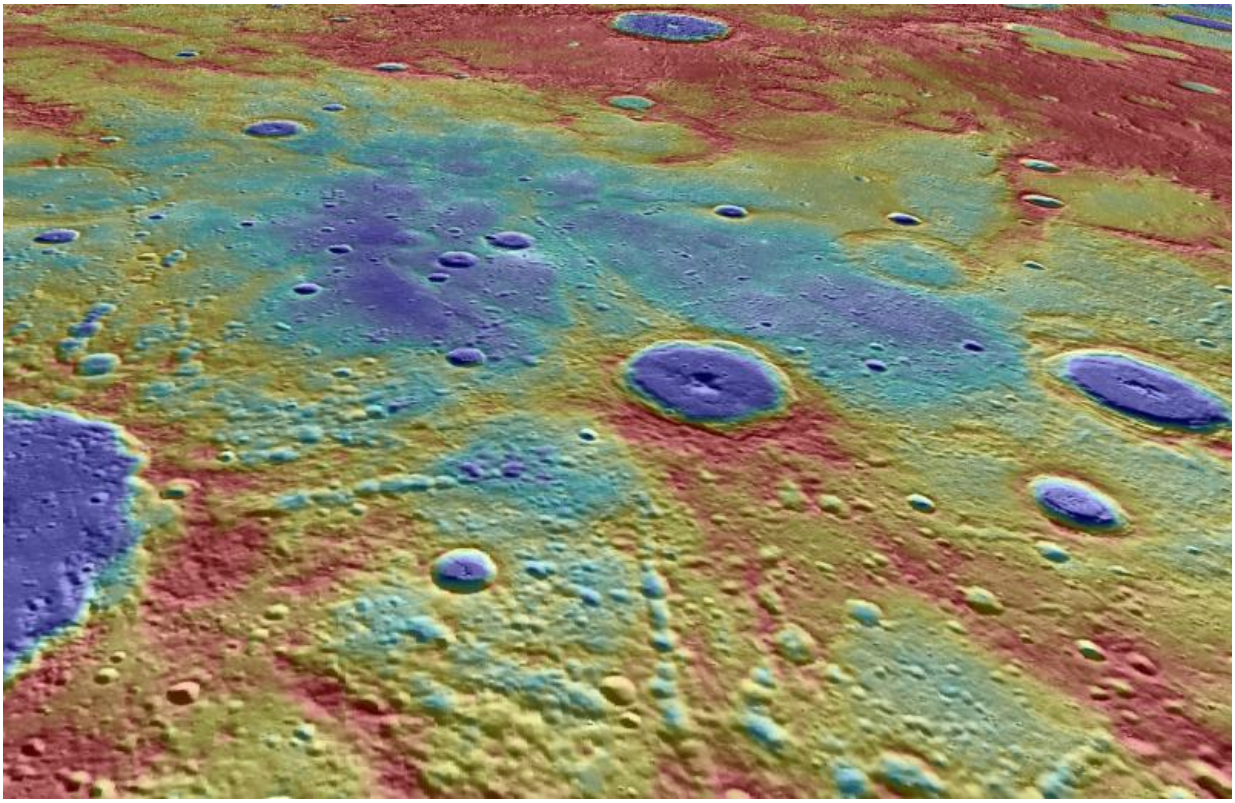
MESSENGER reveals Mercury's magnetic field secrets

May 7 2015



In this perspective view, we look west across Suisei Planitia (blue colors), the site of some of the crustal magnetic signals. The plains are comprised of volcanic lava flows that erupted and solidified several billion years ago, filling the low areas between the higher topography (red colors). The impact crater Kosho, 65 km in diameter, is seen in the center of the image (deep blue floor), and part of the crater Strindberg, 190 km in diameter, is seen in the lower left at the edge of the image. The background image is Mercury Dual Imaging System global mosaic, colored by surface elevation measured by the Mercury Laser Altimeter (MLA), both draped over a digital elevation model derived from MLA data.

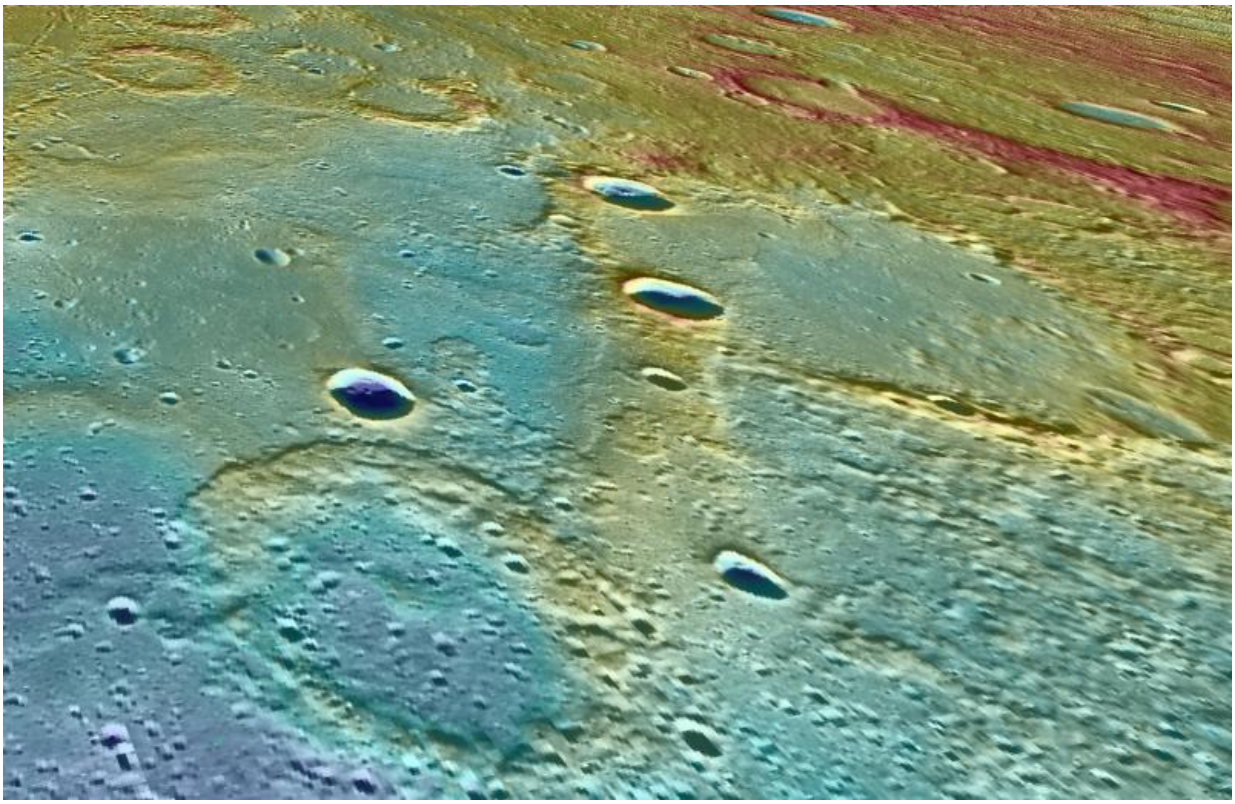
Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington

New data from MESSENGER, the spacecraft that orbited Mercury for four years before crashing into the planet a week ago, reveals Mercury's magnetic field is almost four billion years old. The discovery helps scientists piece together the history of Mercury, the closest planet to the sun and one about which we knew very little before MESSENGER.

NASA's MESSENGER probe left Earth in 2004, reached Mercury in 2008 and has orbited the planet since 2011, sending valuable data back to scientists. A study detailing the planet's ancient magnetic field was published today in *Science Express*. Researchers used data obtained by MESSENGER in the fall of 2014 and 2015 when the probe flew incredibly close to the planet's surface - at altitudes as low as 15 kilometers. In the years prior, MESSENGER's lowest altitudes were between 200 and 400 kilometers.

"The mission was originally planned to last one year; no one expected it to go for four," said Catherine Johnson, a University of British Columbia planetary scientist and lead author of the study. "The science from these recent observations is really interesting and what we've learned about the magnetic field is just the first part of it."

Scientists have known for some time that Mercury has a magnetic field similar to Earth's, but much weaker. The motion of liquid iron deep inside the planet's core generates the field.



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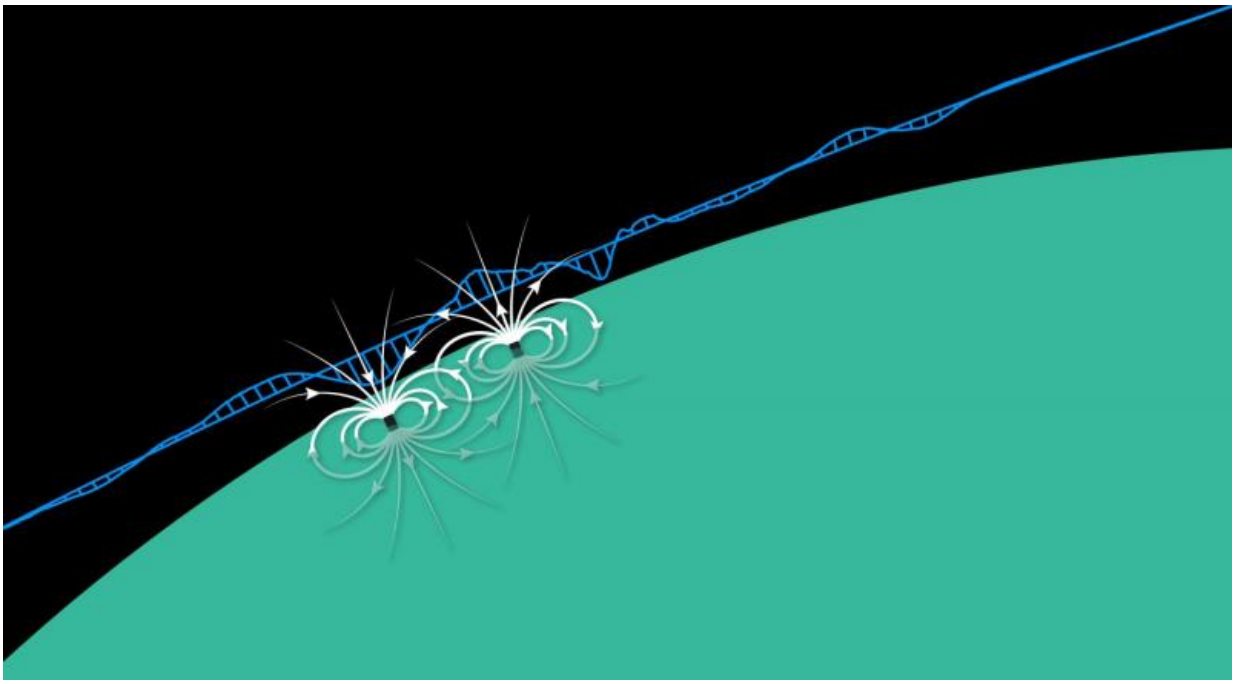
Mercury is the only other planet besides Earth in the inner solar system with such a magnetic field. There is evidence that Mars once had a magnetic field but it disappeared at some point over 3 billion years ago.

When MESSENGER flew close to the planet, its magnetometer collected data on the magnetism of rocks in Mercury's surface. Those tiny signals revealed that Mercury's magnetic field is very ancient, between 3.7 and 3.9 billion years old. The planet itself formed around the same time as Earth, just over 4.5 billion years ago.

"If we didn't have these recent observations, we would never have known how Mercury's magnetic field evolved over time," said Johnson, also a scientist at the Planetary Science Institute. "It's just been waiting to tell us its story."



Schematic magnetic field lines (in white) from magnetized crustal rocks on Mercury. As the MESSENGER spacecraft passed over a region of crustal magnetization, its Magnetometer measured small variations in the magnetic field (blue line). Because the signals are small. they were observed only when MESSENGER was close to the planet. Credit: NASA, University of British Columbia

One of the biggest challenges of the MESSENGER mission was getting the spacecraft into orbit around Mercury. Because the planet is so close to the sun, there was a risk that the spacecraft would get pulled into the sun, rather than go into orbit around Mercury. Engineers also had to deal with the issue of high temperatures. MESSENGER was designed with a protective sunshield to keep the side of the spacecraft facing the sun cool. The engineers also designed large elliptical orbits around Mercury that allowed the spacecraft to spend time far from the planet in each orbit and cool off. Between 2011 and 2015, MESSENGER completed over 4,000 orbits of the planet.

More information: Low-altitude Magnetic Field Measurements by MESSENGER Reveal Mercury's Ancient Crustal Field, www.sciencemag.org/lookup/doi/ … 1126/science.aaa8720

Provided by University of British Columbia