



Making the Building Blocks of Life: Chemical Connections Between Comets and Meteors

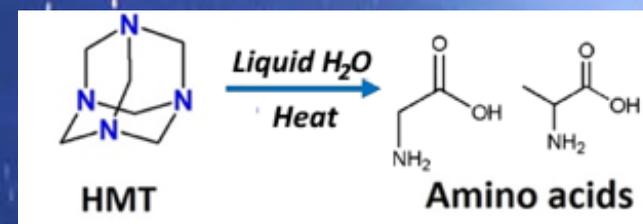
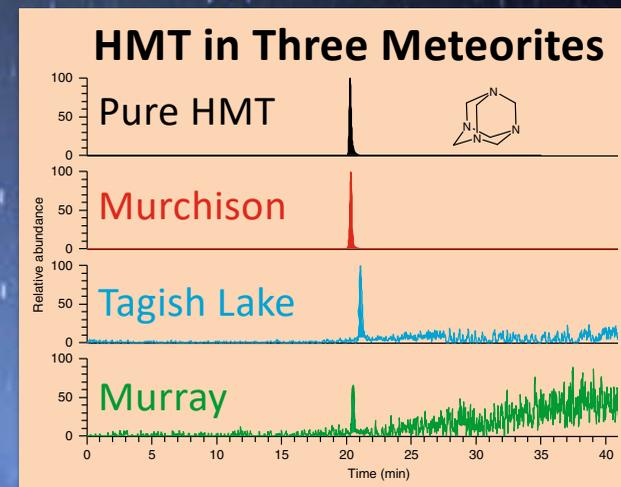


Is there a connection between the chemistry of meteorites and ice in comets? Is it possible that chemicals formed in the rarified, cold tails of comets can form more complex molecules once they arrive on an asteroid?

We developed a new extraction and analytical method for the identification of the fragile organic molecule hexamethylenetetramine (HMT) and its derivatives in carbon-rich meteorites. Using this method, we analyzed three meteorites and confirmed they all contain HMT, the first detection in a meteorite (Oba *et al.*). We also confirmed that HMT will readily form a suite of amino acids under asteroid conditions (Vinogradoff *et al.*).

HMT is a known product of ultra-low temperature ice experiments and is proposed to be present in the tails of comets as a result of ice sublimation. Moreover, HMT can break down into formaldehyde and ammonia, which in turn can form a range of amino acids under meteorite conditions. Amino acids have been seen in meteorites and the simplest, glycine, has been found in comets by the NASA Stardust and ESA Rosetta missions. Our work suggests a link between HMT formation in comets and the formation of amino acids in meteorites.

An enduring mystery regarding the origin of life is how biology could have arisen from non-biological chemical processes. This work provides a better understanding how amino acids can form in space.



Y. Oba, Y. Takano, H. Naraoka, Y. Furukawa, D.P. Glavin, J.P. Dworkin, S. Tachibana (2020) "Extraterrestrial hexamethylenetetramine in meteorites—a precursor of prebiotic chemistry in the inner solar system" *Nature Communications*, doi: 10.1038/s41467-020-20038-x.

V. Vinogradoff, L. Remusat, H.L. McLain, J.C. Aponte, S. Bernard, G. Danger, J.P. Dworkin, J.E. Elsila, M. Jaber (2020) "Impact of Phyllosilicates on Amino Acid Formation under Asteroidal Conditions" *ACS Earth and Space Chemistry* 10.1021/acsearthspacechem.0c00137