MINERALOGY, PETROLOGY AND CHRONOLOGY OF THE DINGLE DELL METEORITE.

G.K. Benedix[1,2], L.V. Forman[1], L. Daly[1,*], B. Godel[3], L. Esteban[3], M.M.M. Meier[4], C. Maden[4], H. Busemann[4], Q-Z Yin[5], M. Sanborn[5], K.Ziegler[6,7], J.M. Friedrich[8], J.W. Strasser[8], K.C. Welten[9], M.W. Caffee[10], D.P. Glavin[11], J.P. Dworkin[11], P.A. Bland[1,2], J.P. Paxman[1], M.C. Towner[1], M. Cupak[1], E.K. Sansom[1], R.M. Howie[1], H.A.R. Devillepoix[1], M.A. Cox[1], T. Jansen-Sturgeon[1], B.A.D. Hartig[1], and A.W.R. Bevan[2]. [1]Dept. Applied Geology, Curtin University, GPO Box U1987, Perth, WA, Australia (g.benedix@curtin.edu.au); [2]Dept. Earth and Planet. Sci., Western Australia Museum, WA, Australia; [3]CSIRO Earth Sci. and Resource Engineering, ARRC, Kensington, WA, Australia; [4]Institute of Geochemistry and Petrology, ETH Zurich, Zurich, Switzerland.; [5]Dept. Earth and Planet. Sci., UC Davis, Davis, CA, USA; [6]Institute of Meteoritics, [7]Dept. Earth and Planetary Sciences, University of New Mexico, Albuquerque, NM, USA; [8]Dept. Chemistry, Fordham University, Brooklyn, NY, USA; [9]Space Sci. Lab., UC, Berkeley, CA 94720, USA. [10]Dept. Physics, Purdue University, West Lafayette, IN 47907, USA. [11]NASA Goddard Space Flight Center, Greenbelt, MD 20771. *School of Geographical and Earth Sciences, University of Glasgow, Glasgow, G12 8QQ, UK

Introduction: The 4th meteorite recovered by the Desert Fireball Network, Dingle Dell, fell on the 31st October 2016 in Western Australia and was collected on the 6th November 2016. The account of the fall, orbit and recovery are found in [1]. The Dingle Dell consortia were sent chips for correlated analysis of O, Cr, and Ti isotopes, bulk compositions, high resolution CT scanning, bulk density/porosity [2], bulk mineral mode, bulk organic composition, cosmic ray exposure and noble gas analysis. We present here the initial description and classification.

Figure 1. Cut surface of Dingle Dell. Scale is in inches.

Macroscopic Description: A roughly shoebox, slightly wedge-shaped meteorite, measuring 16cm x 9cm x 4cm and weighing 1.15kg, was recovered. Although it was entirely covered with fusion crust, the meteorite appears to have broken up during atmospheric entry based on the presence of both primary and secondary (and possibly tertiary) fusion crust.

Computed tomography (CT) scans reveal a distribution of metal and sulfide consistent with an ordinary chondrite, but also showed larger (several mm) circular areas of lower density. Dingle Dell does not appear to be brecciated in either the macro or micro scales. A preliminary density of 3.45g/cm^3 was calculated from the CT data. More precise measurement of the density, along with porosity and magnetic susceptibility is presented in [2]. We used the CT scans to choose an area of the rock containing all relevant features to expose for further investigation. Upon cutting, the interior surface revealed a pristine, light grey interior with no evidence of alteration (Fig. 1), despite the reddish exterior, which is attributed to the sample hitting red dirt on impact (see [1] for more details).

Chronology: Preliminary noble gas results show that He, Ne and Ar in Dingle Dell are nearly completely cosmogenic and radiogenic; it contains no solar wind gases indicating it is not a regolith breccia. This matches what is seen in the hand specimen and thin section. ^{3}He and ^{21}Ne show ages of 8.6±0.5 and 8.7±0.3 Ma. These consistent ages also indicate that Dingle Dell didn't lose He during exposure to cosmic rays. The nominal U,Th-He and K-Ar ages are 2.0 and 4.6 Ga, respectively.

Microscopic Description: The texture is characterised by indistinct chondrules set in a fine-grained, recrystallized matrix. Mineralogy consists of olivine, orthopyroxene, metal and sulfide, with minor plagioclase, clinopyroxene, phosphate and chromite. Olivine composition ranges from $Fa_{24.0}$ to $Fa_{27.8}$ (Avg = $Fa_{25.5\pm0.4}$; n=30), while orthopyroxene falls between $Fs_{21.0}Wo_{1.0}$ and $Fs_{23.4}Wo_{1.9}$ (Avg = $Fs_{21.9\pm0.2}Wo_{1.3\pm0.2}$; n=21). Shock features are mild. Olivine and orthopyroxene exhibit very slight undulose extinction, but olivine has no planar fractures. The meteorite exhibits no features of weathering in thin section.

Results on the bulk mineral mode, chemical and organic composition, and isotopes are forthcoming.

Conclusion: Dingle Dell is an L/LL ordinary chondrite, petrographic type 5 (based on Wo composition of OPX [3]) shock stage S2 [4] and weathering stage W0 [5]. This classification is an revision from what appears in Meteoritical Bulletin [6] due to new and updated analyses.

References: [1] Devillepoix et al., (2017) *This conference.* [2] Macke et al., (2017) *This conference*. [3] Scott E., et al. (1986) *JGR* **91**, E115–E123. [4] Stöffler D. et al., 1991, *GCA*, 55, 3845-3867. [5] Wlotzka, F. (1993) *Meteoritics* 28, 460. [6] Met. Bull., 106, in prep. (2017)