

Texas-Size Asteroid Slammed Early Mars, Studies Say

Richard A. Lovett
for [National Geographic News](#)

June 25, 2008

Early [Mars](#) may have been clobbered by a Texas-size asteroid, creating what could be the largest known impact structure in the solar system, according to three new studies.

The huge depression in the planet's northern hemisphere, dubbed the Borealis Basin, offers new evidence that a massive impact was the cause of Mars's so-called crustal dichotomy.

Scientists have known that the crust in the northern hemisphere is much thinner than it is in the south.

But figuring out why has been a challenge, in part because gigantic [volcanoes](#) cover 30 percent of the original boundary between the two regions.

Now satellite maps have allowed a team led by Jeffrey Andrews-Hanna of the Massachusetts Institute of Technology to use computer models to peer beneath the volcanoes.

"That allowed us to trace the boundary for the first time," Andrews-Hanna said.

What they found was evidence of a giant ellipse 6,000 miles (10,000 kilometers) long. At first the scientists were puzzled, because most impact craters are circular, not elliptical.

Also, an impact big enough to create such a huge crater could have easily melted the crust of the entire planet, obliterating the southern highlands.

In a second paper, Oded Aharonson of the California Institute of Technology and colleagues used computer simulations to show that very large impacts hitting at just the right angle can create elliptical craters.

The team also found a "sweet spot" of impact angles and asteroid velocities that would melt only the crater floor.

Quite Striking

According to the new calculations, the impactor was probably 1,000 to 1,800 miles (1,600 to 2,700 kilometers) wide—two-thirds the size of Earth's moon.

Scientists think it struck the red planet at a 30- to 60-degree angle while traveling at four to six miles (six to ten kilometers) a second.

A third study led by Francis Nimmo of the University of California, Santa Cruz, used a different computer model to confirm that such an impact could thin the northern hemisphere's crust.

That study also predicted that some sort of crustal disruption would have occurred where shock waves from the impact met at the opposite side of the planet.

The geology of Mars is not known well enough to identify physical features that might have been created by the event. But there is an abnormal weak spot in the planet's magnetic field at that point.

This is a sign that something, such as a shock wave, might have altered the underlying crust, perhaps by melting it, noted team member Craig Agnor of Queen Mary, University of London.

All three studies will appear in tomorrow's issue of the journal *Nature*.

The new research hasn't definitively proven that Mars's northern basin was created by a giant impact, said Walter Kiefer of the Lunar and Planetary Institute in Houston, Texas, in a commentary also appearing in *Nature*.

But, he told National Geographic News, "[the studies] have answered many of the objections that have been around the impact model."

Mark Hammergren, an astronomer at Chicago's Adler Planetarium who was not involved in the research, called the results "really quite striking."

In general, a big impact is not an unreasonable explanation for Mars's crustal dichotomy, he added.

"Early in the formation of the solar system, there was a substantial population of large impactors, and many of them would have shared Mars's orbit," he said by email.

In fact, some studies suggest that around the same time Mars got slammed, [an even larger impact may have created Earth's moon](#). And a large impact on Mercury may have been responsible for that planet's unusually high density.

"These impacts were incredibly devastating," MIT's Andrews-Hanna said, "but without them we wouldn't have the terrestrial planets we see today."

© 1996-2008 National Geographic Society. All rights reserved.