Enigmatic Isovaline: Investigating the Stability, Racemization, and Formation of a Non-Biological Meteoritic Amino Acid

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Among the Murchison (CM) meteoritic amino acids, isovaline stands out as being non-biological (nonprotein) and having a high abundance. While equal amounts of D- and L-isovaline have been reported in CM meteorites, the molecule's structure appears to prohibit its racemization in aqueous solutions, but yet to argue for a synthesis by the oft-studied Strecker reaction.

Recently we have investigated the low-temperature solid-phase chemistry of isovaline with an eye toward the molecule's formation, its stability, and the interconversion of its D- and L-enantiomers. Ion-irradiated isovaline-containing ices were examined by IR spectroscopy and highly-sensitive LC/ToF-MS methods to assess both amino acid destruction and racemization. Samples were studied both in the presence and absence of water-ice, and the destruction of isovaline was measured as a function of radiation dose. In addition, we have continued our earlier work on solid-phase amino acid formation, extending it to cover isovaline synthesis. In this presentation we will report the results of these newer investigations. -- This work was supported by a grant to the Goddard Center for Astrobiology through the NASA Astrobiology Institute.