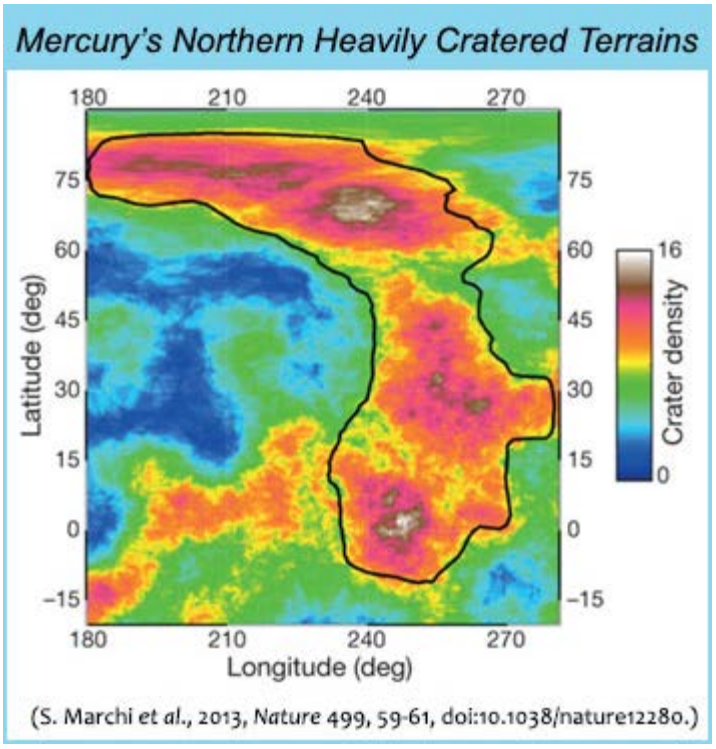
PLANETARY SCIENCE RESEARCH DISCOVERIES
CosmoSparks

Quick Views of Big Advances

Absolute Ages of Mercury's Surface

Heavily cratered terrains–the oldest surfaces–on Mercury are the focus of new studies with cratering statistics that aim to bracket the bombardment and volcanic histories of the closest planet to the Sun.



Simone Marchi (NASA Lunar Science Institute, Southwest Research Institute, Boulder) and colleagues from Colorado, Massachusetts, Rhode Island, and Arizona mapped crater density (for craters >25 kilometers in diameter) on a global mosaic with 500 meter/pixel resolution based on images obtained by MESSENGER during its first year orbiting Mercury (March 2011 to March 2012). MESSENGER (MErcury Surface, Space ENvironment, GEochemistry, and Ranging), a current NASA orbital mission, is collecting the first ever global data set of the planet enabling scientists to study details of the crust, both compositionally and morphologically. One of the regions studied by Marchi and colleagues is the northern heavily cratered terrains, outlined by the black line in the crater areal density map on the left (where crater density is the number of craters at least 25 kilometers in diameter per 100,000 square kilometers). Previous studies with older data found the most heavily cratered terrains had fewer craters (<100 kilometers in diameter) than on the Moon's ancient surfaces, a difference attributed to resurfacing events on Mercury most likely by volcanism. The timing and extent of resurfacing have been ongoing topics of discussion. Lacking actual samples from Mercury, the new cratering statistics provide relative ages of surface terrains, but to calibrate their data, the authors used a model for early lunar crater chronology that is based on ***radiometric dating*** of the Apollo lunar samples and lunar meteorites.

Tweaking the lunar model for the differences in impact velocities, gravitational focusing, and crater scaling relationships at Mercury compared to the Moon, Marchi and coauthors find that the oldest surfaces on Mercury formed 4.0–4.1 billion years ago. Their analysis of large impact basins on Mercury (>300 kilometers in diameter) gives a similar surface age. [For comparison, Alessandro Morbidelli and colleagues show the oldest lunar cratered surfaces are about 4.4 billion years old.] Considering the global data for Mercury's craters and basins, Marchi and colleagues conclude that resurfacing was planet-wide 4.0–4.1 billion years ago, and it was most probably by volcanism, as previously suggested. Their work also indicates that widespread volcanism on Mercury decreased rapidly during the time of the ***Late Heavy Bombardment***.

See References:

· Marchi, S., Chapman, C. R., Fassett, C. I., Head, J. W., Bottke, W. F., and Strom R. G. (2013) Global Resurfacing of Mercury 4.0–4.1 Billion Years Ago by Heavy Bombardment and Volcanism, *Nature,* v. 499, p. 59-61, doi: 10.1038/nature12280 [***abstract***].

· Morbidelli, A., Marchi, S., Bottke, W. F., and Kring, D. A. (2012) A Sawtooth-like Timeline for the First Billion Years of Lunar Bombardment, *Earth and Planetary Science Letters,* v. 355-356, p. 144-151, doi: 10.1016/j.epsl.2012.07.037 [***abstract***].

See also:

· MESSENGER's ***All of Mercury*** spinning globe from NASA's Astronomy Picture of the Day.

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