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# Mercury's shifting, rolling past

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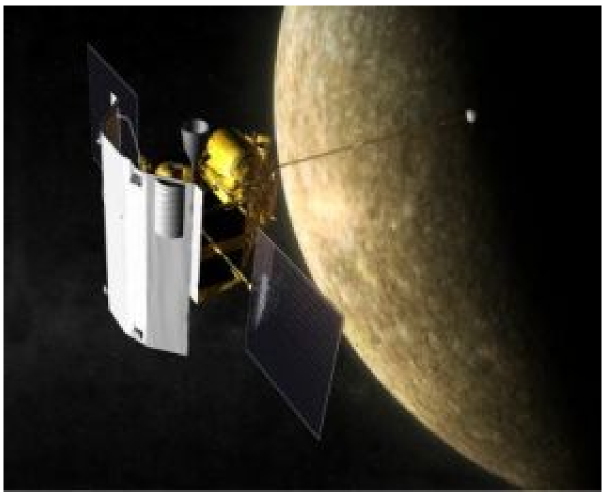

Artist's concept of the NASA's MESSENGER spaceraft at Mercury. Credit: NASA

Patterns of scalloped-edged cliffs or lobate scarps on Mercury's surface are thrust faults that are consistent with the planet shrinking and cooling with time. However, compression occurred in the planet's early history and Mariner 10 images revealed decades ago that lobate scarps are among the youngest features on Mercury. Why don't we find more evidence of older compressive features?

Scott D. King, professor of geosciences in Virginia Tech's College of Science, reports in *Nature Geoscience* this week that mantle convection – loss of heat from the mantle through the crust has also played a role in the formation of lobate scarps on Mercury.

The gravity and topographic data from the MESSENGER (Mercury Surface, Space Environment, Geochemistry, and Ranging) mission will test his hypothesis. In the meantime, King has created numerical simulations of the three-dimensional nature of convection within Mercury's silicate mantle. The computations were done using the Virginia Tech geoscience department's High-Performance Earth Simulation System, a high-speed, high-capacity 768-core Dell computing cluster.

Scientists have offered a number of explanations for global contraction on Mercury, such as cooling and core formation, tidal effects due to gravitation interactions with the Sun, impacts, and mantle convection.

"The idea that contraction due to cooling is the cause of these features has been around for a long time and makes a lot of sense," King said. "But the apparent pattern and the orientation of these features is puzzling. I can't really rule out the idea that this is just an artifact of the one hemisphere we have seen and the one camera/sun angle that we have pictures from. But the orientation of these features seems to require something additional, which I think is mantle convection."

King noted that the upwellings from mantle convection on Mercury takes the form of long, linear rolls in distinctive clusters and directionality, rather than a random pattern associated with upthrusts from global compression acting alone.

"The pattern of convection I see in my mercurian convection models is different from Venus, Mars, and Earth because the mantle is so much thinner -- or the iron core is so much larger relatively speaking," King said. "On Venus, Earth, and Mars, the hot material coalesces into cylindrical plumes, not linear sheets. That could influence the tectonics at the surface and the convection within the iron core, which is most likely what is responsible for Mercury's magnetic field," he said.

“The timing and orientation of these features are controlled by convection and not global contraction,” King said. “Because the model suggests that mantle convection is still active today, gravity and topography data from the Messenger mission may be able to confirm the model.”

King adds that the scarps almost certainly stopped deforming several billion years ago. “The planet has cooled so much and the lithosphere is so thick that even if mantle convection still exists today, it will not modify the surface further.”

He concludes, “I think that if we want to figure out how the Earth got to be the way it is, we need to understand how the other planets got to be the way they are too.”

The article “Pattern of lobate scarps on Mercury’s surface reproduced by a model of mantle convection,” by King in the Letters section of *Nature Geoscience* appears in the Advance Online Publication.

Messenger made its first early pass of Mercury in January 2008. It will enter orbit around the inner planet in March 2011.

Source: By Susan Trulove, Virginia Polytechnic Institute and State University