DaG 1047: A POLYMICT UREILITE CONTAINING EXOTIC CLASTS INCLUDING A CHONDRITE.

A. J. Ross[1,2], H. Downes[1,2], C. L. Smith[2] and A. P. Jones[1], [1]Centre for Planetary Sciences, Joint UCL/Birkbeck Research School of Earth Sciences, UK, [2]IARC, Department of Mineralogy, The Natural History Museum London, UK. (aidan.ross@ucl.ac.uk).

Introduction: Dar al Gani (DaG) 1047 is a polymict (or brecciated) ureilite [1], one of the most complex meteorite types [2,3]. Polymict ureilites make up ~10-15% of ureilite samples and are interpreted to be the regolith of at least one daughter of an impact disrupted ureilite parent body (UPB) [4,5]. They are composed primarily of clasts of material found in unbrecciated (or monomict) ureilites but also contain exotic lithic and mineral clasts such as feldspathic and chondritic material. Ikeda et al. [3] defined seven broad groups of clasts in polymict ureilites, which we find most of.

For this investigation two pieces of DaG 1047 weighing a total of 2.8g were made into five polished sections to be studied, with some saved for later use. This abstract presents preliminary results for four of those thin sections.

Methods: The sections were analyzed at the NHM. Elemental maps and BSE images were acquired using a JEOL 5900LV SEM EDS with Oxford Instrument's INCA software. Individual mineral compositions were measured using a WDS Cameca SX100.

Petrology: The thin sections are all highly heterogenous containing multiple different clasts, with a variety of orientations as expected in a breccia.

Chondrite Clast: Although chondritic fragments and chondrules [2,3,4,6] have been reported in polymict ureilite breccias, we believe we have found some of the best-preserved examples of chondrules within a polymict ureilite. We have identified radial pyroxene (RP) [Fig. 2] and porphyritic olivine pyroxene chondrules (POP) and are continuing to examine the clast, which we initially identify as an Ordinary Chondrite.

Feldspathic Clasts: We analysed clasts of feldspar up to 1.2 mm in size. These show a large variation in composition between grains spanning the entire Ab-An range ($An_{2.6-97.8}Ab_{91-2.2}Or_{0-6.4}$) [Fig. 3]. Most grains show little internal variation, apart from some that are in a glassy mesostasis and appear to show some zonation. Although feldspars are not found in monomict ureilites, some of these grains (those that are determined to be indigenous by composition and are pristine as described in [5]) are interpreted as representing the 'missing basalts' [7] from the UPB. We find multiple clasts similar to those decribed in [7].

Olivines: Olivines display a range of compositions $Fo_{48-95.4}$ [Fig. 4]. This is a larger variation than ranges exhibited by monomict and other polymict ureilites $Fo_{\sim 74-95}$ [5]. It is likely that the olivine grains with Mg#<~74 are non-indigenous. Some of the olivines are mosaicised, indicating that they experiencd high degrees of shock

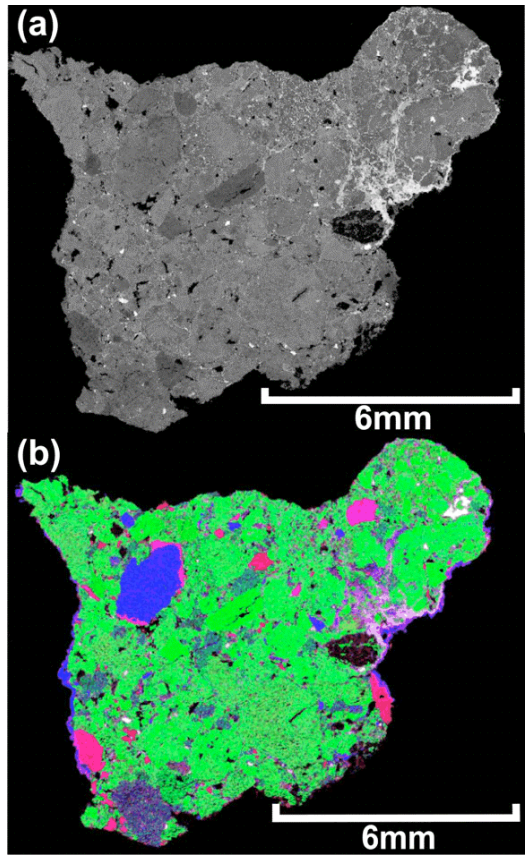

Figure 1: (a) BSE image of a thin section of DaG 1047. (b) Elemental map of the same section. Mg = green, Ca = blue, Al = red, Fe = white. Pink/red feldspars, bright blue Ca-pyroxenes, green olivines and Ca-poor pyroxenes, pure white metals and sulphides with pinky-white weathering products.

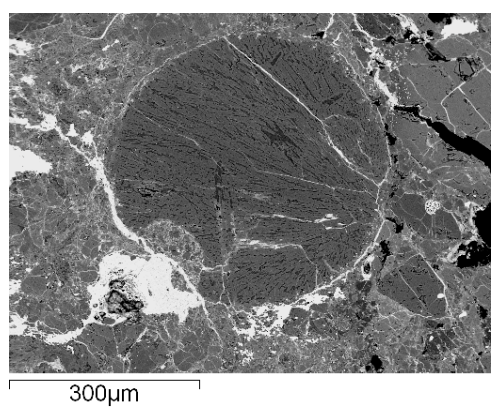

Figure 2: BSE image of a RP chondrule in DaG 1047.

Pyroxenes: Pyroxene grains are present as enstatite, pigeonite and augite ($Wo_{0.2\text{-}44.7}En_{41.2\text{-}99.1}Fs_{0.2\text{-}51.2}$). The data clearly show high- and low-Ca fractionation trends [Fig. 5].

Metals: Si-bearing metals are being recognized in an increasing number of polymict ureilites [e.g. 8,9,10]. In DaG 1047 we have identified a large number of silicides, including the phase suessite ($(Fe,Ni)_3Si$), and kamacites (Fe,Ni) with up to 27.6 wt% Ni [Fig. 6]. This range is similar to that seen in DaG 1000 [8], but wider than that seen in Frontier Mountains ureilites [9]. Sulphides are present as troilite (FeS) with up to 4.41 wt % Cr, similar to those in Frontier Mountains samples [9].

Conclusions: Mineral analyses indicate most clasts are similar to those previously described in other polymict ureilites. Study of DaG 1047 adds a valuable dataset to current information about polymict ureilites and merits further study. Significant differences between thin sections (even though they are from the same sample) indicates small scale heterogeneity and complexity of UPB regolith breccias.

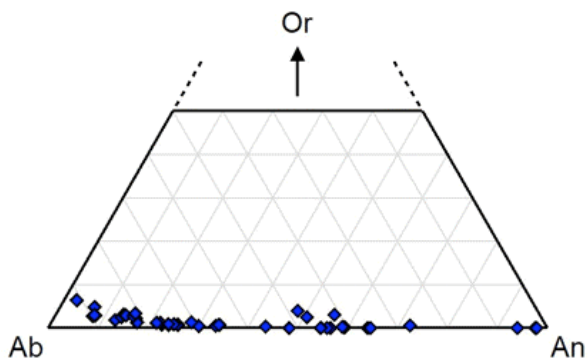

Figure 3: Feldspar compositions span a large range.

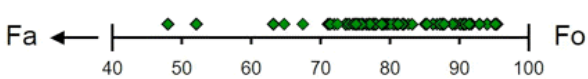

Figure 4: Olivine Fo% = Mg# = 100*Mg/(Mg+Fe).

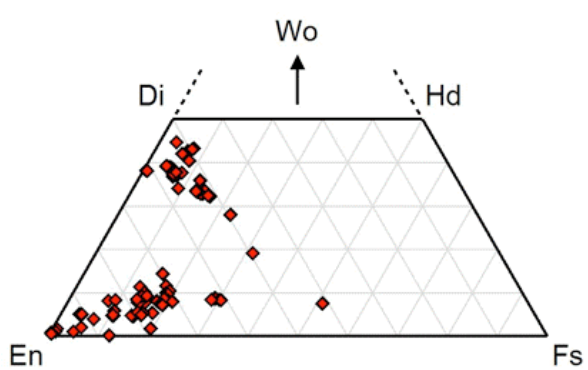

Figure 5: Pyroxene compositions.

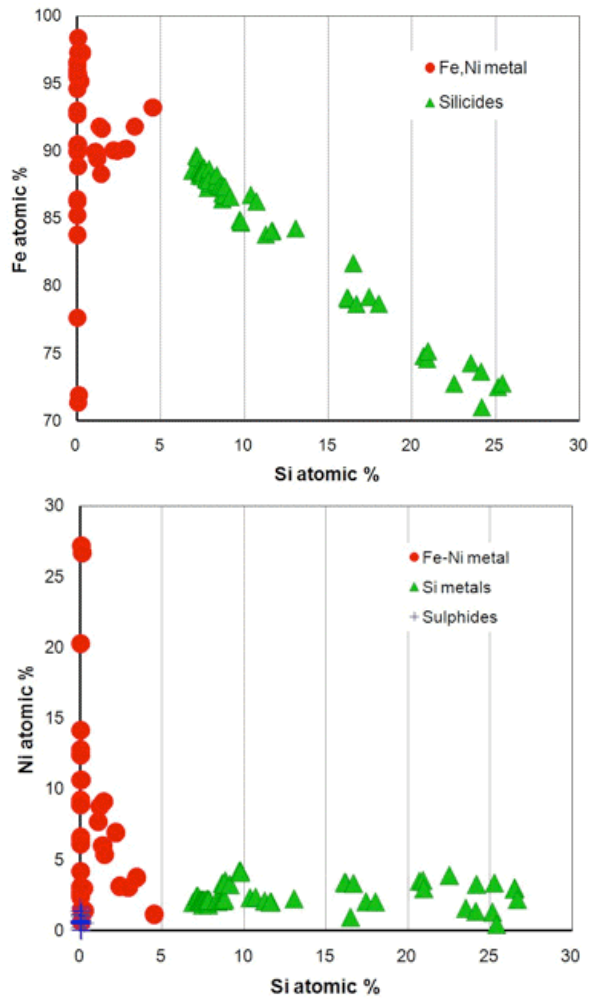

Figure 6: Metal and sulphide compositions.

References: [1] Connolly H. C. et al. (2007) *Met. Bull,. 92*, 1647-1694. [2] Prinz M. et al. (1988) *LPSC XIX*, 947-98. [3] Ikeda Y. et al. (2003) *Antarct. Meteorite Res.*, *16*, 105-127. [4] Downes H. et al. (2008) *GCA*, *72*, 4825-4844. [5] Goodrich C. A. et al. (2004) *Chemie der Erde*, *64*, 283-327. [6] Downes H. et al. (2006) *MAPS 41*: A46. [7] Cohen B. A. et al. (2004) *GCA*, *68*, 4249-4266. [8] Herrin J. S. et al. (2007) *LPSC XXXVIII*: Abstract #2404. [9] Ross A. J. et al. (2008) *MAPS 44*: A177. [10] Smith C. L. et al. (2008) *LPSC XXXIX*: Abstract #1669.

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