

Hunt for water intensifies—on two planets

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(Phys.org) —Scientists are using a promising new theory to track down hidden water both on Earth – where fresh water is becoming dangerously scarce in some regions – and in the quest for life on the red planet, Mars.

The latest Earth-based groundwater theories may aid mankind in its quest for [water](#) on other planets, says Professor Craig Simmons of the National Centre for Groundwater Research and Training (NCGRT) and Flinders University.

Prof. Simmons and his colleagues have been working on a theory that groundwater flows faster when it contains salt, heat, radioactive waste or contaminated liquids from landfills – all of which increase the water's density and hence the speed it travels downwards.

"When a heavier groundwater layer sits on top of a layer of clean fresh water, it will sink because of gravity," says Prof. Simmons. "Similarly, warmer water that's less dense than cold water rises to the top. This rapid mixing caused by varying water densities appears to drive groundwater much faster than previously thought."

Prof. Simmons says density effects can be seen when seawater intrudes into coastal aquifers, when polluted water escapes from landfills, when [radioactive waste](#) leaches out of underground repositories, in geothermal energy production and deep carbon storage, and in the movement of groundwater underneath salt lakes.

"These density-driven groundwater flows can be found around the

world," he says. "They're fundamental to many areas of hydrogeology, and are critical for scientists' understanding and prediction of the occurrence, distribution, movement and quality of groundwater on Earth.

"For instance, we can model where and how fast contaminated or saline water will travel, and so try to prevent it from polluting nearby fresh aquifers which people rely on for drinking or domestic use. This is vital to securing the Earth's [fresh water](#) supplies, especially in heavily populated regions like China, India, the Middle-East and North America where they are already greatly stressed."

In a recent study, US scientists applied the theory to the freezing and thawing of salt water on the Martian surface, using it to explain some of the water phenomena that Mars rovers are now seeing on the Red Planet.

"The search for water on Mars is part of the search for life, which requires water to survive," Prof. Simmons says. "Various studies as well as spacecraft and satellite observations hint that water exists beneath Mars's icy crust, and in this latest study, the scientists have found evidence of water – in the form of ice and brine – at its equator.

"As the subsurface temperatures of the Red Planet are above the melting point of water, water exists as liquid beneath the ground. The scientists speculate that this warm water travels up from the depths of Mars to the surface, bringing salt with it as it rises. It then freezes due to the extreme cold."

"This density-driven groundwater flow is critical on Earth, so it's fascinating to see the theory being applied on Mars," Prof. Simmons says. "It shows that the flow is more important than we thought – even on other planets – and improves our knowledge on how [groundwater](#) behaves. It's very exciting indeed!"

The study of ice and brines on Mars "A mechanism for bringing ice and brines to the near surface of Mars" by Bryan J. Travis, William C. Feldman and Sylvestre Maurice was published in *Journal of Geophysical research*.

More information: Travis, B. J., W. C. Feldman, and S. Maurice (2013), A mechanism for bringing ice and brines to the near surface of Mars, *J. Geophys. Res. Planets*, 118, 877–890, [DOI: 10.1002/jgre.20074](https://doi.org/10.1002/jgre.20074).

Provided by Flinders University

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