

## **Researchers shed new light on the origins of Earth's water**

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An aerial photograph showing the most recent eruption at the Holuhraun lava field in Iceland. This eruption was fed directly from the Iceland mantle plume, and a proportion of the gas emitted is thought to be water vapor sourced from this plume. We measured Baffin Island and Icelandic rocks where plume water was trapped inside the rocks, rather than being degassed into the atmosphere. Credit: Magnús Tumi Guðmundsson



Water covers more than two-thirds of Earth's surface, but its exact origins are still something of a mystery. Scientists have long been uncertain whether water was present at the formation of the planet, or if it arrived later, perhaps carried by comets and meteorites.

Now researchers from the University of Hawaii at Manoa, using advanced ion-microprobe instrumentation, have found that rocks from Baffin Island in Canada contain evidence that Earth's <u>water</u> was a part of our planet from the beginning. Their research is published in the 13 November issue of the journal *Science*.

The research team was led by cosmochemist Dr. Lydia Hallis, then a postdoctoral fellow at the UH NASA Astrobiology Institute (UHNAI) and now Marie Curie Research Fellow at the University of Glasgow, Scotland.

The ion microprobe allowed researchers to focus on minute pockets of glass inside these scientifically important rocks, and to detect the tiny amounts of water within. The ratio of hydrogen to deuterium in the water provided them with valuable new clues as to its origins.

Hydrogen has an <u>atomic mass</u> of one, while deuterium, an isotope of hydrogen also known as "heavy hydrogen," has an atomic mass of two. Scientists have discovered that water from different types of planetary bodies in our solar system have distinct hydrogen to deuterium ratios.

Dr. Hallis explained, "The Baffin Island rocks were collected back in 1985, and scientists have had a lot of time to analyze them in the intervening years. As a result of their efforts, we know that they contain a component from Earth's deep mantle.





Scanning electron microscope images showing one of our Baffin Island rock samples. Large olivine mineral grains dominate this rock (mid-gray colored grains in image A). These olivine grains contain trapped pockets of glass, known as melt inclusions (image B), and this glass contains tiny amounts of water sourced from the mantle plume. Credit: Lydia J. Hallis

"On their way to the surface, these rocks were never affected by sedimentary input from crustal rocks, and previous research shows their source region has remained untouched since Earth's formation. Essentially, they are some of the most primitive rocks we've ever found on Earth's surface, and so the water they contain gives us an invaluable insight into Earth's early history and where its water came from.

"We found that the water had very little deuterium, which strongly suggests that it was not carried to Earth after it had formed and cooled. Instead, water molecules were likely carried on the dust that existed in a disk around our Sun before the planets formed. Over time this waterrich dust was slowly drawn together to form our planet.

"Even though a good deal of water would have been lost at the surface



through evaporation in the heat of the formation process, enough survived to form the world's water.



The Cameca 1280 ims ion microprobe, housed at the University of Hawaii, was used to measure the hydrogen composition inside the Baffin Island and Icelandic rock samples. This state-of-the-art instrument is able to analyze the rocks olivine-hosted melt inclusions, which have a diameter less than a 10th the size of a human hair. Credit: Gary R. Huss.

"It's an exciting discovery, and one which we simply didn't have the technology to make just a few years ago. We're looking forward to further research in this area in the future."



The paper is entitled "Evidence for primordial water in Earth's deep mantle." UH co-authors are Dr. Gary Huss, Dr. Kazuhide Nagashima, Prof. G. Jeffrey Taylor, Prof. Mike Mottl, and Dr. Karen Meech.

**More information:** "Evidence for primordial water in Earth's deep mantle," by L.J. Hallis et al. <u>www.sciencemag.org/lookup/doi/...</u> <u>1126/science.aac4834</u>

Provided by University of Hawaii at Manoa

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