NITROGEN ANOMALIES IN CARBONACEOUS METEORITES: IMPRINT FROM A SOLAR SYSTEM PROCESS? Maitrayee Bose\textsuperscript{1} and Sandra Pizzarello\textsuperscript{2,15} Department of Chemistry and Biochemistry, Arizona State University, Tempe AZ 85287. Corresponding authors: maitrayee.bose@asu.edu, sandra.pizzarello@asu.edu.

Introduction: The nitrogen-bearing organic molecules observed in the local interstellar medium, protosolar environments, and comets can be a source of the life’s building blocks on earth [e.g., 1, 2]. The nitrogen isotopic composition of extraterrestrial materials can help decipher the origin of these molecules, and their possible evolution in these primordial environments. A large portion of the organics in carbonaceous chondrite meteorites is in the form of insoluble organic matter (IOM), which is isolated from a piece of meteorite rock by HF-HCL treatments, and therefore deemed resistant to chemical treatment and contain abundant submicron-sized ‘hotspots’ with $^{15}$N excesses [e.g., 3]. Other laboratory analysis of IOM extracted from meteorites has revealed the complexity of this material [e.g., 4]. More recent work has shown that IOM releases ammonia under hydrothermal treatment (HT), the lost ammonia displays $^{15}$N enrichments from +45‰ to +455‰n, and is related closely to the mineralogy and classification of the meteorites [5].

In order to better understand the characteristics of the IOM, we analyzed the IOM from several meteorites before and after HT to evaluate possible relationship between the $^{15}$N-rich hotspots and the released $^{15}$N-rich ammonia.

Analytical Details: The carbonaceous chondrites that were studied include Murchison (CM2), Ivuna (C11), Bells (C2-ung), Tagish lake (C2-ung), GRA 95229 (CR2), Allende (CV3), Sutter’s Mill (C-ung). Hydrothermal experiments were conducted in sealed gold tubes and degassed water at 300°C and 100MPa for 6 days.

Figments of IOM and HT-treated IOM were mounted, documented and imaged in the NanoSIMS 50L. A 16 keV, <1pA Cs\textsuperscript{+} primary ion beam with a beam diameter of \textless 50nm scanned and sputtered the sample surface while acquiring mass filtered images of $^{13}$C, $^{15}$C, $^{13}$CH\textsubscript{3}, $^{12}$CH\textsubscript{4}N, $^{12}$CH\textsubscript{15}N, $^{28}$Si, as well as secondary electrons in multicollected mode. The instrument was operated at high mass resolving powers so as to separate isobaric interferences from $^{15}$C\textsubscript{2}, $^{10}$B$^{16}$O, $^{13}$C$^{13}$CH and $^{11}$B$^{16}$O, $^{13}$C$^{14}$N at mass 26 and 27, respectively. A 50–100 pA Cs\textsuperscript{+} beam achieved by the D1-1 aperture was used to pre-sputter for ~5 minutes to achieve steady state sputtering. Each ion image is composed of a stack of 6-10 cycles. For each cycle, a 10×10μm\textsuperscript{2} or 15×15μm\textsuperscript{2} areas decomposed into 256×256 pixels is measured for 10–15 ms/pixel dwell time. About 4000μm\textsuperscript{2} areas on each IOM and HT-treated IOM mount covered with >75% material were measured. Isotopically anomalous ‘hotspots’ defined by micron-sized regions in the ion images that exhibit $^{15}$N excesses were identified after applying a threshold. The $\delta^{15}$N value of the hotspots is >3σ away from terrestrial ratios, the anomaly is present in more than 3 consecutive layers for a given measurement, and regions with C/Si ratios of ~1 & C-anomalies are ignored because they are possibly presolar grains.

Results: The $\delta^{15}$N of the hotspots upon HT appears to be related to the $\delta^{15}$N of the ammonia released upon HT (Figure 1). The average $\delta^{15}$N of the hotspots is inversely correlated to the $\delta^{18}$O of the meteoritic matrix. Implications of these data will be discussed at the meeting.

Figure 1: Histograms showing the extent of $^{15}$N excesses in carbonaceous meteorites before and after HT, and the $\delta^{15}$N of the ammonia from [5]. The meteorite names and the number of hotspots identified in each sample are listed at the base of the plot.