

# Pre-life molecules present in comets

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Evidence of atomic nitrogen in interstellar gas clouds suggests that pre-life molecules may be present in comets, a discovery that gives a clue about the early conditions that gave rise to life, according to researchers from the University of Michigan and the Harvard-Smithsonian Center for Astrophysics.

The finding also substantially changes the understanding of chemistry in space.

The question of why molecular nitrogen hasn't been detected in comets and meteorites has puzzled scientists for years. Because comets are born in the cold, dark, outer reaches of the solar system they are believed to be the least chemically altered during the formation of the Sun and its planets.

Studies of comets are thought to provide a "fossil" record of the conditions that existed within the gas cloud that collapsed to form the solar system a little more than 4.6 billion years ago. In this cloud, since nitrogen was thought to be in molecular form, and it follows that comets should contain molecular nitrogen as well.

But the reason it isn't there is because it isn't present in the gas clouds whose microscopic solid particles eventually form comets, said S bastien Maret, research fellow in astronomy at the University of Michigan, and Edwin Bergin, a professor of astronomy at the University of Michigan. Those clouds contain mostly atomic nitrogen, not molecular nitrogen, as previously thought.

Maret, Bergin, and collaborators from Harvard-Smithsonian Center for Astrophysics will publish their findings in the July 27 issue of the journal *Nature*.

The nitrogen bearing molecules in comets that crashed into Earth millions of years ago may have provided a sort of "pre-biotic jump start" to form the complex molecules that eventually led to life here, Bergin said.

"A lot of complex and simple biotic molecules have nitrogen and it's much easier to make complex molecules from atomic nitrogen," Bergin said. "All DNA bases have atomic nitrogen in them, amino acids also have atomic nitrogen in them. By that statement what we're saying is if you have nitrogen in its simplest form, the atomic form, it's much more reactive and can more easily form complex prebiotic organics in space". These complex organics were incorporated into comets and were provided to the Earth.

"What we're seeing in space is telling us something about how you make molecules that led to us," Bergin said.

Also of importance is the fact that odd anomalies in isotopic values in meteorites can also be explained if the nitrogen is not molecular, Bergin said.

Source: University of Michigan

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