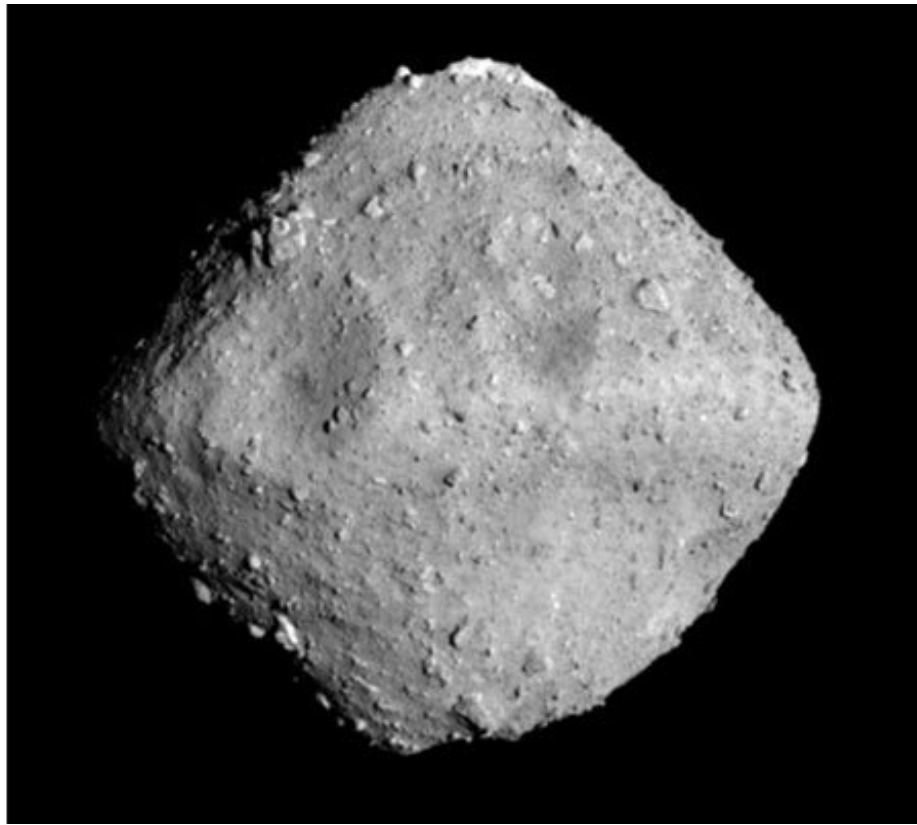


Meteorite amino acids derived from substrates more widely available in the early solar system

April 29 2021



Asteroid Ryugu. Credit: JAXA

Scientists have recreated the reaction by which carbon isotopes made their way into different organic compounds, challenging the notion that

organic compounds, such as amino acids, were formed by isotopically enriched substrates. Their discovery suggests that the building blocks of life in meteorites were derived from widely available substrates in the early solar system.

Their findings were published online in *Science Advances* on April 28, 2021.

Carbonaceous meteorites contain the building blocks of life, including amino acids, sugars, and nucleobases. These meteorites are potential providers of these molecules to the prebiotic Earth.

The [small organic molecules](#) found in meteorites are generally enriched in a heavy carbon isotope (^{13}C). However, the most abundant organic matter in meteorites is depleted in ^{13}C . Such a difference has long since puzzled scientists. It has been thought the [small molecules](#) came from ^{13}C enriched substances found in the extremely cold outer solar system and/or the solar nebula.

However, a team of researchers from Tohoku University and Hokkaido University has presented a new hypothesis. They argue that the formose-type reactions, the formation of sugar from formaldehyde, create sizeable differences in the ^{13}C concentration between small and large organic molecules.

Recreating the formose-type reaction in the lab, the researchers found that the carbon isotope components of meteorite organics are created by the formose-type reaction even in a hot aqueous solution.



Murchison Meteorite. Credit: Yoshihiro Furukawa

Their findings suggest that the [organic compounds](#) were formed without the use of isotopically enriched substrates from the outer solar system; rather, their formation may have taken place using substrates commonly present in the early solar system.

"The discrepancy in carbon [isotopic composition](#) between the small organic compounds and large insoluble organic matter is one of the most mysterious characteristics of meteorite organic compounds," said Tohoku University's Yoshihiro Furukawa, lead-author of the study. "However, the behavior of ^{13}C in this reaction solves the puzzle completely."

"Even though the compounds were synthesized 4.6 billion years ago, the isotope compositions tell us the process of synthetic reaction," added co-author Yoshito Chikaraishi, from Hokkaido University.

Looking ahead, the research group is planning to investigate the impact of the formose-type reaction in nitrogen and carbon isotope characteristics in a number of [meteorite](#) organics and carbonates.

More information: Yoshihiro Furukawa et al, Synthesis of ^{13}C -enriched amino acids with ^{13}C -depleted insoluble organic matter in a formose-type reaction in the early solar system, *Science Advances* (2021). [DOI: 10.1126/sciadv.abd3575](https://doi.org/10.1126/sciadv.abd3575)

Provided by Tohoku University

Citation: Meteorite amino acids derived from substrates more widely available in the early solar system (2021, April 29) retrieved 26 April 2024 from <https://phys.org/news/2021-04-meteorite-amino-acids-derived-substrates.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.