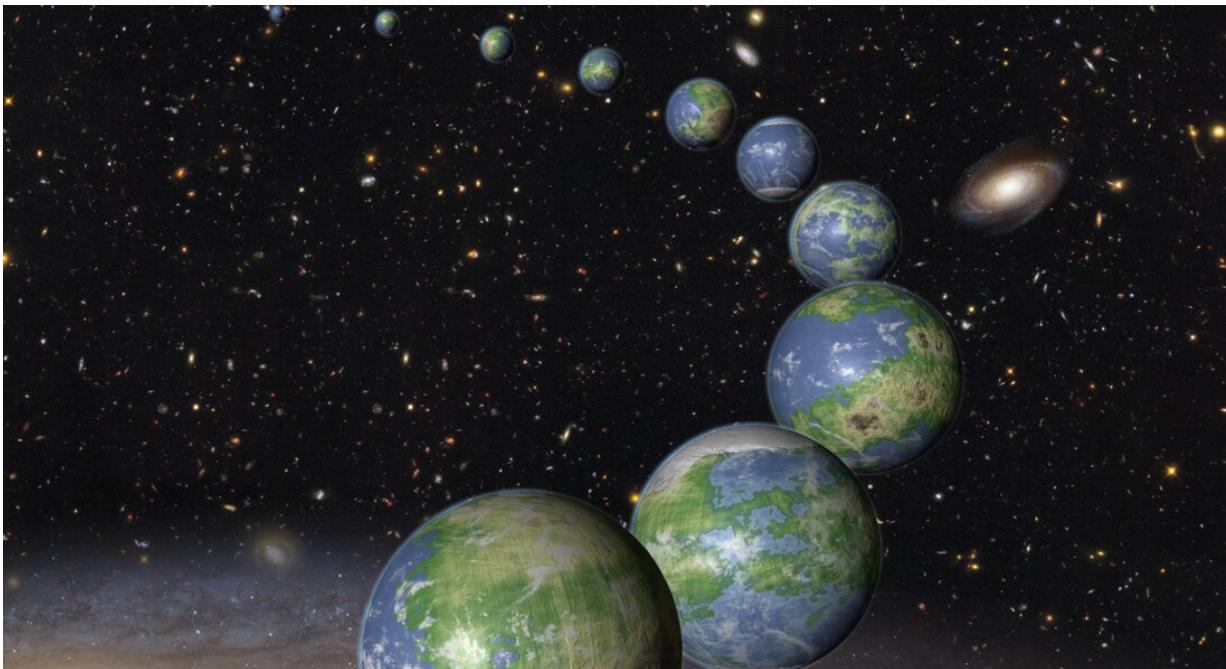


The Milky Way may be swarming with planets with oceans and continents like here on Earth

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Credit: NASA, ESA and G. Bacon (STScI).

Astronomers have long been looking into the vast universe in hopes of discovering alien civilisations. But for a planet to have life, liquid water must be present. The likelihood of that scenario has seemed impossible to calculate because it has been the assumption that planets like Earth got their water by chance when a large ice asteroid hit the planet.

Now, researchers from the GLOBE Institute at the University of Copenhagen have published an eye-opening study, indicating that [water](#) may be present during the very formation of a planet. According to the study's calculations, this is true for both Earth, Venus and Mars.

"All our data suggest that water was part of Earth's building blocks, right from the beginning. And because the water molecule is frequently occurring, there is a reasonable probability that it applies to all [planets](#) in the Milky Way. The decisive point for whether [liquid water](#) is present is the distance of the planet from its star," says Professor Anders Johansen from the Centre for Star and Planet Formation who has led the study that is published in the journal *Science Advances*.

Using a computer model, Anders Johansen and his team have calculated how quickly planets are formed, and from which building blocks. The study indicates that it was millimeter-sized dust particles of ice and carbon—which are known to orbit around all [young stars](#) in the Milky Way—that 4.5 billion years ago accreted in the formation of what would later become Earth.

"Up to the point where Earth had grown to one percent of its current mass, our planet grew by capturing masses of pebbles filled with ice and carbon. Earth then grew faster and faster until, after five million years, it became as large as we know it today. Along the way, the temperature on the surface rose sharply, causing the ice in the pebbles to evaporate on the way down to the surface so that, today, only 0.1 percent of the planet is made up of water, even though 70 percent of Earth's surface is covered by water," says Anders Johansen, who together with his research team in Lund ten years ago put forward the theory that the new study now confirms.

The theory, called 'pebble accretion,' is that planets are formed by pebbles that clump together, and that the planets then grow larger and

larger.

Anders Johansen explains that the water molecule H_2O is found everywhere in our galaxy, and that the theory therefore opens up the possibility that other planets may have been formed in the same way as Earth, Mars and Venus.

"All planets in the Milky Way may be formed by the same building blocks, meaning that planets with the same amount of water and carbon as Earth—and thus potential places where life may be present—occur frequently around other stars in our galaxy, provided the temperature is right," he says.

If planets in our galaxy had the same [building blocks](#) and the same temperature conditions as Earth, there will also be good chances that they may have about the same amount of water and continents as our planet.

Professor Martin Bizzarro, co-author of the study, says:

"With our model, all planets get the same amount of water, and this suggests that other planets may have not just the same amount of water and oceans, but also the same amount of continents as here on Earth. It provides good opportunities for the emergence of life," he says.

If, on the other hand, it was random how much water was present on planets, the planets might look vastly different. Some planets would be too dry to develop life, while others would be completely covered by water.

"A planet covered by water would of course be good for maritime beings, but would offer less than ideal conditions for the formation of civilisations that can observe the universe," says Anders Johansen.

Anders Johansen and his research team are looking forward to the next generation of space telescopes, which will offer far better opportunities to observe exoplanets orbiting a star other than the Sun.

"The new telescopes are powerful. They use spectroscopy, which means that by observing which type of light is being blocked from the planets' orbit around their star, you can see how much water vapor there is. It can tell us something about the number of oceans on that planet," he says.

More information: Anders Johansen et al, A pebble accretion model for the formation of the terrestrial planets in the Solar System, *Science Advances* (2021). [DOI: 10.1126/sciadv.abc0444](https://doi.org/10.1126/sciadv.abc0444)

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