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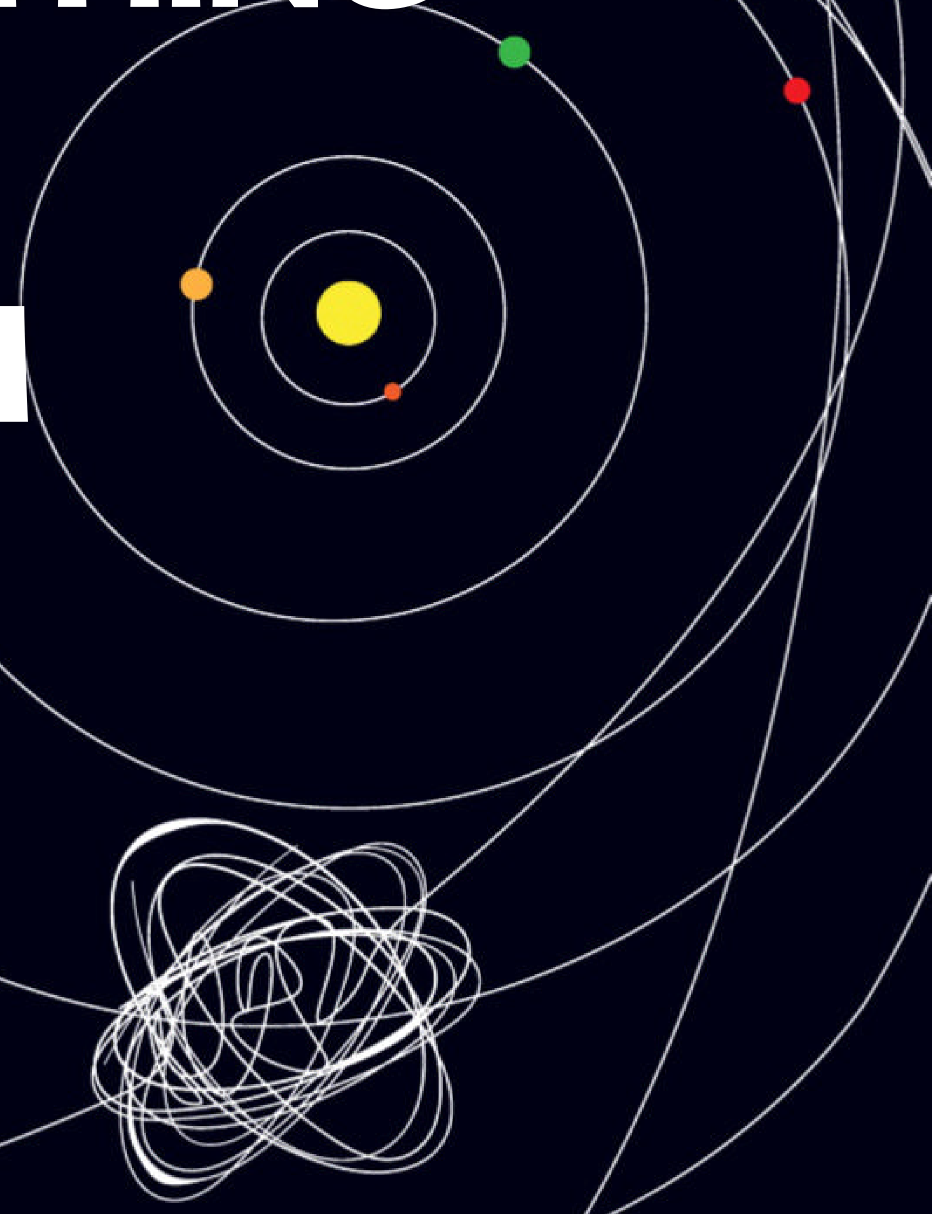

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Astronomy

Heat pipes helped shrink Mercury

Magma travelling from the planet's core to its surface led to cooling

Leah Crane

MERCURY is a mysterious little world. Its surface shows signs that cooling of its core has caused the entire planet to shrink by between about 5 and 10 kilometres in radius – but for that shrinking to occur, heat must have somehow escaped. A series of simulations now show that it may have travelled from Mercury's core through its mantle via heat pipes.

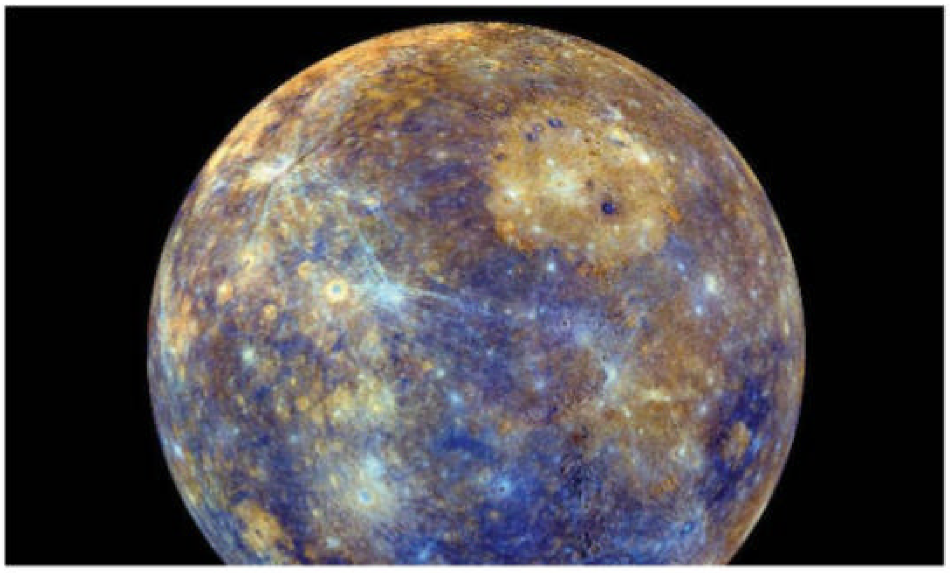
Many of our current models for the early history of Mercury fail to explain all of the features we see now. For example, the stretch marks left behind by the planet's contraction suggest that most of the shrinking happened early on, within the first 500 million years after Mercury formed, before continuing at a slower rate.

Georgia Peterson at the University of British Columbia in Canada and her colleagues analysed images of Mercury's surface sent back from the Messenger and Mariner 10 missions. They ran 2430 simulations of Mercury's evolution – changing parameters including the initial temperatures of the core and mantle and the types of materials making up those layers – to determine how the planet's features may have formed. The work was presented at the virtual Lunar and Planetary Science Conference on 17 March.

"Everything about Mercury is a little bit strange," says Lauren Jozwiak at Johns Hopkins University in Maryland. "There are all these parts that don't quite fit, and this work takes the data and tries to go back and make the models explain it."

Magnetic rocks in the crust show that the planet had a global magnetic field around the same time as it rapidly contracted, but we don't know how that field was sustained. Generally, planetary magnetic fields are formed as molten cores churn, which creates a phenomenon called a magnetic dynamo. Without taking volcanism into account, Mercury's early core wouldn't have churned enough to maintain a magnetic field, said Peterson.

Stretch marks on Mercury's surface suggest it shrank quickly in its early years



NASA/JHU APPLIED PHYSICS LAB/CARNEGIE INST. WASHINGTON

But if magma travelled from the planet's core through its mantle, finally solidifying to form a crust on the surface, that could have stirred up the core. Usually, volcanoes are fuelled by small veins of magma called dykes, but Mercury may have been cooled by melted rock flowing through larger tubes called heat pipes.

"There is so much melt being generated that the inside of the planet streamlines it into a sort of mega dyke, which is really efficient in getting heat out of the interior," says Jozwiak. Peterson's team found that magma flowing to the surface in heat pipes could have cooled down the mantle quickly, explaining why the planet shrank so rapidly in its early years.

The cooling would have created temperature gradients that would enhance the churning in the core. "Early mantle cooling associated with volcanic resurfacing is great for maintaining a dynamo," said Peterson.

Understanding how Mercury's early magnetic field worked could help us explain what keeps its current magnetic field going. ▮

Climate change

Hotter and drier days could make wildfires a big threat in the UK

CLIMATE change is projected to drive a large increase in fire danger across the whole of the UK, leading researchers to warn that planning rules may need to block the building of new homes in fire-prone areas.

Flooding is considered the UK's biggest threat from climate change, but even rare wildfires can cause disruption, from the toxic smoke created by massive recent fires on Saddleworth Moor near Manchester to large blazes in west Scotland and Cornwall last month. A new analysis has found that if the world continues to have high carbon emissions, the number of days with conditions hot and dry enough for serious wildfires in the south of England will climb from 20 a year today to 111 by the 2080s. Even traditionally wet parts of the UK, including Wales, will see big increases in days when fire danger is very high (*Environmental Research Letters*, doi.org/f3nz).

"If we don't think we've got a wildfire hazard at the moment, in a few decades we will have a much more obvious and noticeable one, perhaps to the extent that people are familiar with it in the Mediterranean," says Nigel Arnell at the University of Reading in the UK.

To model the future risk, Arnell and his colleagues divided the UK into 12 by 12-kilometre squares and looked at how temperatures, humidity and rainfall would change in those areas using a climate model developed by the UK's Met Office.

"In a few decades, the UK will have a much more obvious and noticeable wildfire hazard"

The results were then combined with a weather index of how serious fires could be if they broke out. The main reason for greater fire danger was higher temperatures, followed by humidity decreasing.

Thomas Smith at the London School of Economics says one important caveat is that the indicators of fire danger in the UK are still poorly understood. Those in the study are based on indicators developed for Canadian wildfires in large forests, not the heathlands and moorlands that tend to burn in the UK. ▮

Adam Vaughan