

N 9 2 - 1 3 5 9 5**ISOTOPIC COMPOSITION OF MURCHISON ORGANIC COMPOUNDS:
INTRAMOLECULAR CARBON ISOTOPE FRACTIONATION OF ACETIC
ACID.
SIMULATION STUDIES OF COSMOCHEMICAL ORGANIC SYNTHESSES.**

G. U. Yuen* and J. R. Cronin
Arizona State University,
N. E. Blair
North Carolina State University,
and
D. J. Des Marais and S. Chang
NASA Ames Research Center

During the last 20 years, the organic compounds of the Murchison meteorite and, to a lesser extent, other carbonaceous chondrites have been the object of extensive qualitative and quantitative analyses. These data provide a detailed record of the formation of organic compounds in the early solar system. Recent stable isotope analyses, especially deuterium analyses, suggest that the meteorite organics are closely related to, although not identical to, interstellar organic compounds. The meteorite organics appear to have been derived from interstellar precursors during hydrothermal alteration of the meteorite parent body. Meteorites, as well as comets, may have been essential carriers of organic compounds to planetary bodies in the habitable (liquid water) zone of the solar system. The organic compounds of carbonaceous chondrites seem to provide evidence for a relationship between the massive organic content of interstellar clouds and the organic-rich environment that is presumably necessary for the origin of life on a planetary body. Further characterization of the organic components of these meteorites is essential to understanding organic chemical evolution in the early solar system. Research in progress is aimed at (i) acquisition of additional qualitative and quantitative data concerning meteoritic hydrocarbons, amines, amino acids, amino acid precursors, and carboxylic acids, (ii) determination of the stable isotope content of these compounds, (iii) comparison of isomeric variation and isotopic content in the meteorite compounds with that found in the synthetic products from model processes, and (iv) relating organic compounds to specific mineral phases of the meteorite matrix. These data will further illuminate the origin of meteorite organic compounds and their relationships to interstellar organics and other solar organic matter, for example, that of comets and interplanetary dust particles (IDPs).

Recently, in our laboratories, samples of Murchison acetic acid were decarboxylated successfully and the carbon isotopic composition was measured for the methane released by this procedure. These analyses showed significant differences in $^{13}\text{C}/^{12}\text{C}$ ratios for the methyl and carboxyl carbons of acetic acid molecule - strongly suggesting that more than one carbon source may be involved in the synthesis of the Murchison organic compounds. On the basis of this finding, laboratory model systems simulating cosmochemical synthesis are being studied, especially those processes capable of involving two or more starting carbon sources.