Meteorites may have delivered first ammonia for life on earth: new study

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A Renazzo stony meteorite. Credit: NASA

Researchers have teased ammonia of a carbon-containing meteorite from Antarctica, and propose that meteorites may have delivered that essential ingredient for life to an early Earth.

The results appear today in the Proceedings of the National Academy of Sciences, and add to a growing body of evidence that meteorites may have played a key role in the development of life here. The NASA graphic at left was released just last month, when researchers reported that meteorites may have also delivered Earth's first left-hand amino acids.

Lead author Sandra Pizzarello, of Arizona State University, and her colleagues note in the new paper that carbonaceous chondrites are asteroidal meteorites known to contain abundant organic materials.

“Given that meteorites and comets have reached the Earth since it formed, it has been proposed that the exogenous influx from these bodies provided the organic inventories necessary for the emergence of life,” they write.

The carbonaceous meteorites of the Renazzo-type family (CR) are known to be especially rich in small soluble organic molecules, such as the amino acids glycine and alanine. To test for the presence of ammonia, the researchers collected powder from the much-studied CR2 Grave Nunataks (GRA) 95229 meteorite and treated it with water at high temperature and pressure. They found that the treated powders emitted ammonia, NH4, an important precursor to complex biological molecules such as amino acids and DNA, into the surrounding water.

Next, the researchers analyzed the nitrogen atoms within the ammonia and determined that the atomic isotope did not match those currently found on Earth, eliminating the possibility that the ammonia resulted from contamination during the experiment. Researchers have struggled to pinpoint the origin of the ammonia responsible for triggering the formation of the first biomolecules on early Earth. The authors suggest that now, they may have found it.

“The findings appear to trace CR2 meteorites’ origin to cosmochemical regimes where ammonia was pervasive, and we speculate that their delivery to the early Earth could have fostered prebiotic molecular evolution,” they write.

More information: Pizzarello et al., Abundant ammonia in primitive asteroids and the case for a possible exobiology. DOI:

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