Geophysical Research Abstracts, Vol. 9, 03074, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-03074

Latest in solar system origin from mass independent isotopic observations:sulfur and oxygen

M.H.Thiemens

Department of Chemistry and Biochemistry. UCSD, La Jolla, California. (mthiemens@ucsd.edu).

Since the first observation of mass independent oxygen isotopic compositions in meteorites in 1973 by Clayton and co-workers, it has been clear that understanding their source is a fundamental issue in understanding the origin and evolution of the solar system. In stony planets and asteroids, oxygen is the major element and, in meteoritic material, the isotopic anomalies exist at the bulk level, which is not the case for any other element in the periodic chart. As such, whatever process is responsible for generation of these anomalies represents a major process in the origin of the solar system and understanding this process remains the largest uncertainty in understanding the origin of the solar system.

Originally, it was assumed that the oxygen isotopic anomalies must derive from nuclear processes as there are no chemical processes that produce mass independent isotopic compositions. Following the demonstration of a chemically produced mass independent oxygen isotopic fractionation process by this laboratory that assumption was demonstrated to be invalid. The observed symmetry dependent isotopic fractionation process in fact identically reproduces the calcium inclusion fractionation line in Allende. The nuclear model has now been abandoned and it appears that a chemical or photochemical process may be responsible for the meteoritic isotopic distributions. There are a number of models that discuss both processes and, there are a number of relevant laboratory studies that address the possible mechanisms for generation of the meteoritic compositions. Synchrotron based studies have investigated the isotope effects associated with short wavelength self shielding reactions as well as excited state chemistry. The return samples of solar wind from Genesis and cometary samples from STARDUST have added to the basis of understanding of these processes and all will be discussed in this talk.