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SHRINKING MOON GENERATING LUNAR QUAKES: STUDY

Relevant for: Geography | Topic: The Earth and the Solar System

In this image, a mosaic composed of many images taken by NASA's Lunar Reconnaissance Orbiter (LRO), and released by NASA on May 13, 2019, show wrinkle ridges in a region of the Moon called Mare Frigoris. | Photo Credit: AFP

The Moon is shrinking as its interior cools — getting over 50 metres skinnier through the last several hundred million years — and causing quakes on the lunar surface, a study has found. Just as a grape wrinkles as it shrinks down to a raisin, the Moon gets wrinkles as it shrinks, researchers said.

Unlike the flexible skin on a grape, the Moon's surface crust is brittle, so it breaks as the Moon shrinks, forming "thrust faults" where one section of crust is pushed up over a neighbouring part.

"Our analysis gives the first evidence that these faults are still active and likely producing moonquakes today as the Moon continues to gradually cool and shrink," said Thomas Watters, senior scientist at the Smithsonian's National Air and Space Museum in the U.S.

"Some of these quakes can be fairly strong, around five on the Richter scale," scientist Watters said in a statement.

These fault scarps resemble small stair-step shaped cliffs when seen from the lunar surface, typically tens of metres high and extending for several kilometres.

The study, published in the journal *Nature Geoscience*, analysed data from four seismometers placed on the Moon by the Apollo astronauts using an algorithm, or mathematical programme, developed to pinpoint quake locations detected by a sparse seismic network.

The algorithm gave a better estimate of moonquake locations. Seismometers are instruments that measure the shaking produced by quakes, recording the arrival time and strength of various quake waves to get a location estimate, called an epicentre.

Astronauts placed the instruments on the lunar surface during the Apollo 11, 12, 14, 15, and 16 missions. The Apollo 11 seismometer operated only for three weeks, but the four remaining recorded 28 shallow moonquakes — the type expected to be produced by these faults — from 1969 to 1977.

The quakes ranged from about two to five on the Richter scale.

Using the revised location estimates from the new algorithm, the team found that eight of the 28 shallow quakes were within 30 kilometres of faults visible in lunar images.

This is close enough to tentatively attribute the quakes to the faults, since modelling by the team shows that this is the distance over which strong shaking is expected to occur, given the size of these fault scarps.

Other evidence that these faults are active comes from highly detailed images of the Moon by NASA's Lunar Reconnaissance Orbiter (LRO) spacecraft.

The Lunar Reconnaissance Orbiter Camera (LROC) has imaged over 3,500 of the fault scarps. Some of these images show landslides or boulders at the bottom of relatively bright patches on the slopes of fault scarps or nearby terrain.

Weathering from solar and space radiation gradually darkens material on the lunar surface, so brighter areas indicate regions that are freshly exposed to space, as expected if a recent moonquake sent material sliding down a cliff.

“It’s really remarkable to see how data from nearly 50 years ago and from the LRO mission has been combined to advance our understanding of the Moon while suggesting where future missions intent on studying the Moon’s interior processes should go,” said LRO Project Scientist John Keller of NASA’s Goddard Space Flight Centre in Greenbelt, Maryland.

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