

with a quadrupole mass spectrometer, and non-volatile products were analyzed by HPLC after acid-hydrolysis.

Amino acids such as glycine, alanine and β -alanine were detected in the hydrolysates of the products of UV-irradiation, as well as those of proton-irradiation [1]. Apparent G-value of glycine by UV was 2.7×10^{-5} , which was 3 orders of magnitude smaller than that from a gas mixture of the same components. This difference seems to be mainly contributed to the fact that carbon monoxide might easily escape from the ice mixture during irradiation: When a mixture of methanol, ammonia and water was used, the ice mixture and the gas mixture gave almost the same G-values of glycine.

It is suggested that both UV and cosmic rays can easily form amino acid precursors in ISDs. In space, wider range of UV light, including extreme UV light, are available. It will be of great interest to test the effects of such high-energy UV on the formation and modification of bioorganic compounds by using an exposed facility of the space station.

References

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PHOTOPRODUCTION OF CHIRAL AMINO ACIDS UNDER SIMULATED INTERSTELLAR CONDITIONS

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The interstellar medium ISM is known to be composed of both gas and dust particles. These dust particles are assumed to be made up of silicate grains, surrounded by an ice layer including carbon containing molecules. We simulated interstellar conditions in the laboratory in order to receive information on the interaction between the interstellar gas and interstellar dust particles. H₂O, CO₂, CO, CH₃OH, and NH₃ were deposited at 12 K and a pressure of 10^{-7} mbar onto a solid surface under irradiation of representative interstellar electromagnetic radiation. The ice layer developed on the solid surface was analysed by enantioselective gas chromatography and mass spectrometry GC-MS. In order to exclude contamination processes parallel experiments were performed with ¹³C-containing educts. After the analytical steps of extraction, hydrolysis, and derivatization 16 amino acids were identified in the simulated ice mantle of interstellar dust particles [1]. The

results were confirmed by the ^{13}C -experiments, definitely excluding contaminations. The chiral amino acids were identified as being totally racemic. The obtained results strongly suggest that amino acids had already been formed in the ISM. With the delivery of such precursor molecules through the bombardment of Earth with meteoritic resp. cometary material during the early history of Earth they might have contributed to prebiological reactions forming molecules being of crucial relevance for processes in chemical evolution.

References

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CHIRALITY AND MINERAL ASSOCIATION OF ISOVALINE IN THE MURCHISON METEORITE

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Carbonaceous chondrites have been found to contain non-racemic amino acids and amines (1). The range and locales of formation of this chiral asymmetry have been subject to debate, however, studies conducted so far point to L-enantiomeric excesses (ee) that are limited only to compounds having an alkyl-substituted chiral carbon adjacent to the functional group(s).

Observed ee appear to vary between molecular species, various meteorites, and, for given a compound, even within the same meteorite; this variability extends also to the abundance ratios of asymmetry-carrying to racemic species. For example, meteoritic isovaline has shown ee that vary from 0–15% and ratios to alanine varying from 0.3–7.0.

Ee in meteorites have been attributed to possible photolysis by UV CPL. However, this process is strictly dependent upon the difference between coefficients of absorption for enantiomers in chiral compound, which limits the range of obtainable asymmetry. In view of the low anisotropy factor for amino acids, the CPL model appears inadequate to explain the range of ee observed in meteorites.

A comparative study was undertaken assessing the possible correlation between amino acid molecular and chiral distribution and petrological content in meteorites. Contiguous fragments of a Murchison stone were analyzed and organic analyses of the water extracts were coupled with XRD microscopy of the extracted powders, with focus on the main minerals serpentine and forsterite.

Results so far show a relation between calculated wt% of serpentine, i.e. matrix wt%, and relative abundance of isovaline, the most abundant homologue of the symmetry carrying α -substituted amino acids. The data appear to point to a secondary, possibly catalytic symmetry breaking process in locales of water alteration.