THE CENTRAL IMPORTANCE OF CHONDRITIC ORGANIC MATTER TO UNDERSTANDING THE ORIGIN OF THE SOLAR SYSTEM AND MAYBE EVEN LIFE. C. M. O'D. Alexander, DTM, Carnegie Institution of Washington, Washington, DC 20015, USA.

Studies of organic matter has always been the poor stepchild of meteoritics. However, a recent resurgence of interest has demonstrated that it is an essential element in the puzzle of the origin of the Solar System.

Soluble organic material, especially amino acids and nucleic acids in CI-CM-CRs, have been a particular focus of study given their potential significance for the origin of life, a significance that was enhanced by the discovery of non-chirality in some. At first, it was speculated that this non-chirality was created in the ISM, but now it seems that it is the product of aqueous alteration. This diminishes the potential importance of exogenous organics to the origin of life on Earth if: (i) comets were their main source, and (ii) comets did not experience aqueous alteration.

Amino acids may also provide important constraints on the temperatures during accretion of the chondrites. The likely formation mechanism for amino and hydroxy acids is Strecker synthesis that requires HCN and NH_3. These molecules presumably accreted in the ices responsible for aqueous alteration, but they are both relatively volatile. The accretion of ice already places an upper limit of ~200 K on the ambient temperature when CI-CM-CRs formed. The HCN and NH_3 may require even lower temperatures.

It has yet to be demonstrated that indigenous amino acids were ever present in CVs, COs and OCs. All three groups experienced some hydrothermal activity and presumably accreted the water as ice, although oxidation of organic matter during metamorphism could also have produced some water.

All chondrites, including the ECs, accreted an insoluble organic material (IOM) in ~CI-like matrix-normalized abundances, suggesting that CI-like material is a major component of all chondrite matrices. The progressive transformation of this material into something more graphitic during metamorphism has proven to be a very useful petrologic tool. However, most work on IOM has tended to focus on the petrologically most primitive chondrites (CI-CM-CRs) whose IOM have large D and ^{15}N enrichments. The general assumption has always been that the larger the isotopic anomalies the more primitive the IOM. However, recent measurements of IOM in the OCs have found that D enrichments increase with increasing metamorphism, reaching ~12,000‰ in one meteorite. This enrichment is almost 4 times that in the most primitive chondrites. One explanation for the OC data is that oxidation of metal by water at low temperatures produced isotopically very light H_2 that escaped leaving isotopically heavy residual water that then exchanged with the IOM.

H_2 would also have been produced during alteration of the CI-CM-CRs, and could potentially explain the D enrichments in them. However, at present there is no obvious parent body explanation for the large ^{15}N excesses present in their bulk IOM. Also, CP-IDPs have largely avoided aqueous alteration, but they have large isotope anomalies in their organic material. If the isotope anomalies in primitive IOM were not produced in parent bodies, they must have formed in the nebula and/or ISM. Either way, establishing how the IOM acquired its isotope anomalies and was accreted into chondrites will reveal important information about processes during and after Solar System formation.