Scientists: The Moon is slowly shrinking

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Courtesy of the Smithsonian Institution
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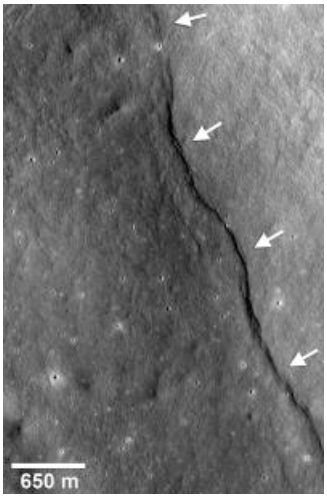
NASA's Lunar Reconnaissance Orbiter satellite is revealing landforms that indicate the moon is shrinking, researchers say.

Researchers are examining so-called lobate scarps, a type of "thrust fault." A thrust fault is a break in a planetary or lunar crust in which originally low-lying layers of rock are pushed up over higher layers.

These features can be produced as a result of a shrinking planet or moon, according to Thomas Watters of the Center for Earth and Planetary Studies at the Smithsonian Institution's National Air and Space Museum in Washington, D.C.



As the lunar interior cooled and contracted the entire Moon shrank, researchers say. As a result its brittle crust ruptured and formed distinctive landforms known as lobate scarps. In a particularly dramatic example, a thrust fault pushed crustal materials (arrows) up the side of the farside impact crater named Gregory (2.1°N, 128.1°E). By mapping the distribution and determining the size of all lobate scarps, the tectonic and thermal history of the Moon can be reconstructed. (Credit: NASA/GSFC/Arizona State U./Smithsonian)

"One of the remarkable aspects of the lunar scarps is their apparent young age," Watters said. "Relatively young, globally distributed thrust faults show recent contraction of the whole moon, likely due to cooling of the lunar interior. The amount of contraction is estimated to be about 100 meters [yards] in the recent past," about a hundred million to a billion years ago, he added.

The lower estimate would put the shrinkage speed at one micron (thousandth of a millimeter) per year. Watters and colleagues reported their findings in in the Aug. 20 issue of the research journal Science.

The moon formed in a chaotic environment of intense bombardment by asteroids and meteors, scientists say. These collisions, along with the decay of radioactive elements, made the moon hot, but it cooled off as it aged.

The team believes the scarps are among the freshest features on the moon, in part because they cut across small craters. Since the moon is constantly bombarded by meteors, features like small craters are quickly destroyed by other impacts and don't last long. If a small crater has been disrupted by a scarp, the scarp formed after the crater and is even younger.

Lobate scarps were first recognized in photos taken near the moon's equator by the Apollo 15, 16 and 17 missions. The new Orbiter, which circles the Moon (click here for a fine video showing its orbit and how it was moved there), has revealed 14 additional scarps. These faults are globally distributed and not clustered near the moon's equator, as was previously thought, Watters said.

This confirms that the scarps are a global phenomenon, making a shrinking moon the most likely explanation for their wide distribution, according to the team.

“The ultrahigh resolution images from the [Orbiter’s] Narrow Angle Cameras are changing our view of the moon,” said study co-author Mark Robinson of Arizona State University, principal investigator of the Lunar Reconnaissance Orbiter Camera. “We’ve not only detected many previously unknown lunar scarps, we’re seeing much greater detail on the scarps identified in the Apollo photographs.”

Lobate scarps are found on other worlds in our solar system, including Mercury, where they are much larger.

“Lobate scarps on Mercury can be over a mile high and run for hundreds of miles,” said Watters. Massive scarps like these lead scientists to believe that Mercury was completely molten as it formed. If so, Mercury would be expected to shrink more as it cooled, and thus form larger scarps, than a world that may have been only partially molten with a relatively small core. Our moon has more than a third of the volume of Mercury, but since the moon’s scarps are typically much smaller, the team believes the moon shrank less.