A REFRACTORY INCLUSION IN UNEQUILIBRATED ORDINARY CHONDRITE (LL3.3) ALLAN HILLS A81251.

R. K. Mishra[1,2], J. I. Simon[2], D. K. Ross[2,3], L. P. Keller[2], K. K. Marhas[2,4,5], and A. W. Needham[1,2]. [1]Oak Ridge Associated Universities (ritesh.k.mishra@nasa.gov), [2]NASA-Johnson Space Center, Houston, TX 77058, USA, [3]Jacobs Technology-JETS, Houston TX 77058, USA, [4]LPI,, Houston, TX 77058, USA, [5]Physical Research Laboratory, Ahmedabad, India.

Introduction: The earliest formed solar system objects, Ca-, Al-rich inclusions (CAIs), are found in all types of chondrites. However their abundance, classified type, modal mineral composition, and mean size, vary largely between different classes of meteorites. CAIs are typically very rare in ordinary chondrites and smaller in size [1-3] compared to the populations commonly associated with abundant large (few mm) type 'B' CAIs in carbonaceous chondrites. These differences may reflect a combination of dynamical sorting in the protosolar disk and preservation related to parent body alteration processes. As part of a larger survey of CAIs to enable us to study their isotopic diversity, an inclusion was found in the unequilibrated ordinary chondrite Allan Hills A81251. Here we report our initial petrologic observations of this fine-grained CAI.

Meteorite and Petrology: Allan Hills (ALH) A81251 is an Antarctic "find" belonging to the ordinary chondrite subgroup LL of petrologic Type 3.3. It has the weathering grade of B/C and is paired with ALH A76004 (LL3.3). A small ~80x30 μm inclusion rich in Ca, Al was found by a systematic search of several (n=8) thin sections, first by petrographic microscope, and then by elemental mapping using EDS on the JEOL 8530 hyperprobe field emission electron probe microanalyser at NASA JSC. The inclusion has an ovoid shape and aggregate texture that appears sintered together similar to fine-grained spinel-rich inclusions found in *CV* chondrites. The primary spinel core of each nodule is surrounded by a thin rim sequence of altered calcium-rich silicates. Ilmenite grains (2-5μm) are present throughout the inclusion and often found associated with the spinel grains (~5μm), typical of the morphology seen in more pristine spinel-perovksite bearing inclusions in Efremovka and Vigarano.

The CAI is heavily altered as evidenced by: (1) Na-, K-rich fine-grained minerals and a glassy phase at the margins of the CAI, (2) Presence of ilmenite ($FeTiO_3$), indicative of oxidizing conditions, (3) An Fe-, S-rich vein/crack that transects the object, and (4) Presence of vesicles, holes within the inclusion. Perovskite which is found as part of the primary mineral assemblages of other less-altered fine-grained CAIs, has likely been entirely altered to the ilmenite observed. Likewise, the thin leached rims and perforations around the core-spinel nodules may be alteration remnants of previous melilite and pyroxene layers surrounding the typical pristine fine-grain spinel rich inclusions found in *CV* chondrites. The inclusion is surrounded by a fine-grained matrix and does not have Wark-Lovering rim. Detailed characterization, including fine-scale mineral compositional zonation, and mineralogy of the inclusion will be presented.

References: [1] Russell S. S. et al. 1996. Science 273:757-762. [2] Huss G. R. et al. 2001 *Meteoritics & Planetary Science* 36:975-997. [3] Itoh S. et al. 2007. *Meteoritics & Planetary Science* 42:1241-1247.