

Extensive water in Mars' interior

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Mars, as seen by the Hubble Space Telescope. Image credit: NASA

Until now, Earth was the only planet known to have vast reservoirs of water in its interior. Scientists analyzed the water content of two Martian meteorites originating from inside the Red Planet. They found that the amount of water in places of the Martian mantle is vastly larger than previous estimates and is similar to that of Earth's. The results not only affect what we know about the geologic history of Mars, but also have implications for how water got to the Martian surface. The data raise the possibility that Mars could have sustained life.

The research was led by former Carnegie postdoctoral scientist Francis McCubbin, now at the University of New Mexico. The analysis was performed by Carnegie Institution investigator Erik Hauri and team and is published in the journal [Geology](#).

The scientists analyzed what are called shergottite meteorites. These are

fairly young meteorites that originated by partial melting of the Martian mantle—the layer under the crust—and crystallized in the shallow subsurface and on the surface. They came to Earth when ejected from Mars approximately 2.5 million years ago. Meteorite geochemistry tells scientists a lot about the geological processes the planet underwent.

"We analyzed two meteorites that had very different processing histories," explained Hauri. "One had undergone considerable mixing with other elements during its formation, while the other had not. We analyzed the water content of the mineral apatite and found there was little difference between the two even though the chemistry of trace elements was markedly different. The results suggest that water was incorporated during the formation of Mars and that the planet was able to store water in its interior during the planet's differentiation."

Based on the mineral's [water content](#), the scientists estimated that the Martian mantle source from which the rocks were derived contained between 70 and 300 parts per million (ppm) water. For comparison, the upper mantle on Earth contains approximately 50-300 ppm water. Hauri and team were able to determine these values with new techniques and new standards they developed that can quantify water in apatite using a technology called secondary ion mass spectrometry (SIMS).

"There has been substantial evidence for the presence of liquid water at the [Martian surface](#) for some time," Hauri said. "So it's been puzzling why previous estimates for the planet's interior have been so dry. This new research makes sense and suggests that volcanoes may have been the primary vehicle for getting water to the surface."

McCubbin concluded, "Not only does this study explain how Mars got its water, it provides a mechanism for hydrogen storage in all the terrestrial planets at the time of their formation."

Provided by Carnegie Institution

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