THE UNIQUE DIFFERENTIATED METEORITE NWA7325: HIGHLY REDUCED, STARK AFFINITIES TO E-CHONDRITES AND UNKNOWN PARENTAL PLANET.

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Introduction: NWA7325 is a 345 gms green ungrouped achondrite tentatively classified as olivine gabbro cumulate perhaps from planet Mercury [1]. Fragments were collected in the Moroccan desert in 2012. Originally, it was a differentiated meteorite and experienced a complex evolution. NWA7325 has heterogeneous mineral abundances. Constituents include: major (55%) anorthite (An_{88}), (10-15%) forsterite, (25-30%) Cr- diopside, minor Ti-chromite, Co-rich (3.5 wt.% Co) kamacite, taenite, $(FeNi)_3P$, and considerably weathered sulfides. NWA7325 is an extremely reduced meteorite that shows evidence for Ti^{3+}, V^{2+} and Cr^{2+} in olivine and diopside, suggesting fO_2 between IW-7 and IW-2 [2]. Diopside seems to have higher valence for these cations than olivine. NWA7325 was subjected to a pervasive melting episode in its early history. Dating of the melting episode revealed 4562.5 ± 4.4 Ma [3]. Oxygen isotopic compositions were believed to indicate genetic alliance with ureilites [4], albeit this is discrepant with the fabric and petrology. We report the discovery of novel assemblages of residual re-melted oldhamite (CaS) with unique REE pattern Ba-rich sulfide and unusual trace element abundances in silicates, CaS residues and chromite. New cosmochemical venues for evaluating as what a second melting episode of a differentiated meteorite could produce.

Results: We investigated 6 sections sliced from the same fragment. Modal abundance of metals, $(FeNi)_3P$ and sulfides to total silicates and chromite vary considerably among the 6 sections. Intergrowth textures reported by [5] as evidence for anorthite replacing diopside rather realistically depict typical intersertal fabric also including 60µm large FeS and metal assemblages, that are characteristic of not rapid quenching. Meteorite probably didn't emerge from an ureilitic parental planet. Enclaves in both FeNi and FeS with high abundance of Ca and S were originally CaS with unique REE and trace element signatures: CI-normalized Eu (5~164), Ba (3~442), and Sr (68~217) and is hence different from CaS in EH, EL and aubrites altogether [6]. Anorthite depicts high concentrations in Eu (5~18) and Sr (22~47). Chromite shows enormous CI-normalized V (1486) and low Ti. Claim that this meteorite is related to ureilites is discrepant with mineralogy, CI-normalized trace element inventories of the mineral constituents. The unique REE pattern with positive Eu anomaly of the oldhamite residues unambiguously indicates that this Meteorite couldn't have resulted by melting of an enstatite chondrite.

References: [1] Irving A. J. et al. 2013, abstract #2164, 44th Lunar & Planetary Science Conference. [2] Sutton S. R. et al. 2014, 45th Lunar & Planetary Science Conference., abstract #1275. [3] Amelin, Y. et al. 2013 Meteoritics am Planetary Science, 48, abstract #5165. [4] Kita N. L. et al. 2014, 45th Lunar & Planetary Science Conference. 45th, absract # 1455. [5] Weber et. al. 2014 Lunar and Planetary Science Conference, 45th, abstract # 1223. [6] Gannoun et al., 2011, Geochim Cosmochim. Acta 75, 3269-3289.