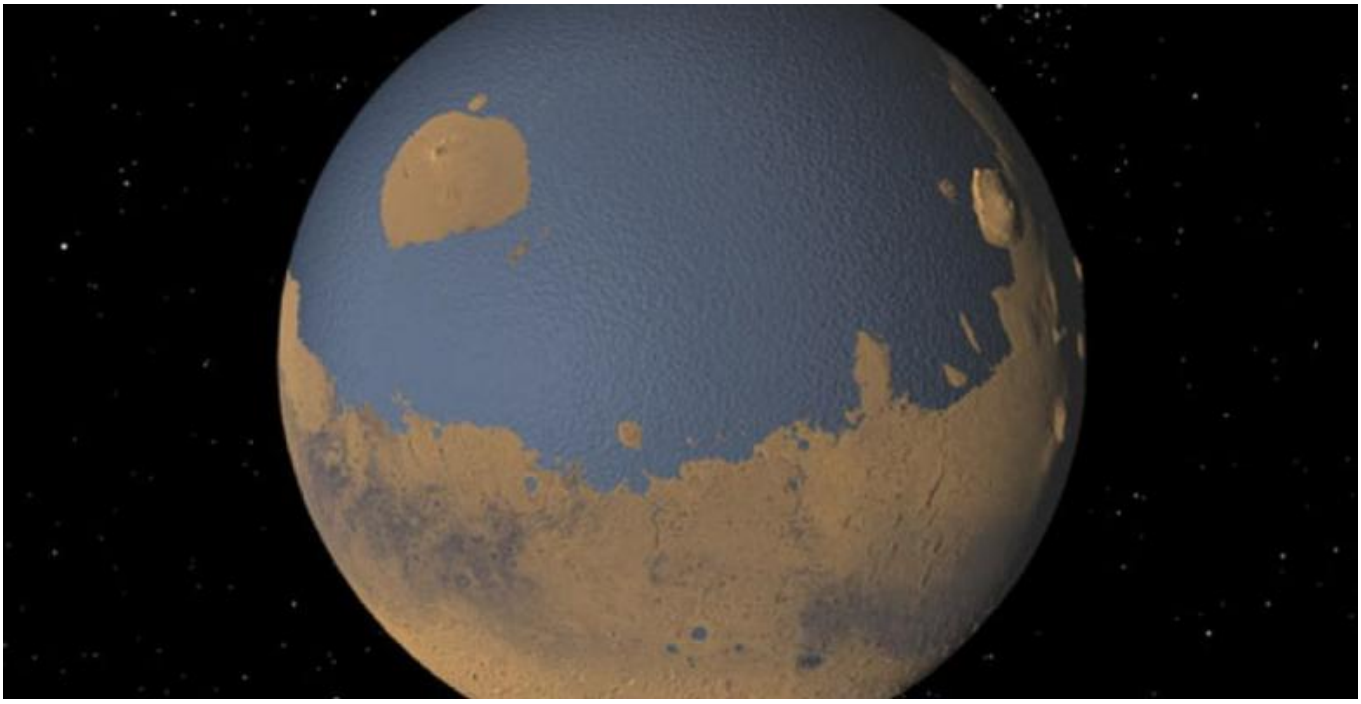

It was probably the size of the Arctic Ocean, larger than previously estimated, the researchers reported Thursday. The body of water spread across the low-lying plain of the planet's northern hemisphere for millions of years, they said.

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If confirmed, the findings would add significantly to scientists' understanding of the planet's history and lend new weight to the view that ancient Mars had everything needed for life to emerge.

"The existence of a northern ocean has been debated for decades, but this is the first time we have such a strong collection of data from around the globe," said Michael Mumma, principal

investigator at NASA's Goddard Center for Astrobiology and an author of the report, published in the journal Science. "Our results tell us there had to be a northern ocean."

But other experts said the question was hardly resolved. The ocean remains "a hypothesis," said Ashwin Vasavada, project scientist of the Curiosity rover mission at the Jet Propulsion Laboratory in Pasadena, California.

Mumma and Geronimo Villanueva, a planetary scientist at NASA, measured two slightly different forms of water in Mars' atmosphere. One is the familiar H2O, which consists of two hydrogen atoms and one oxygen atom.

The other is a slightly "heavier" version of water, HDO, in which the nucleus of one hydrogen atom contains a neutron. The atom is called deuterium.

The two forms exist in predictable ratios on Earth, and both have been found in meteorites from Mars. A high level of heavier water today would indicate that there was once a lot more of the "lighter" water, somehow lost as the planet changed.

The scientists found eight times as much deuterium in the Martian atmosphere than is found in water on Earth. Villanueva said the findings "provide a solid estimate of how much water Mars once had by determining how much water was lost to space."

He said the measurements point to an ancient Mars that had enough water to cover the planet to a depth of at least 137 meters, or about 450 feet. Except for assessments based on the size of the northern basin, this is the highest estimate of the amount of water on early Mars that scientists have ever made.

The water on Mars mostly would have pooled in the northern hemisphere, which lies 1 to 3 kilometers - 0.6 to 1.8 miles - below the bedrock surface of the south, the scientists said.

At one time, the researchers estimated, a northern ocean would have covered about 19 percent of the Martian surface. In comparison, the Atlantic Ocean covers about 17 percent of Earth's surface.

The new findings come at a time when the possibility of a northern ocean on Mars has gained renewed attention.

The Curiosity rover measured lighter and heavier water molecules in the Gale Crater, and the data also indicated that Mars once had substantial amounts of water, although not as much as Mumma and Villanueva suggest.

"The more water was present - and especially if it was a large body of water that lasted for a longer period of time - the better the chances are for life to emerge and to be sustained," said Paul Mahaffy, chief of the atmospheric experiments laboratory at the Goddard Space Flight Center.

Just last month, the science team running the Curiosity rover held its first formal discussion about the possibility of such an ocean and what it would have meant for the rest of Mars.

Scientists generally agree that lakes must have existed for millions of years in Gale Crater and elsewhere. But it's not clear how they were sustained and replenished.

"For open lakes to remain relatively stable for millions of years - it's hard to figure how to do that without an ocean," Vasavada said. "Unless there was a large body of water supplying humidity to the planet, the water in an open lake would quickly evaporate and be carried to the polar caps or frozen out."

Yet climate modelers have had difficulty understanding how Mars could have been warm enough in its early days to keep water from freezing. Greenhouse gases could have made the planet much warmer at some point, but byproducts of those gases have yet to be found on the surface.

James Head, a professor of geological sciences at Brown University, said in an email that the new paper had "profound implications for the total volume of water" on ancient Mars.

But, he added, "climate models have great difficulty in reconstructing an early Mars with temperatures high enough to permit surface melting and liquid water."

Also missing are clear signs of the topographic and geological features associated with large bodies of water on Earth, such as sea cliffs and shorelines.

Based on low-resolution images sent back by the Viking landers, the geologist Timothy Parker and his colleagues at the NASA Jet Propulsion Lab reported in 1989 the discovery of ancient shorelines. But later high-resolution images undermined their conclusions.

Still, Parker and his colleagues have kept looking for - and finding, they say - some visible signs of a northern ocean. The new data "certainly encourages me to do more," he said in an interview.

Other researchers have also been looking for signs of an ancient ocean.

In 2013, Roman DiBiase, then a postdoctoral student at the California Institute of Technology, and Michael Lamb, an assistant professor of geology there, identified what might have been a system of channels on Mars that originated in the southern hemisphere and emptied steeply into the northern basin - perhaps, they said, water flowing through a delta to an ocean.