Is Vesta the 'smallest terrestrial planet?'

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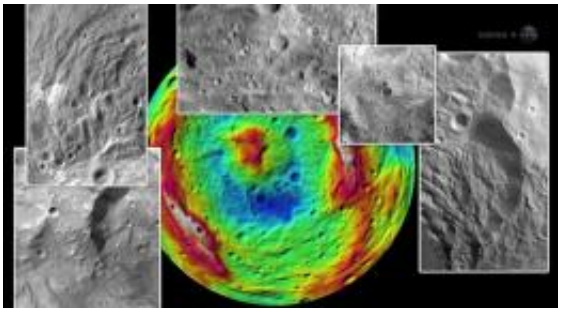

Like Earth and other terrestrial planets, Vesta has ancient basaltic lava flows on the surface and a large iron core. It also has tectonic features, troughs, ridges, cliffs, hills and a giant mountain. False colors in this montage denote topography, where the colors indicate heights ranging from -22 km to +19 km above a reference ellipsoid.

NASA's Dawn spacecraft spent the last four years voyaging to asteroid Vesta – and may have found a planet.

Vesta was discovered over two hundred years ago but, until Dawn, has been seen only as an indistinct blur and considered little more than a large, rocky body. Now the spacecraft's instruments are revealing the true complexity of this ancient world.

"We're seeing enormous mountains, valleys, hills, cliffs, troughs, ridges, craters of all sizes, and plains," says Chris Russell, Dawn principal investigator from UCLA. "Vesta is not a simple ball of rock. This is a world with a rich geochemical history. It has quite a story to tell!"

In fact, the asteroid is so complex that Russell and members of his team are calling it the "smallest terrestrial planet."

Vesta has an iron core, notes Russell, and its surface features indicate that the asteroid is "differentiated" like the terrestrial planets Earth, Mercury, Mars, and Venus.

Differentiation is what happens when the interior of an active planet gets hot enough to melt, separating its materials into layers. The light material floats to the top while the heavy elements, such as iron and nickel, sink to the center of the planet.

Researchers believe this process also happened to Vesta.

The story begins about 4.57 billion years ago, when the planets of the Solar System started forming from the primordial solar nebula. As Jupiter gathered itself together, its powerful gravity stirred up the material in the asteroid belt so objects there could no longer coalesce. Vesta was in the process of growing into a full-fledged planet when Jupiter interrupted the process.

Although Vesta's growth was stunted, it is still differentiated like a true planet.

"We believe that the Solar System received an extra slug of radioactive aluminum and iron from a nearby supernova explosion at the time Vesta was forming," explains Russell. "These materials decay and give off heat. As the asteroid was gathering material up into a big ball of rock, it was also trapping the heat inside itself."

As Vesta's core melted, lighter materials rose to the surface, forming volcanoes and mountains and lava flows.

"We think Vesta had volcanoes and flowing lava at one time, although we've not yet found any ancient volcanoes there," says Russell. "We're still looking. Vesta's plains seem similar to Hawaii's surface, which is basaltic lava solidified after flowing onto the surface.

Vesta has so much in common with the terrestrial planets, should it be formally reclassified from "asteroid" to "dwarf planet"?

"That's up to the International Astronomical Union, but at least on the inside, Vesta is doing all the things a planet does."

If anyone asks Russell, he knows how he would vote.

Source: Science@NASA