CARBON IN METEORITES. D.T. Britt, University of Central Florida, Department of Physics, Orlando, FL 32816 and The Center for Lunar and Asteroid Surface Science (CLASS) .Email: dbritt@ucf.edu.

Introduction: While there are 46 meteorite groups (Figure 1), only a small fraction of these groups have a significant carbon component. The presence of carbon is very much a function of the meteorite's evolution and processing. To start with, cosmic abundances put carbon as the 4th most abundant element, with an abundance 11 times that of silicon and about 60% that of oxygen. However, the fact that carbon is atmophile, thermal processing and redox conditions of the nebula, the accretional history of the solar nebula, and subsequent processing of planetesmals has drastically altered the abundance of carbon in meteorites and terrestrial planets. Essentially only the low metamorphic grade meteorites have more than trace amounts of carbon. In the low metamorphic grade meteorites carbon content is strongly correlated with the abundance of volatiles and fine-grained matrix material. Meteorites with abundant matrix such as the CI carbonaceous chondrites are the most carbon-rich, while meteorites with high contents of chondrules and low matrix volumes are progressively poorer in carbon.

Carbonaceous Chondrites: Carbonaceous chondrites a collection of diverse meteorites that often do not share significant chemical, textural, and mineralogical tends. They are essentially divided by volatile content. Volatile-rich carbonaceous chondrites (CI, C2, CM, CR) have varying amounts of fine-grained matrix, water and hydrated minerals, and significant carbon components (Figure 2). Volatile-poor carbonaceous chondrites (CO, CV, CK, CH, CB) often have more in common with ordinary chondrites in mineralogy, hydration state, and carbon content

Ordinary Chondrites: These are the most abundant meteorite fall, but except for the low metamorphic grade ordinary chondrites, they are essentially devoid of carbon. Most ordinary chondrites have a high-temperature silicate mineralogy dominated by olivine and pyroxene in chondrules with very little or no matrix material. Only the lowest metamorphic grade meteorites have even small amounts of carbon (Figure 2).

Enstatite Chondrites: Again these are meteorites dominated by high-temperature minerals, contain very little or no matrix, and only trace carbon.

Irons: The 12 groups of iron meteorites show trace amounts of carbon, typically in the form of iron carbides (Cohenite). It is estimated that the Earth's core contains 2000 ppm carbon.

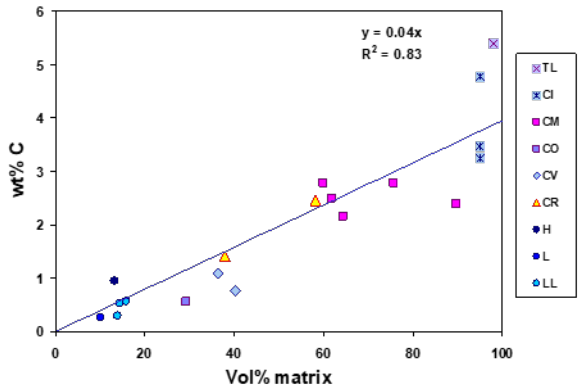

Figure 2: Carbon content versus matrix volume for low metamorphic grade (below 3.4) meteorites

Differentiated Meteorites: Martian, lunar, HED (Vesta-like), mesosiderates, pallasites are all limited by their thermal processing to trace amounts of carbon.

Primitive Achondrites: These are a variety of highly metamorphosed meteorites whose thermal history strongly depletes carbon.

Summary: Meteoritic carbon is strongly correlated with the presence of volatiles in meteorites. The vast majority of meteorites are limited to trace amounts of carbon because of their thermal history.

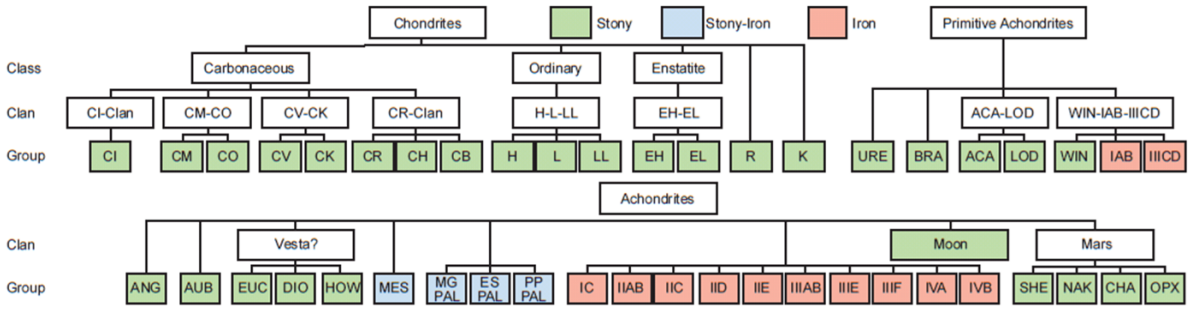

Figure 1: The structure of meteorite groups