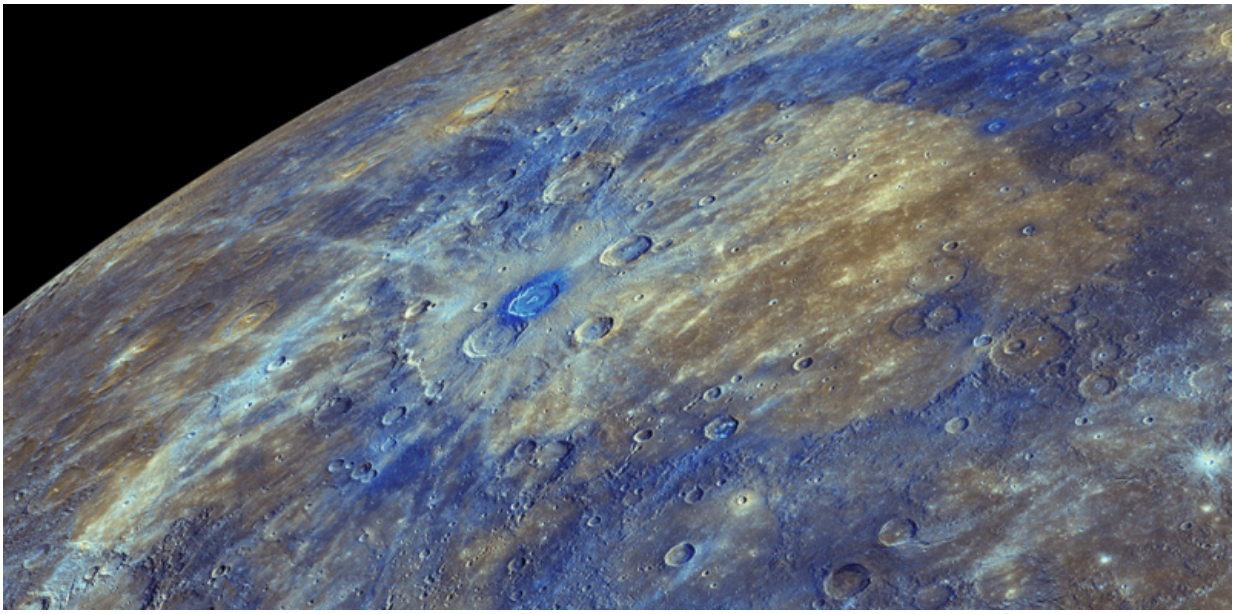
Discovery of carbon on Mercury reveals the planet's dark past

March 9 2016, by Ivy Shih



This enhanced colour image shows the traces of carbon on the surface, coloured here in blue. Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington

Mercury has been found to have a dark side with graphite, a crystalline form of carbon commonly found in pencils, being the source of the mysterious dark colouration of the planet's surface.

The study, published this week in *Nature Geoscience*, was led by a team

from the Johns Hopkins University Applied Physics Laboratory in the US, which analysed measurements collected by NASA's Messenger spacecraft as it went through its final orbits of Mercury.

The findings not only test theories of early planetary formation but may offer an explanation of the amount of carbon here on Earth.

Remains of a primordial crust

The surface colour of planetary bodies is often an indicator of the elements that make them up. For example, the distinctive rusty red appearance of Mars can be attributed to iron oxide.

It had previously been believed that the iron and titanium were typically responsible for the dark coloration on planetary surfaces. However, Mercury is quite dark, but lacked high enough concentrations of those elements to account for its colour.

"Mercury's surface was significantly darker than we could account for on the basis of our understanding of Mercury's surface chemistry," said Dr Patrick Peplowski, from the Johns Hopkins University Applied Physics Laboratory, and lead author on the study.

"So what was causing Mercury to be so dark?"

By carefully examining data sent back to Earth by the Messenger probe, the team found that the dark colouration was due to the presence of carbon, with Mercury having high levels than any other planets or their moons.

The discovery of carbon on Mercury was an unexpected one, so much so that none of the instruments on Messenger were designed to detect the element. Instead, Peplowski and his colleagues had to use multiple

instruments to identify the carbon.

Need for continued planetary exploration

The discovery gives weight to a theory on how Mercury was formed. The carbon-rich material was detected underneath younger volcanic materials that make up Mercury's present day surface. This suggests that early Mercury's original carbon-rich crust may have been formed from graphite that floated to the top of a global magma ocean.

These primordial "floating crusts" provide a rare perspective on early planetary formation.

"This is interesting because the original crusts of the other planets were destroyed long ago by processes like volcanic resurfacing, plate tectonics and erosion," Peplowski told The Conversation.

"The carbon we see today may be the remains of that ancient, 4.5 billion-year-old crust."

However, there are still questions as to how the planetary crust was originally formed and why carbon was found around some craters and not others.

"There is a lot of follow-on work to be done," said Peplowski. "Future missions to Mercury might benefit from instrumentation specifically designed to map carbon in order to follow up on this result."

The next planetary exploration of Mercury could provide further answers, with the European Space Agency launching the BepiColumbo probe to Mercury next year.

"It has an entirely new suite of instruments that can add to our

understanding of carbon on Mercury."

Planetary puzzles

Dr Helen Maynard-Casely, an Instrument Scientist from the Australian Nuclear Science and Technology Organisation, who was not involved in the study, said the study sheds light on some longstanding mysteries in planetary science.

She added that the theory they study suggests that how Mercury evolved shares many similarities to the early formation of the Moon.

"The early crust of the Moon was made of lighter minerals. It is thought these were stripped off the Earth. In terms of planetary formation, these minerals are like froth on a coffee. Then, as the surface of the Moon has evolved, impacts and lava flows have brought the darker material onto the faces of the Moon," she said.

"What they're seeing is that this darker material on Mercury is the remnants of the early frothy material. Graphite is light compared to the other materials on Mercury. They suggest this rose to the top at the very beginning of the planet's formation creating the first crust of Mercury as it was cooling down."

But throughout the life of Mercury in the solar system, repeated impacts had churned up the crust, leaving very little of the early surface intact.

Maynard-Casely says that the discovery came as a surprise and may change our view on the how the solar system was formed, and the current model of predicting the presence of carbon, including here on Earth.

"Carbon's been a very tricky element to pin down, even on Earth, and it

is a puzzle to discover what has happened to our carbon. There's a thought now that a lot of the carbon on Earth is trapped further down within the interior and that we are missing a lot of minerals. There is currently a bit of a worldwide hunt for these," she said.

"The knowledge of carbon's significance on Mercury would bring those questions back to the forefront and reinvigorate discussions."

This article was originally published on The Conversation. *Read the* original article.

Source: The Conversation

Citation: Discovery of carbon on Mercury reveals the planet's dark past (2016, March 9) retrieved 24 April 2024 from
https://phys.org/news/2016-03-discovery-carbon-mercury-reveals-planet.html