

C2054N “Bletchley”

Stardust Cratering Subgroup Foil report. 28 June 2006

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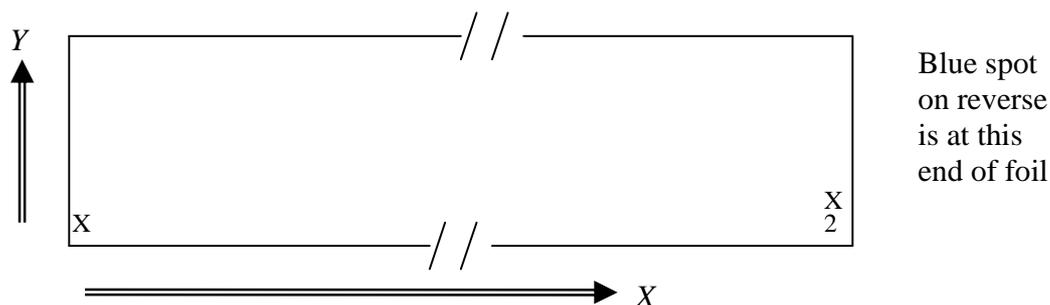
(1) General Information

General appearance: 33.35 x 1.13 mm.

- Less than 10% covered by grooves and damage or aerogel.
- Contamination is similar to that of Avebury. Grains of Ca-carbonate have been identified on the foil. Some of these appear to have been pressed into the foil. Other grains on the foil include traces of Na, S, Cl and Zn. Iron-rich patches are ubiquitous across the foil. In addition to this, Fe-rich grains a few microns in diameter are present within pits. These grains appear to be part of the foils which were exposed by the milling process. Aerogel is present, with some lumps up to 200 μm width.

Sample mounting: Held by Sn-coated restraining wires on custom Al holder.

Foil Coordinates: Fiducial marks, size 5 μm , milled by ion beam in foil near corners of long side:



All measured coordinates transformed to Coordinate system (X,Y) with origin at fiducial mark ‘X’ and X axis towards fiducial mark ‘X2’ Units of mm.

Crater surveys:

Quanta 200D Dual Beam FIB-SEM. D_c measurement accuracy checked with etched quartz graticule. Zeiss FEG SEM also used for some imaging with In-Lens images.

- Manual survey mosaic images taken of entire foil (LOWRES): secondary electrons 15 kV, 0.5 nA, x187 magnification, x1024 pixel resolution, 30 microseconds dwell time..
Area = 36.4 mm². Estimated complete to $D_c = 2\mu\text{m}$.
- Automated surveys of smaller areas (2 mm² and 3 mm²). 20 kV, 0.6 nA, x1000 magnification, secondary electrons, 2048 x 1792 pixel resolution, Kalman frame (3) averaging. Working distance 7 mm. Resolution limited by flatness of foil over sub-area.
SA1: Nominal 3 mm². Actual area used 2.03 mm² due to obscuration by wire and poor focus at one edge. Estimated complete to $D_c = 0.8\mu\text{m}$.
Corners (13.61, 1.06) (15.44, 1.08) (15.46, -0.07) (13.60, -0.08)
SA2: Nominal 2 mm². Actual area 2.17 mm². Estimated complete to $D_c = 0.7\mu\text{m}$.
Corners (10.38, 0.96) (12.49, 0.97) (12.50, -0.06) (10.39, -0.08).

EDX measurements:

15 kV, 75 s

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(2) Crater Location

LOWRES manual survey of entire foil.

Target completeness limit $D_c=5\mu\text{m}$. Estimated complete to $D_c=2\mu\text{m}$.

Coordinates reproducible to $\sim 0.1\text{mm}$ due to flexure of foil.

Randomly selected areas SA1 and SA2 to obtain completeness to $D_c\sim 1\mu\text{m}$.

Craters that also appear in LOWRES survey are cross-referenced.

41 separate craters identified.

LOWRES survey
9 craters

Crater	X (mm)	Y (mm)	D_c (μm)
1	20.63	0.84	12.0
2	-0.01	0.62	2.0
4	8.57	0.43	2.6
5	1.92	-0.13	1.7
6	20.50	0.50	1.6
7	17.05	0.19	1.3
8	16.96	0.23	1.4
9	13.20	0.03	1.7
10	12.09	0.30	2.8

SA1
12 craters

Crater	X (mm)	Y (mm)	D_c (μm)
101	14.86	1.04	0.6
102	14.50	0.99	0.8
103	14.67	0.92	0.8
104	14.40	0.85	0.8
105	15.21	0.72	1.1
106	14.48	0.54	0.9
107	14.13	0.59	0.7
108	15.16	0.47	0.7
109	14.07	0.39	0.7
110	14.13	0.30	0.6
111	13.74	0.26	0.5
112	14.42	0.07	0.8

SA2
21 craters

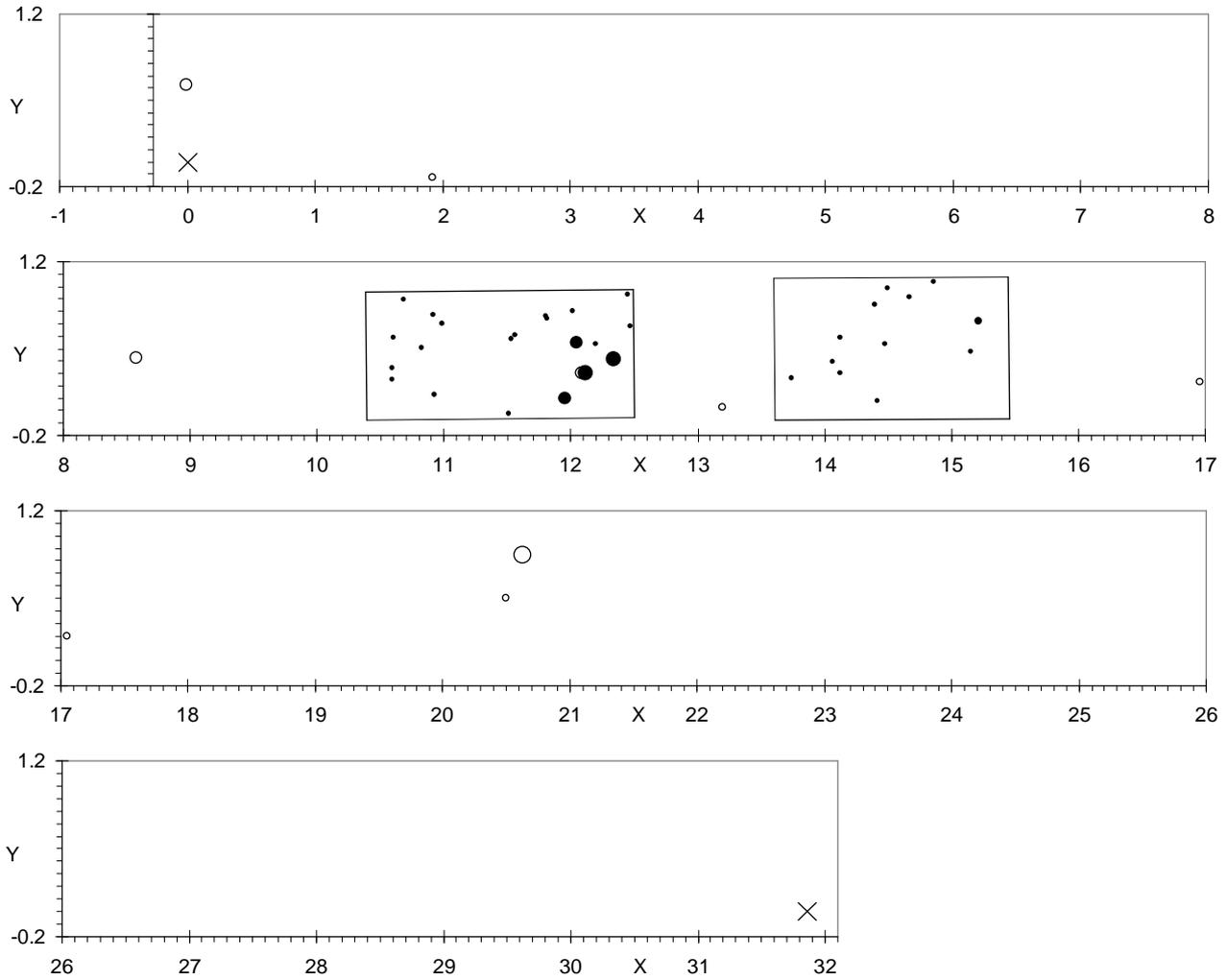
Crater	X (mm)	Y (mm)	D_c (μm)
113	12.45	0.93	0.6
114	10.68	0.89	0.7
115	12.01	0.80	0.7
116	11.81	0.74	0.7
117	11.80	0.76	0.7
118	10.91	0.77	0.6
119	12.47	0.68	0.6
120	10.98	0.70	0.7
121	12.20	0.53	0.7
122	12.05	0.55	1.2
123	11.54	0.57	0.6
124	11.56	0.61	0.6
125	10.83	0.50	0.6
126	10.61	0.59	0.5
127	12.34	0.42	2
128 = 10	12.12	0.30	2.7
129	10.59	0.35	0.5
130	10.59	0.25	0.6
131	11.96	0.10	1
132	10.92	0.13	0.7
133	11.51	-0.03	0.7

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(2) Crater Location (continued)

X indicates fiducial marks

Open circles are LOWRES survey craters, filled circles are sample area craters.



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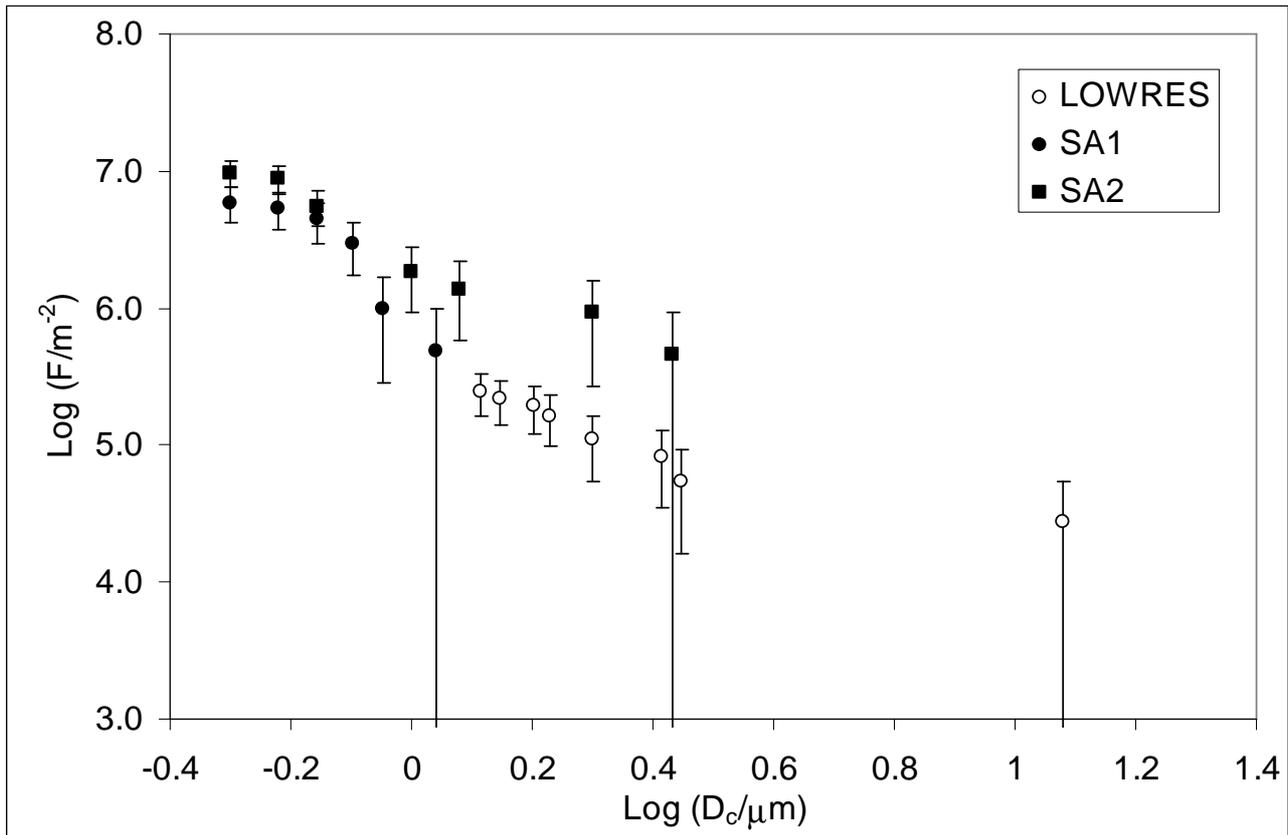
(3) Size distribution

Crater sizes are listed in crater location tables.

Size distributions plotted separately for each area scanned due to differing completeness limits.

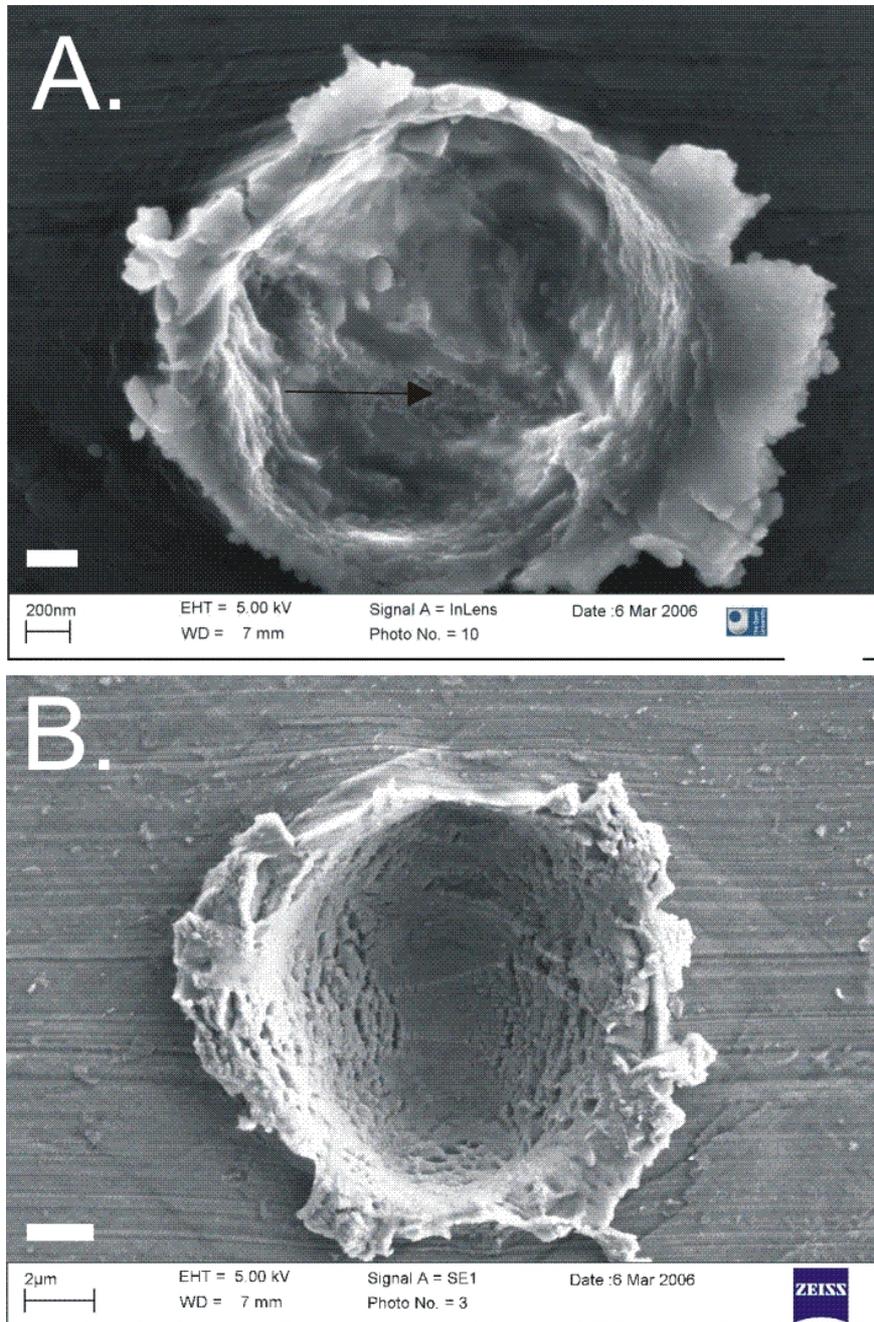
Crater distributions appear non-random on scales of a few mm

Error bars reflect counting statistics only.



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(4) Images



A. Crater #4. Scale bar 200 nm. Mg-Fe-Si residue visible, arrowed. B. Largest Crater , Crater #1. Scale Bar 2 μ m. Crater 1 is unusual in having no detectable residue. Both are In-Lens images (FEG SEM Zeiss Supra 55).

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(5) Composition

NB. A summary is given here. Quantitative analysis will be reported to the Min & Pet Sub-Group.

Crater	Elements detected	D _c (μm)
1	None *	12.0
2	Mg, Si	2.0
4	Mg, Fe, Si	2.6
5	Mg, Fe, Si	1.7
6	Mg, Si	1.6
7	Si	1.3
8	Fe, Si	1.4
9	Mg, Fe, Si	1.7

* Crater 1 is the only feature identified on any of our foils as an impact crater but with no identifiable residue. Could it possibly be a high speed interplanetary particle (elongated crater shape could be a result of significantly inclined impact direction)?