NATURE OF CARBON IN MARTIAN METEORITES

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Introduction: Interior samples from the Nakhla SNC made available by the British Natural History Museum and Yamato 000593 SNC from the National Institute of Polar Research (Japan), were analyzed for their carbon components. Petrographic examination of Nakhla and Y000593 showed evidence of dark-dendritic material [1] within iddingsite filling fractures which was examined by SEM-EDX, TEM-EDX, Focused Electron Beam microscopy, Laser Raman Spectroscopy, Nano-SIMS Ion Micro-probe, and Stepped-Combustion Static Mass Spectrometry.

Nano-SIMS Ion Microprobe studies of the C-bearing dark dendritic material, show direct correlation between C^- and CN^- abundances. Ion abundances for epoxy are distinct from those of the dendritic material [2].

Laser Raman Spectrometry examined the optically dark dendritic material prior to stepped- combustion [3]. Samples of the epoxy were examined along with the 100 - 150 □m diameter cores. Individual 3 - 5 μm size regions within the cores were analyzed in the 1000 - 2000 wave number (cm-1) region. Apparent complex mixtures of carbonaceous components are associated with Nakhla dendritic material and iddingsite.

Stepped Combustion Static Mass Spectrometry analysis is capable of distinguishing different C- and N-bearing components present along with their C and N isotopic compositions. Analysis of epoxy blanks along with cored samples bearing the opaque carbonaceous-rich materials were analyzed. Three distinct components were detected in Nakhla [3]. A low-temperature C component (<300°C) was predominately terrestrial contamination with an isotopic composition of –22 to –24‰. A reduced C-bearing component with isotopic compositions of -16.1‰, -18.4‰, -20.2‰ and -19.4 ‰ was measured for the 400°, 450°, 500° and 550°C temp. intervals, resp. Possible presence of a pre-terrestrial secondary carbonate with an isotopic composition of >+5‰ was released at T > 550°C. The isotopic composition of the reduced C-component was identical to values -18 to -20‰ reported by [4]. Our C analysis is the first isotopic measurement of directly imaged high molecular weight C-bearing phases in Nakhla. N isotopic compositions associated with the reduced C-component were ~+5‰.

References: [1] Fisk M.R. et al., (2006) *Astrobiology* 6, 48-68. [2] McKay D.S. et al. (2006) *LPSC* XXXVII, Abst. 2251. [3] E.K. Gibson, Jr. et. al (2006) LPSC XXXVII, Abst. 2039. [4] Sephton M.A. (2002) *Planet. Space Sci*. 50, 711-716.