PETROLOGY AND GEOCHEMISTRY OF NEW UREILITES AND UREILITE GENESIS.

D. W. Mittlefehldt[1] , J. S. Herrin[2], and H. Downes[3]. [1]NASA/Johnson Space Center. david.w.mittlefehldt@nasa.gov. [2]ESCG Jacobs, [3]University of London.

Ureilites are C-bearing, basalt-depleted olivine+pyroxene achondrites from a differentiated asteroid. The group is heterogeneous, exhibiting ranges in O isotopic composition, Fe/Mg, Fe/Mn, pyx/ol, siderophile and lithophile trace element content, and C content and isotopic composition [1]. Some of these characteristics are nebular in origin; others were strongly overprinted by asteroidal igneous processes. The consensus view is that most ureilites are melt-residues, but some are partial cumulates or have interacted with a melt [1,2]. An "unroofing" event occurred while the parent asteroid was hot that froze in mineral core compositions and resulted in FeO reduction at olivine grain margins. We have studied several new ureilites, but will focus here on two anomalous stones; LAR 04315 and NWA 1241.

LAR 04315 is texturally unusual. It contains olivine with angular subdomains, and low-Ca pyroxene riddled with wormy inclusions of metal+troilite, graphite, and possibly other phases, and irregular inclusions of high-Ca pyroxene. Reduction occurred along olivine grain margins and internal fractures, but not along subdomain boundaries. Although texturally odd, LAR 04351 is a typical ureilite in mineral and bulk composition. The olivine is $Fo_{80.8}$ and falls on the ureilite Fe/Mn-Fe/Mg trend. Its olivine composition falls within the range of the majority of ureilites, and it is typical of these ureilites in bulk rock lithophile and siderophile element contents.

NWA 1241 has been classified as a monomict ureilite bearing suessite ($(Fe,Ni)_3Si$) [3], but our sample does not support this. We obtained two chips of distinct material. Lithology A is an unbrecciated ureilite containing magnesian olivine ($Fo_{89.1}$) only a trace of fine-grained metal, and no suessite. It is coarse-grained with part having typical ureilite texture, and part consisting of large (1-2 mm) low-Ca pyroxene grains poikilitically enclosing olivine. Lithology B is highly weathered, contains $Fo_{82.5}$ olivine and abundant metal, much of it as medium-grained (up to 0.1 mm) suessite. Lithology B is medium grained and appears to have a typical ureilite texture, but because of the abundance of opaque phases and plucked grains, the texture is obscured. Lithology B is the material previously described [3]. Both lithology A and B fall on the ureilite Fe/Mn-Fe/Mg olivine trend. We had sufficient material only of lithology A for bulk analysis. It is typical of the magnesian group of ureilites in lithophile and siderophile elements. Although classified as a monomict ureilite, NWA 1241 is certainly dimict, and could be polymict.

Suessite previously has been documented only from polymict ureilites in uncertain textural context. Its occurrence in unbrecciated lithology B may allow for definition of the formation mechanism of this reduced phase. We do not concur with the suggestion that it is the product of the late reduction event [3]; it is too coarse-grained and abundant in lithology B compared to the metal typically formed by this event. Yet at this time it does not seem possible that Si^0 could have formed in equilibrium with FeO-bearing silicates of lithology B.

References: [1] Mittlefehldt D. W. et al. 1998. *Rev. Mineral.* 36, Chapter 4. [2] Goodrich C. A. et al. 2001. *Geochim. Cosmochim. Acta* 65:621. [3] Ikeda Y. 2006. *Antarctic Meteorites* XXX:28.