SPACE Community

Welcome, Guest

Curious? Join our community!

Members: Log In

New? Register: Join Now!

Discussion Board

e-Newsletter Sign Up

Shop SPACE

Starry Night Store Software & DVDs

Alan Hawkshaw's - Orchestral Encounters

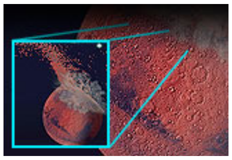
$18.00

Explore More

SPACE Daily Spotlight

Hot Topics

Send to a Friend | Bookmark del.icio.us | Submit to Digg | Mobile Space News | RSS | Yahoo! Buzz



Huge Impact Created Mars' Split Personality

By Clara Moskowitz
Staff Writer
posted: 25 June 2008
1:00 p.m. ET

Mars' two-faced nature may have been caused by a giant kick in the head, according to a new study.

Recent evidence suggests the vast disparity seen between the northern and southern halves of the planet is caused by the long ago impact of a gigantic space rock into Mars.

The finding, based on a survey of the red planet's gravity and topography, provides the first convincing support for the idea that the red planet is the site of the largest impact crater in our solar system. The collision that caused the scar would have occurred more than 3.9 billion years ago, the researchers said, around the time an even larger asteroid is thought to have struck Earth, forming our planet's moon.

"This impact is really one of the defining events in Mars' history," said MIT postdoctoral researcher Jeffrey Andrews-Hanna, who led the new study with MIT geophysicist Maria Zuber and NASA Jet Propulsion Laboratory researcher Bruce Banerdt. "More than anything this has determined the shape of the planet's surface. Mars would not be the planet it is today if this hadn't occurred."

Two-faced planet

Scientists have been scratching their heads trying to explain the differences between the two sides of Mars for about 30 years. The northern hemisphere of the planet is smooth and low, and some experts think it may have contained a vast ocean long ago. Meanwhile, the southern half of the Martian surface is rough and heavily-cratered, and about 2.5 miles to 5 miles (4 km to 8 km) higher in elevation than the northern basin.

Scientists first proposed the idea of a space rock impact to explain the difference in 1984, but for a long time this hypothesis had less support in the field than a competing idea, that internal processes, such as the convection of heat through the mantle, created the different features.

"In the past it has been thought that it just doesn't look like an impact crater," Andrews-Hanna said. "The outline just looked irregular, not circular."

By combining detailed topographical data from the Mars Global Surveyor mission with measurements of the variations in the planet's gravitational field made by the Mars Reconnaissance Orbiter satellite, Andrews-Hanna and his team assembled a map of the Martian surface before volcanic eruptions added layers and obscured the boundary between the hemispheres. The map revealed a stunning elliptical basin shape covering about 40 percent of Mars' surface.

"This was a kind of surprising result," Andrews-Hanna said. "What we noticed is that the dichotomy boundary around the planet was actually smooth and regular. We tested to see if we could fit this with any shape, and it just so happens that it's almost perfectly fitted by an ellipse. There's only one process that's known to make an elliptical depression like that, and that's a giant impact."

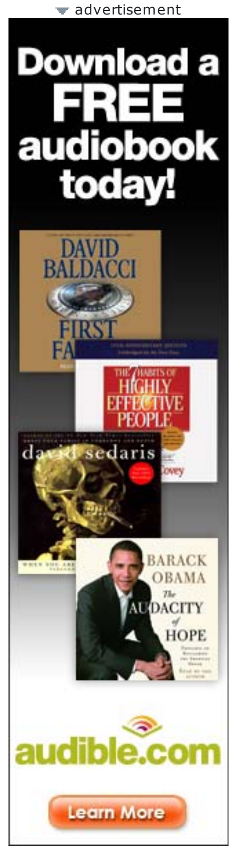
The discovery helps to overcome a major criticism of the space rock impact suggestion, that there is not enough visual evidence to support it.

"This is the one thing that nobody had seen before," Andrews-Hanna told *SPACE.com*. "One of the main arguments against the giant impact hypothesis was that it doesn't look like an impact basin, therefore that's not a good solution. Now we can say that all the evidence we have available to us is pointing toward a giant impact. We can't disprove the other hypotheses, but I think it becomes a challenge now for those hypotheses to explain the feature."

The elliptical crater the study revealed is roughly 5,300 miles (8,500 km) across and 6,600 miles (10,600 km) long, about the size of the combined area of Asia, Europe and Australia. That makes this crater about four times larger than the next-biggest impact basins known, the Hellas basin on Mars and the South Pole-Aitken basin on the moon.

Proof?

advertisement



IMAGES

CLICK TO VIEW

This artistic representation of a giant impact on Mars was created from simulations by Marinova et al. (Nature, 2008). Mars is shown using a combination of Viking color images and shaded relief from the Mars Orbiter Laser Altimeter (MOLA). Credit: Jeff Andrews-Hanna

MULTIMEDIA

- **Video: Fly Over the Two Faces of Mars**

A topographical map of Mars and a simulated flight over the planet reveal the smooth northern lowlands and rugged, heavily cratered southern highlands.

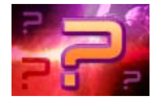
- **Video Player: Mars Mysteries**

Uncover the mysteries surrounding the Red Planet.

- **Video Player: Mars Reconnaissance Orbiter**


The Space Top 10s


Vote for your Space Favorites

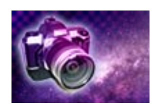

Space Trivia


Multimedia Features


SPACE.com Reader Favorites


Space Wallpapers


Space Video Collection


Space Image Gallery Collection

The research changes the debate about the two faces of Mars, but doesn't settle the question forever.

Animation of the Mars Reconnaissance Orbiter's journey to the Red Planet.

"I think it's an important step forward, but it's not the last word," said Jay Melosh, a planetary scientist at the Lunar and Planetary Lab at the University of Arizona, who was not involved in the new study. "It certainly makes the impact scenario look a lot more plausible than it did before. It's a very strong argument in favor of the giant impact, but there is still no proof."

In order to prove the features seen on Mars are the result of a space rock smash and not some other event or process, scientists would need to find rocks or minerals that could have formed only as the result of an impact.

"If you have a big impact it changes the rocks in characteristic ways," Melosh said. "Minerals like quartz are changed into a form that only occurs at high pressure. It's that kind of change we use on Earth to verify whether impact craters are caused by an impact or something else. If they are right we should be able to find evidence in Martian rocks."

This kind of test will have to wait a while until humans can mount missions to Mars to search for these rocks. Scientists would probably need a suite of samples returned from various areas on the planet to be sure, Melosh said.

Modeling the impact

The map created by Andrews-Hanna and his colleagues will be published in the June 26 issue of the journal *Nature*, along with two other papers that support the Mars findings.

For the latter papers, two groups of researchers used computer models to study the effects such an impact would have had on the planet.

Caltech graduate student Margarita Marinova and planetary scientists Oded Aharonson of Caltech and Erik Asphaug of the University of California, Santa Cruz (UCSC) tested a series of theoretical space rocks approaching Mars with various velocities, energies and sizes. The scientists found that an asteroid about one-half to two-thirds the size of Earth's moon striking Mars at an angle of 30 to 60 degrees could have produced a basin such as the one mapped by Andrews-Hanna's team.

The results help address one of the other main objections to the impact hypothesis — the suggestion that any space rock massive enough to form such a large basin would have melted so much of the planet's surface that all evidence of it would be erased.

"They found, contrary to what was previously thought, that you don't produce that much melt," Andrews-Hanna said. "Most of the melt gets contained in the basin."

Another computer model, by UCSC planetary scientist Francis Nimmo, graduate student Shawn Hart, associate researcher Don Korycansky, and Craig Agnor of Queen Mary University, London, complements these findings.

This group simulated the behavior of the Martian crust during an impact and found that not only could an impact such as the one proposed cause the differences seen in Mars' two halves, it could also explain other features seen on the red planet, such as magnetic field anomalies found in the Southern hemisphere.

Nimmo's model showed how shock waves from the impact on the northern hemisphere would travel through the planet and disrupt the crust on the other side, causing changes in the magnetic field.

"The impact would have to be big enough to blast the crust off half of the planet, but not so big that it melts everything," Nimmo said. "We showed that you really can form the dichotomy that way."

- Video: Fly Over the Two Faces of Mars
- Video: Mars Mysteries
- The 10 Best Mars Images Ever

Comments (0)

You must be logged in to post a comment: Log In | Register

Post a Comment **Sort by:** **Newest** **Oldest** **Recommended**

Post a Comment

You must be logged in to post a comment: Log In | Register

You are currently not logged in.
You must be logged in to leave a comment.

Submit Comment

User Comment Guidelines: It may take up to a minute for your comment to appear. Posting of comments requires membership in the Imaginova Community, which is subject to our Terms of Service. Imaginova reserves the right to remove, without notice, any comment for any reason whatsoever.

Marketplace Links

- **New Galapagos Expedition Offers**
  Lindblad Expeditions Explore the Galapagos and save up to 25% off select departure dates
  www.Expeditions.com

- **BP**
  There's energy security in energy diversity.

- **One-stop destination for the lowest domestic airfares**
  Search all airlines, including Southwest now!

- **HP ProLiant Servers**
  The HP portfolio of servers-leading technology that respects the bottom line. Powerful ProLiant technology at a price that's worth a second look.

- **Facing a Dilemma? Let Geek Logik help.**
  Use Algebra to inform your decisions

- **Orion Telescopes & Binoculars**
  Let us magnify your stargazing experience!

Ads by Google

Space Jobs

Want a job out of this world? We have 100s of space jobs available

www.space-careers.com

SPACE.com Top Stories

- Exotic Life Could Sprout From Titan Chemistry
- The Exoplanet Sleuth Behind NASA's Kepler Mission

LiveScience Top Stories

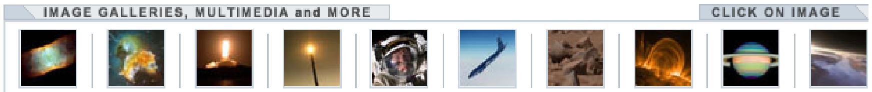
- See-Through Frogs Discovered
- Early Humans Had Nutcracker Jaws
- Marijuana May Disrupt Brain Development

- Secrets of Space Blobs Revealed
- Stuck on Mars, Spirit Rover Does Science
- NASA to Check Space Shuttle Fix With Fueling Test
- Source of Cosmic Rays Pinned Down
- SPACE.com Forums: NASA's Looming Shuttle-Orion Gap
- Starhopping: Find a Pair of Galaxies
- December Trial Set for Ex-Astronaut
- Modest New Moon Images Leave NASA Elated
- Ocean Hidden Inside Saturn's Moon
- Prototype Missile Defense Satellites Primed for Test Flight
- Spitzer Telescope Warms Up to Its New Mission
- NASA Poised to Join Europe's Mars Rover Mission
- Live From the Moon: NASA Probe Beams Home New Lunar Views
- SPACE.com Forums: Who is Your Favorite Apollo Astronaut?

- Timing of Seasons Is Changing
- Belly Buttons May Signal a Woman's Vigor
- Traffic Noise Causes Heart Attacks
- The Problem with Evolution Surveys
- Erectile Dysfunction Predicts Heart Disease

IMAGE GALLERIES, MULTIMEDIA and MORE

CLICK ON IMAGE



© 2007 Imaginova Corp. All rights reserved..