COMPARING THE FOREIGN CLAST POPULATIONS OF ALMAHATA SITTA AND TYPICAL POLYMICT UREILITES, WITH IMPLICATIONS. C.A. Goodrich[1], A.M. Fioretti[2], D.P. O'Brien[1], M. Zolensky[3], P. Jenniskens[4] and M.H. Shaddad[5]. [1]Planet. Sci. Inst. cgoodrich@psi.edu; [2]CNR-IGG, Ital. Nat. Res. Council; [3]NASA, JSC; [4]SETI Inst., NASA Ames; [5]Univ. Khartoum.

Introduction: Almahata Sitta (AhS) is the first meteorite observed to originate from an asteroid (2008 TC_3) that had been studied in space before it hit Earth [1,2]. It is also unique because the fallen fragments comprise a variety of meteorite types. Based on ~110 samples, ~69% are ureilites (C-rich ultramafic achondrites) and 31% are chondrites, including all major classes [3]. Two main hypotheses have been proposed to explain how all these materials became mixed: 1) an accretionary model [3,4]; or 2) a regolith model [5,6]. Critical to distinguishing these hypotheses is determining whether the range of types and relative proportions of non-ureilitic materials in AhS are the same as in typical polymict ureilites [6]. Currently, E-chondrites (EC) dominate (79% of non-ureilites) in AhS [3]. In contrast, CC matrix-like clasts and R-chondrites are most common in typical polymict ureilites [7,8]. Enstatite grains consistent with EC or aubrites have been reported [8,9], but their abundance is uncertain. E-meteorite material may be difficult to recognize in typical polymict ureilites because ureilites contain Mg-rich opx [10], as well as sulfides (e.g., alabandite) characteristic of E-meteorites [11]. We began a systematic search for E-meteorite material in typical polymict ureilites.

Methods: We obtained whole-section WDS X-ray maps for Si, Mg, Fe, Al and Ca in 6 polished sections of polymict ureilites, and used them to identify grains with very high Si and Mg and very low Ca contents. Then we searched for unusual sulfides in such grains. Quantitative analyses were obtained for each grain.

Results: In each of 4 sections we found 1-3 enstatite grains (300-600 μm) having FeO, CaO, MnO, Al_2O_3, Cr_2O_3 and TiO_2 consistent with E-meteorites [10,12]. They are distinguished from primary opx in main group ureilites [13,14] by lower FeO, CaO, Al_2O_3 and Cr_2O_3. They are too large to be derived from enstatite reduction rims in ureilites [10]. One grain contains Fe-alabandite and Fe,Cr-sulfides. One has an inclusion of diopside. These enstatites will be analyzed for O-isotopes. All 6 sections examined contain multiple CC matrix and R chondrite clasts up to 3 mm in size.

Discussion: E-meteorite material appears to be present, but at low abundance compared with other foreign clasts, in typical polymict ureilites (more samples will be examined). Although this seems a major difference from AhS, only a small fraction of AhS material [2] has been studied, and extreme heterogeneity is likely.

References: [1] Jenniskens P. et al. 2009. Nature 458, 485-488. [2] Shaddad M.H. et al. 2010. MAPS 35, 1618-1637. [3] Horstmann M., Bischoff A. 2014. Chemie der Erde 74, 149-183. [4] Gayon-Markt J. et al. 2010. Monthly Notices Royal Astr. Soc. 424, 508-518. [5] Herrin J. et al. 2010. MAPS 45, 1789-1803. [6] Goodrich C.A. et al. 2015. MAPS 50, 782-809. [7] Goodrich C.A. et al., 2004. Chemie der Erde 64, 283-327. [8] Downes H. et al. 2008. GCA 72, 4825-4844. [9] Jaques A.L., Fitzgerald M.J. 1982 GCA 46, 893-900. [10] Mittlefehldt D.W. et al. 1998. RIM 36. [11] Fioretti A.M., Molin G. 1998. MAPS 36, A46. [12] Brearley A., Jones R.H. 1998. RIM 36. [13] Takeda H. 1987. EPSL 81, 358-370. [14] Goodrich C.A. et al. 2014. GCA 135, 126-169.