

Dawn spacecraft finds signs of water on Vesta

Excess hydrogen and pitted vents suggest asteroid once contained water.

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Vesta, the second-most-massive body in the asteroid belt, was thought to be bone dry. But NASA's Dawn spacecraft has found evidence that smaller, water-rich asteroids once implanted themselves in Vesta's surface. The water stays locked up in hydrated minerals until subsequent impacts create enough heat to melt the rock and release the water as a gas, leaving pitted vents in the surface.

The discovery shows that yet another body in the inner Solar System has a water cycle, says Carle Pieters, a planetary scientist at Brown University in Providence, Rhode Island, and a member of the Dawn science team.

"This is really getting to be interesting," says Pieters. The cycle was described in two papers published today in *Science*^{1,2}.

One paper shows how one of Dawn's instruments, which measures γ rays and neutrons to depths of about a metre, detected an excess of hydrogen in the asteroid's equatorial regions that would indicate a water content as high as 400 parts per million¹. The second paper identifies hundreds of pits — some as deep as 200 metres — in several of the same regions that are thought to reflect places where the heat of a subsequent impact unlocked the water content and allowed it to vent into space².

William Boynton, a planetary scientist at the University of Arizona in Tucson, says that the excess hydrogen could well have come from water in hydrated minerals. He used a similar instrument on the Mars Odyssey spacecraft to identify excess hydrogen that was interpreted as coming from a layer of ice just below the surface in the polar plains of Mars.

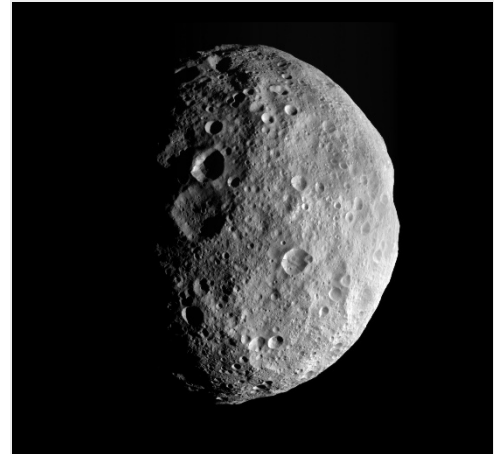
Hydrated minerals have also been discovered on the Moon by an instrument on the Indian Chandrayaan-1 spacecraft. But Pieters, who is principal investigator of the instrument, says that a very different mechanism was responsible. There, hydrogen atoms from the solar wind implanted themselves in minerals at the surface. Although water-rich asteroids also hit the Moon, she says, any water they contain would be less likely to survive the impact. The Moon has a stronger gravitational field than Vesta, so asteroids hit it much faster.

The Dawn spacecraft left Vesta on 5 September and is now heading to Ceres, the biggest asteroid in the Solar System. But Ceres is already known to contain water — some scientists have even proposed that it harbours a subsurface, briny ocean.

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References

1. Prettyman, T. H. *et al. Science* <http://dx.doi.org/10.1126/science.1225354> (2012).
2. Denevi, B. W. *et al. Science* <http://dx.doi.org/10.1126/science.1225374> (2012).



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Some of the pits on Vesta's surface suggest that water has been vented from the interior of the asteroid.