New study finds water deeper in Earth than scientists previously believed

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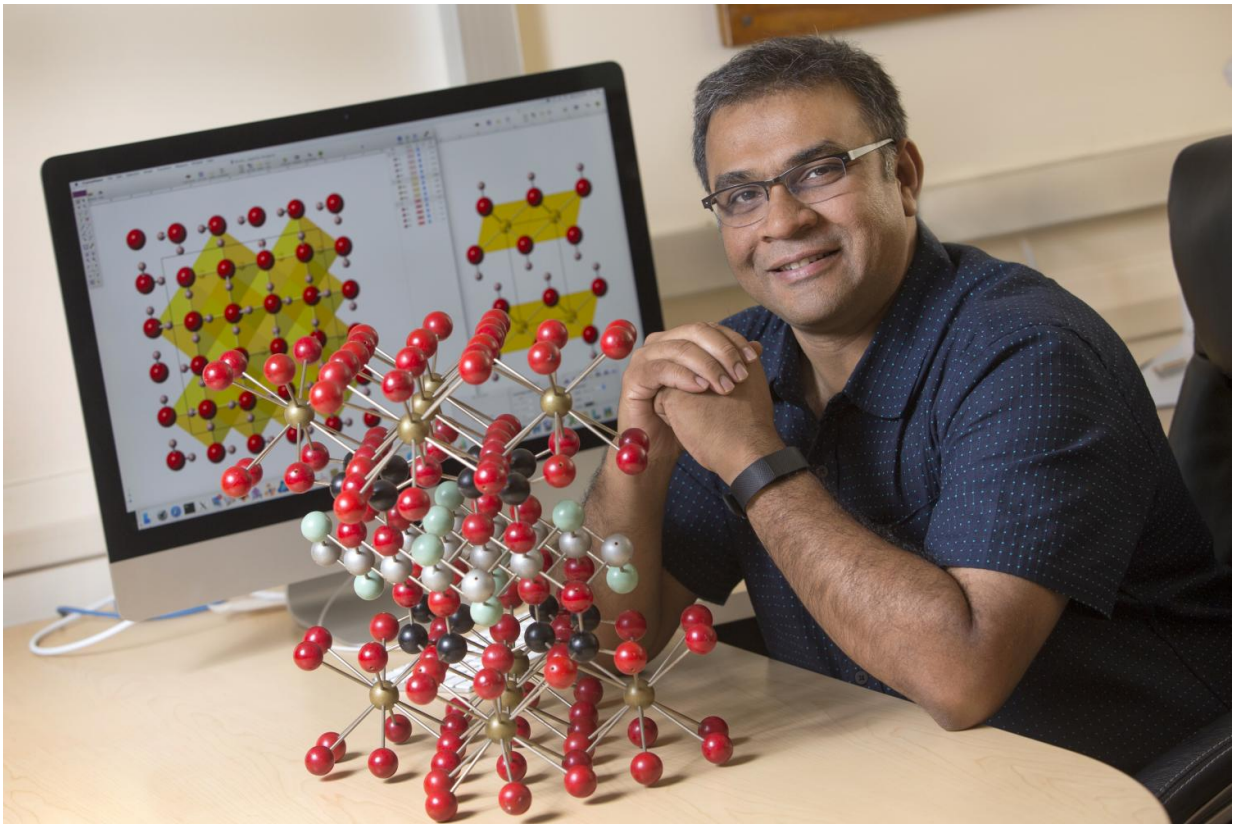

FSU Assistant Professor of Geology Mainak Mookherjee reports that water exists far deeper in the Earth than scientists previously thought. Credit: Bruce Palmer/Florida State University

A mineral far below the Earth's surface may hold the key to how much

water is stored in the planet, a Florida State University researcher says.

In a paper published this week in the *Proceedings of the National Academy of Sciences*, FSU Assistant Professor of Geology Mainak Mookherjee reports that water exists far deeper in the Earth than scientists previously thought.

Mookherjee and Andreas Hermann from the University of Edinburgh estimate that in the deep Earth—roughly 400 to 600 kilometers into the mantle—water is stored and transported through a high-pressure polymorph of the mineral brucite.

Previously, scientists thought brucite was not thermodynamically stable that deep in the Earth. "This opens up a Pandora's Box for us," Mookherjee said.

"We didn't think water could be stored by hydrous minerals such as brucite. But now that we know it's there, we need to figure out how much water could be effectively stored inside it."

Based on high-pressure experimental studies, scientists knew minerals that transported water—such as brucite—had limited stability and that these minerals decomposed in the deep Earth. As they decomposed, they released the water, which is recycled back to surface via volcanic activity.

But this discovery of a new high-pressure phase of brucite indicates that water could be efficiently transported to far deeper realms without decomposition.

"We had to do quantum-mechanical calculations on thousands of potential structures until we found the one we now reported," Hermann said. "It really is remarkable that such a well-studied mineral as brucite

has something so surprising to offer."

Water plays a critical role in sustaining geological activity below the Earth's surface. Scientists have been working for years to quantify the oceans' worth of water that lay hidden in the crust and mantle.

"For the activity of the planet, deep Earth water is equally important to water on the surface," Mookherjee said. "My goal is to understand how much water is stored in the deep Earth. If the planet becomes dry on the inside, the planet dies because geodynamic activity within the planet ceases."

Mookherjee said he and Hermann plan to follow up on this paper with additional simulations to better understand the physical properties of brucite at that depth and try to decipher the amount of water that is potentially stored in the deep Earth along the cold-subduction zones.

More information: High-pressure phase of brucite stable at Earth's mantle transition zone and lower mantle conditions, www.pnas.org/cgi/doi/10.1073/pnas.1611571113

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