NANOGLOBULE ABUNDANCES IN IOM EXTRACTS: CORRELATION WITH PARENT BODY PROCESSING.

H. G. Changela[1,2], R. M Stroud[2], B. T. De Gregorio[3], L. R. Nittler[4], C. M. O'D. Alexander[4] and G. D. Cody[4] [1]George Washington University, Department of Physics, Washington, DC, 20052. [2]Naval Research Laboratory, 4555 Overlook Ave. SW, Washington, DC, 20375. E-mail: changela@anvil.nrl.navy.mil [3]Johnson Space Center, Houston, TX, 77058. [4]Carnegie Institution of Washington, Washington, DC, 20015.

Introduction: Nanoglobules are a form of Insoluble Organic Matter (IOM) found in chondrites [1], IDPs [2] and Comet 81P/Wild2 [3]. Some nanoglobules exhibit large ^{15}N and D enrichments relative to solar values, indicating that they likely originated in the ISM or the outskirts of the protoplanetary disk [4]. Recent studies of samples from the Tagish Lake meteorite with varying levels of hydrothermal alteration suggest that nanoglobule abundance decreases with increasing hydrothermal alteration [5]. The aim of the present study is to further constrain the morphologies of IOM from a range of primitive chondrites in order to determine any correlation between morphology and petrographic grade and chondrite class.

Methods: We are performing a comprehensive scanning transmission electron microscopy (STEM) survey of IOM residues prepared by methods described in [3]. STEM annular dark-field (ADF) imaging surveys were performed with NRL's JEOL 2200FS on residues from Murchison (CM2), EET92042 (CR2) and QUE97008 (L3). IOM textures were classified as either having a 'globular' morphology, i.e. spherical, non-porous regions approximately 50 – 1000 nm in size; 'fluffy', i.e. porous material with fine scale heterogeneity below 50 nm; and 'dense-irregular', i.e. uniformly dense, non-spherical material >50 nm. ADF images were taken of each chondrite, sampling approximately 100 μm^2 of IOM. The different morphologies were manually identified from the images and masked using Adobe Photoshop. Area fractions were then obtained using Image J software. Because some small globules (<100 nm) are difficult to distinguish from the background of fluffy IOM, our results reflect a lower limit on globular abundances.

Results and Discussion: Globular to fluffy and dense irregular to fluffy IOM fractions in these chondrites show distinctive variations. Murchison contains the highest abundance of nanoglobules (~7%), followed by EET92042 (~5%) and then QUE97008 (~1%). The abundances of dense irregular IOM fractions are similar for Murchison and EET92402, but have much higher abundance (~20% of measured IOM) in QUE97008. We will also present new analyses of residues from types 1, 2 and 3 CR and other chondrites to identify any links between nanoglobule abundances and petrographic grade. It has been shown that isotopic enrichment within the IOM is not just localized to globular species, but to some 'fluffy' components as well [6]. It is not clear whether some of the 'dense irregular' morphologies of IOM contain similar enrichments. Coordinated analyses of these extracts and *in situ* IOM studies will enable us to further constrain the nature of these morphologically distinct components and how they vary with petrographic grade or chondrite class.

References: [1] Nakamura-Messenger, K., et al. 2006. *Science*, 314, 1439-1442. [2] Flynn, G. J., et al. 2003. *Geochimica et Cosmochimica Acta* 4791-4806. [3] De Gregorio, B. T., et al. 2010. *Geochimica et Cosmochimica Acta* 74 4454–4470. [4] Alexander, C.M.O'D., et al. 2007. *Geochimica et Cosmochimica Acta*, 71, 4380-4403. [5] Herd, C. D. K., et al. 2011. *Science*, In press. [6] De Gregorio et al. 2010, Abstract #2108. 41st Lunar and Planetary Science Conference.