

# Study opens new questions on how the atmosphere and oceans formed

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Dr. Mark Kendrick is shown with a sample of volcanic glass. Credit: Stuart Hay, ANU

A new study led by The Australian National University (ANU) has found seawater cycles throughout the Earth's interior down to 2,900km, much

deeper than previously thought, reopening questions about how the atmosphere and oceans formed.

A popular theory is that the atmosphere and oceans formed by releasing water and gases from the Earth's [mantle](#) through [volcanic activity](#) during the planet's first 100 million years.

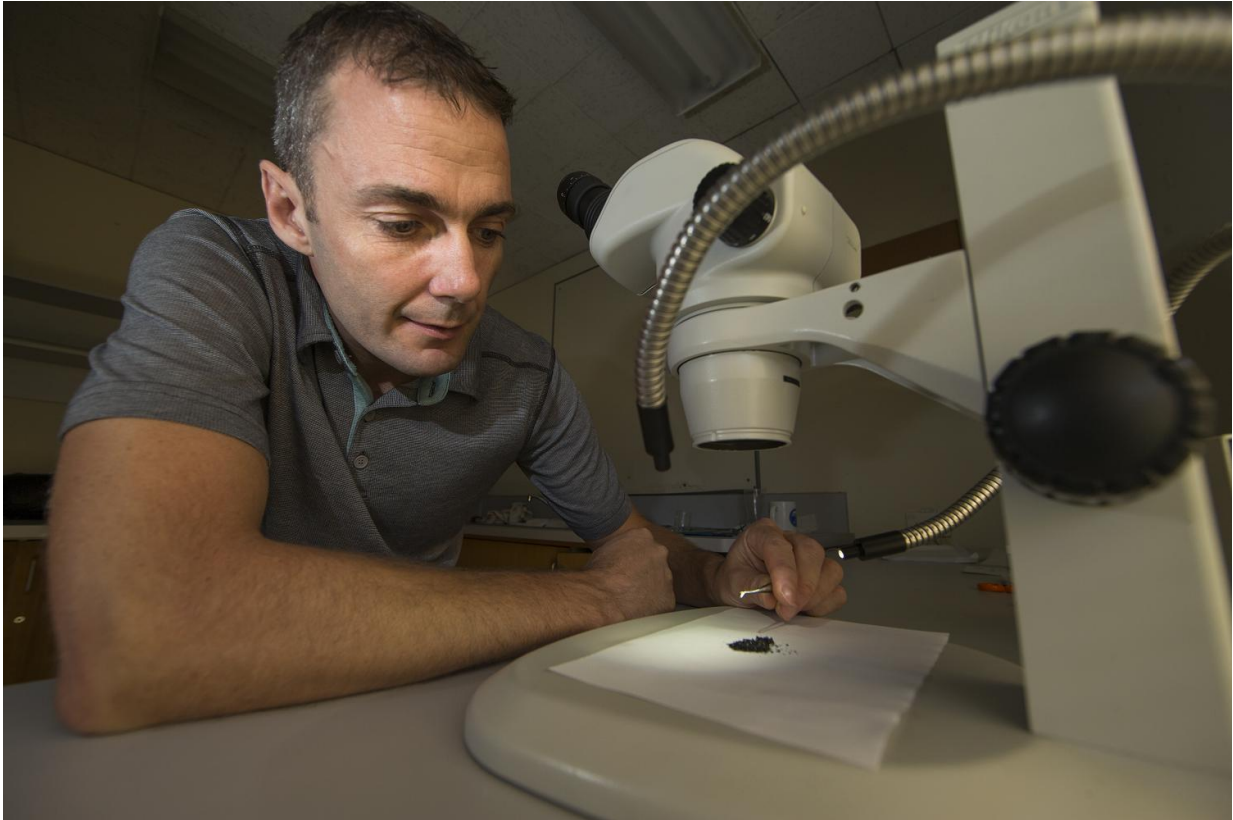
But lead researcher Dr Mark Kendrick from ANU said the new study provided evidence to question this theory.

"Our findings make alternative theories for the origin of the atmosphere and oceans equally plausible, such as icy comets or meteorites bringing water to the Earth," said Dr Kendrick from the ANU Research School of Earth Sciences.

Seawater is introduced into the Earth's interior when two tectonic plates converge and one plate is pushed underneath the other into the mantle.

The study has overturned the notion that seawater only makes it about 100km into the mantle before it is returned to the Earth's surface through volcanic arcs, such as those forming the Pacific Ring of Fire that runs through the western America's, Japan and Tonga.

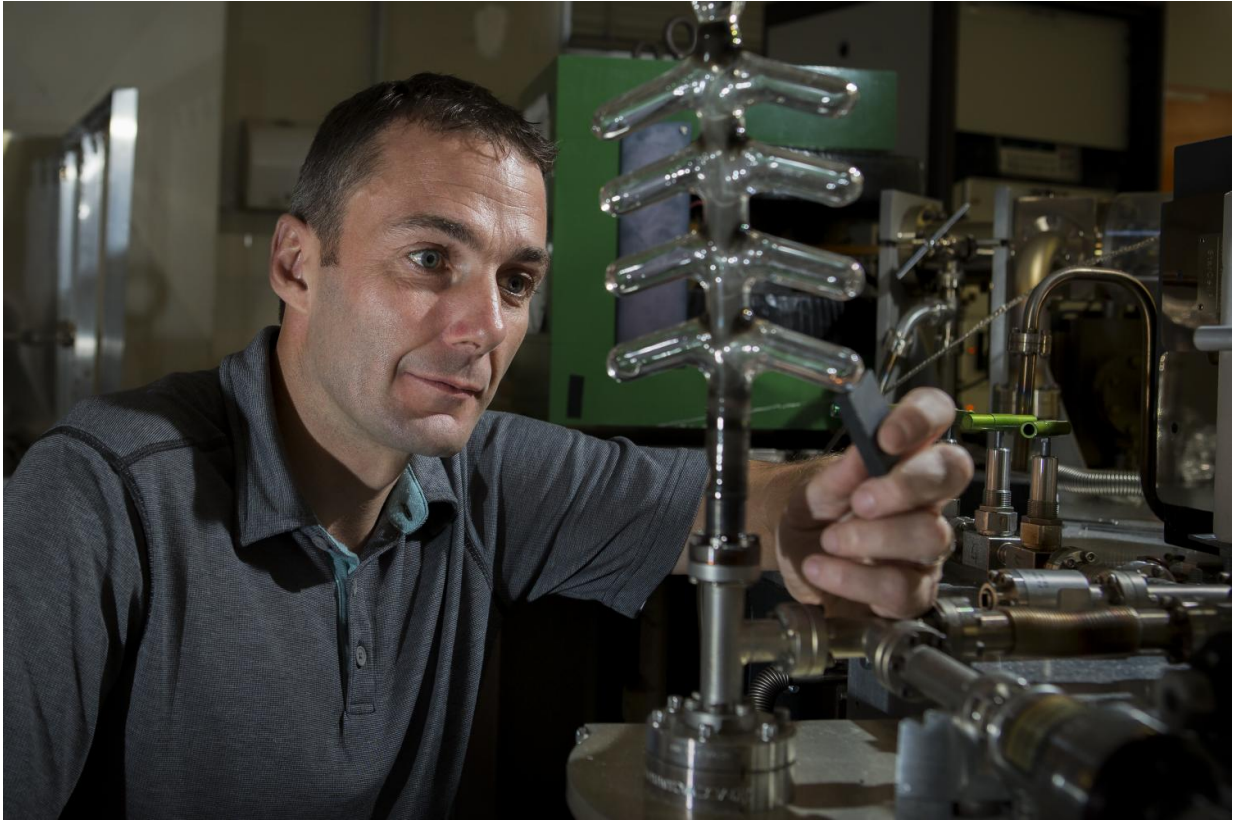
The team analysed samples of [volcanic glass](#) from the Atlantic, Pacific and Indian oceans that contained traces of seawater that had been deeply cycled throughout Earth's interior.



Dr. Mark Kendrick analyses a sample of volcanic glass. Credit: Stuart Hay, ANU

"The combination of water and halogens found in the volcanic glasses enables us to preclude local seawater contamination and conclusively prove the water in the samples was derived from the mantle," Dr Kendrick said.

The study is published in *Nature Geoscience*.



Dr. Mark Kendrick is in a laboratory at the ANU Research School of Earth Sciences. Credit: Stuart Hay, ANU

**More information:** Seawater cycled throughout Earth's mantle in partially serpentinitised lithosphere, *Nature Geoscience*, [nature.com/articles/doi:10.1038/ngeo2902](https://nature.com/articles/doi:10.1038/ngeo2902)

Provided by Australian National University

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