

WHAT IS THE EVIDENCE THAT EARTH FORMED INSIDE A SOLAR NEBULA?

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Helium-3 is made in solar nebulae — massive, spinning clouds of gas and dust like the one that gave rise to our Solar System.

Helium-3 has been measured at Earth's surface in relatively small quantities. But scientists did not know how much was leaking from the Earth's core, as opposed to its middle layers, called the mantle.

The new study (*Geochemistry, Geophysics, Geosystems*) pins down the core as a major source of helium-3 for the Earth. Some natural processes can generate helium-3, such as the radioactive decay of tritium, but helium-3 is made primarily in solar nebulae — massive, spinning clouds of gas and dust like the one that gave rise to our Solar System. Because helium is one of the earliest elements produced in the universe, most helium-3 can be traced back to the Big Bang.

As a planet grows, it accumulates material from its surroundings, so its composition reflects the environment in which it formed. To get high concentrations of helium-3 deep in the core, Earth would have had to form inside a thriving solar nebula, not on its fringes or during its waning phase.

The new research adds further clues to the mystery surrounding Earth's formation, lending additional evidence to the theory that our planet formed inside the solar nebula.

About 2,000 grams of helium-3 leak out of the Earth every year. Using the modern helium-3 leak rate along with models of helium isotope behavior, the researchers estimated there are between 10 teragrams (10¹³ grams) to a petagram (10¹⁵ grams) of helium-3 in the core — a vast quantity that points to Earth's formation inside the solar nebula, where high concentrations of the gas would have allowed it to build up deep in the planet.

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