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Chiral molecules in space and their likely passage to planetary bodies as recorded by meteorites

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The findings in carbonaceous meteorites of organic compounds having both a lineage to interstellar environments and identical counterparts in the biosphere have revealed very deep roots for the chemical evolution that preceded life. The most intriguing and debated similarity between these abiotic compounds and terrestrial biomolecules has been the detection in meteorites of several chiral compounds showing enantiomeric excesses of configurations matching those of biomolecules, e.g., L-, for amino acids[1] and D-, for sugars[2]. We searched Murchison meteorite extracts for propylene oxide (PO), the only chiral molecule discovered so far outside solar environments[3], and detected its possible derivative. This compound is also chiral, displays a mass profile and chromatographic separation very similar to those of the oxide and, upon acid hydrolysis, produces propylene glycol (PG), the expected water alteration product of PO. Both PO and PG were detected in Murchison with variable enantiomeric excesses (*ee*) averaging ~ 10% and to have the (R)(+) configuration, i.e., of the same optical isomer as for sugars in the biosphere and sugar derivatives in meteorites. The hydrolysates of meteoritic PO also contained several PG homologous compounds as well as polymeric materials with δD of *+235 and +65* respectively, suggesting the possibility of a yet unknown compositional complexity in meteorites. If the occurrence of *ee* in PO or other interstellar molecules cannot be ascertained with current spectroscopic methodologies, our data would allow to imply it

References:

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