Salty water and gas sucked into Earth interior helps unravel planetary evolution

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An international team of scientists has provided new insights into the processes behind the evolution of the planet by demonstrating how salty water and gases transfer from the atmosphere into the Earth's interior.

The paper was published in *Nature Geoscience* today.

Scientists have long argued about how the Earth evolved from a primitive state in which it was covered by an ocean of molten rock, into the planet we live on today with a solid crust made of moving tectonic plates, oceans and an atmosphere.

Lead author Dr Mark Kendrick from the University of Melbourne's School of Earth Sciences said inert gases trapped inside the Earth's interior provide important clues into the processes responsible for the birth of our planet and the subsequent evolution of its oceans and atmosphere.
"Our findings throw into uncertainty a recent conclusion that gases throughout the Earth were solely delivered by meteorites crashing into the planet," he said.

The study shows atmospheric gases are mixed into the mantle, inside the Earth's interior, during the process called 'subduction', when tectonic plates collide and submerge beneath volcanoes in subduction zones.

"This finding is important because it was previously believed that inert gases inside the Earth had primordial origins and were trapped during

the formation of the solar system," Dr Kendrick said.

Because the composition of neon in the Earth's mantle is very similar to that in meteorites, it was recently suggested by scientists that most of the Earth's gases were delivered by meteorites during a late meteorite bombardment that also generated visible craters on the Earth's moon. "Our study suggests a more complex history in which gases were also dissolved into the Earth while it was still covered by a molten layer, during the birth of the solar system," he said.

It was previously assumed that gases could not sink with plates in tectonic subduction zones but escaped during eruption of overlying volcanoes.

"The new study shows this is not entirely true and the gases released from Earth's interior have not faithfully preserved the fingerprint of solar system formation."

To undergo the study researchers collected serpentinite rocks from mountain belts in Italy and Spain. These rocks originally formed on the seafloor and were partially subducted into the Earth's interior before they were uplifted into their present positions by collision of the European and African plates.

"The serpentinite rocks are special because they trap large amounts of seawater in their crystal structure and can be transported to great depths in the Earth's mantle by subduction," he said.

By analysing the inert gases and halogens trapped in these rocks, the team was able to show gases are incompletely removed by the mineral transformations that affect serpentinites during the subduction process and hence provide new insights into the role of these trapped gases in the evolution of the planet.

Provided by University of Melbourne