CORRELATED MICROANALYSIS OF CARBONACEOUS NANOGLOBULES. R.M. Stroud[1], C. M. O'D. Alexander[2], G. D. Cody[2], B. T. De Gregorio[1], A. L. D. Kilcoyne[3], L. R. Nittler[2], T. J. Zega[1] [1]Materials Science and Technology Division, Naval Research Laboratory, Washington, DC 20375, USA. [2]Carnegie Institution of Washington, Washington, DC 20015, USA. [3]Chemical Science Division, Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA.

Introduction: Recent work has shown that sub-micron carbonaceous spheres ("nanoglobules") constitute a microstructurally distinct, ubiquitous form of extraterrestrial organic carbon. Nanoglobules have been reported to occur in the insoluble organic matter (IOM) of carbonaceous chondrites, in the matrices of primitive chondrites, in interplanetary dust particles and in Wild-2 samples [1-4]. Nanoglobules are carriers of D and/or ^{15}N enrichments relative to bulk IOM and are often identified as components of isotopic "hotspots" [5]. To better understand the origin and processing histories of the nanoglobules we are conducting spatially correlated studies of meteoritic and cometary organic matter, to characterize the same sub-micron samples for their molecular chemistry, morphology, structure and isotopic compositions.

Results: We have now performed transmission electron microscopy (TEM) and X-ray absorption near-edge structure spectroscopy (XANES), and secondary ion mass spectrometry.(SIMS) isotopic characterization on two globules identified in Wild-2 samples, and TEM and XANES on several globules and surrounding non-globule IOM in the residues of six primitive chondrites. The two Wild-2 globules are distinct in both molecular chemistry and isotopic composition [4].

Preliminary results on meteoritic globules indicate that in a given meteorite, the majority of globules and bulk IOM exhibit similar C-XANES spectra, although the globules appear to exhibit slightly enhanced C-O bonding (e.g. carboxyl and vinyl-keto groups). Some globules with unusual spectra are also observed, e.g., purely aromatic C. The enhanced C-O bonding and aromatic signatures could result from radiation damage during electron beam analysis or preaccretionary radiation processing. Evidence for preaccretionary, rather than laboratory processing, comes from analysis of two spatially co-located globules in an IOM residue of Murchison. These globules, which experienced identical low dose electron imaging conditions prior to C-XANES analysis, show very different spectra: one typical of Murchison IOM and one graphite-like. Post-XANES high-resolution TEM imaging confirmed that the highly aromatic globule was in fact an amorphous hollow globule and not a graphite grain; no evidence of long-range graphitic order was observed. We have also observed globules with graphitic C-XANES signatures in Bells IOM that exhibit no signature of crystalline graphite in TEM analyses. Isotopic measurements of the meteoritic globules are in progress.

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