Ancient Monuments Laboratory Report 47/92

THE IDENTIFICATION AND ANALYSIS OF THE HAMMERSCALE FROM BURTON DASSETT, WARWICKSHIRE

A Mills and J G McDonnell

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Summary

Soil samples were taken from surfaces and features and outside the smithy. The inside magnetic susceptibility of the sample was measured. The samples were then processed to recover any flake and spheroidal hammerscale present. The quantity of hammerscale and magnetic susceptibility were compared; the distribution hammerscale inside of the and outside the smithy building was examined. The results were used to confirm the building as a smithy.

Authors' address :-

A Mills and J G McDonnell

Ancient Monuments Laboratory English Heritage 23 Savile Row London W1X 2HE © Historic Buildings and Monuments Commission for England The Identification and Analysis of the Hammerscale From Burton Dassett, Warwickshire.

By Alison Mills and Dr Gerry McDonnell

1 Introduction.

1.1 There are two morphological forms of hammerscale. The first is called flake hammerscale and is the iron oxide scale that forms on the surface of the iron being worked in a forge. Physical or thermal shock will break it off from the iron. After withdrawing the iron from the fire modern smiths will often tap it on the side of the anvil to dislodge this scale. Spheroidal hammerscale is believed to be the liquid slag that is trapped between two pieces of iron being fire welded together which is expelled as they are hammered together. In flight the scale will spherodise while liquid and freeze in the form of small balls.

The recovery of hammerscale is important in the investigation of early ironworking sites, since both forms will be scattered around the working area. Unlike the macro-slags (SSL and HB) they are not used as hard core etc. and therefore remain close to the smithy and slag dumps and do not become dispersed. The purpose of this work was to confirm or refute the identity of the building thought to be a smithy through the presence or absence of hammer scale. Further, that if it was confirmed as a smithy, to examine the distribution of the hammerscale to investigate the layout of the smithy. It is probable that a medieval smithy building would include domestic or living accommodation as well as the forge and working area. The project would also investigate the relationship between magnetic susceptibility of soil samples and the concentration of hammer scale in them.

1.2 Previous work

The term "smithy" encompasses a wide range of activities: the workshops of cutlers, farriers, itinerant and general smiths are all "smithies" although their work differs. Differences have already been noted between excavated smithies, for example, the rod-shaped blanks present at Coppergate, York (Ottaway 1992) had no parallels at Hamwih, Southampton (P Andrews pers. comm.). Ironworking debris, particularly hammerscale, is often recovered from environmental samples, but this is the first study in which samples were taken specifically to recover hammerscale.

Little detailed work has been carried out on the structure of hammerscale. Chemical and mineralogical analysis using a Scanning Electron Microscope were undertaken by McDonnell (1986), and Allen (1986) has suggested preliminary morphological guidelines and nomenclature.



Figure 1 Burton Dassett Plan of area J, showing N-S and E-W transect lines

2 Sampling Procedure.

The large quantity of slag recovered from around the building in Area J suggested that it was a smithy (Figure 1, see AM Lab Report Number 46/91). The building was excavated down to about floor level, although there was no clearly defined floor, e.g. a flagged floor. Samples of at least 200g of soil were taken at 50cm intervals in the central area of the smithy. Additional samples were taken from particular features such as the smithy walls and negative features both inside and outside the building. More samples were taken at 1m intervals on a 20m transect running south from the building and along a shorter east-west transect running 2m to the south of the building (Figure 1). These were used to establish any background level of hammerscale present on the site, and to examine the fall-off in the occurrence of hammerscale.

3 Analysis.

3.1 Selection of Samples.

Before analysis began, the plans of the site and sampling points were digitised. This information has been transferred into a database and integrated with the experimental results. Due to a shortage of time, it was not possible to analyse all the 208 samples taken. Attention was concentrated on samples from the smithy itself and from the north-south transect.

3.2 Experimental Procedure.

Each sample was placed in an oven at 70°C until dry and then crushed to break up the larger lumps of soil. A sub-sample of between 65 and 75g was weighed and its magnetic susceptibility measured. This portion was then broken down to extract any hammerscale it contained. The sample size was chosen as it was suitable for the magnetic susceptibility measurement and should also give reproducible quantities of each soil fraction up to a particle size of lmm. (Extrapolated from Mace, 1964 quoted in Shackley, 1975.)

The predominantly clay soil was broken down according to the standard procedure used by soil scientists: 300ml of nearly-boiling water was added to the sample, which was then allowed to stand for a few minutes. A little calgol sodium hexametaphosphate) was added to deflocculate the clay particles. Each sample was then placed in an ultrasonic bath for five minutes to disaggregate the soil and finally agitated for an hour in an end-over-end shaker.

The dispersed sample was subsequently sieved under running water using four sieves with mesh sizes of lmm, 500um, 250um and 90um respectively. Each sieved fraction was washed with distilled water, then with acetone and left to dry. The three larger fractions of each sample were weighed and separated into magnetic and non-magnetic portions using a strong magnet. In each case the weight of the magnetic fraction was measured.

Inspection of a few samples under a binocular microscope revealed that the non-magnetic fractions contain negligible quantities of hammerscale. The magnetic fractions contain particles of slag, fired clay and naturally magnetic minerals in addition to hammerscale. Certain samples from the 500um sieve were selected for further analysis. Particles from this sieve are large enough to be identified easily under a binocular microscope at x10 magnification and, given the sample size, are more likely to be representative than those from the lmm sieve. Forty-two samples, selected to cover the full range of magnetic susceptibilities measured, were separated under the microscope and the proportions of hammerscale, slag and other material making up the magnetic fraction noted.

4 Results

All measured values given in Table 1 and Appendix 1 (full data) have been standardised to an initial soil weight of 100g. In addition it should be noted that the "magnetic weight" mentioned below refers to the weight of magnetic particles extracted from the soil fraction in the 500um sieve i.e. particles in the range 500um to 1mm in size. The weight of this fraction has been used as an indication of the total amount of magnetic material present; smaller fractions are less easily handled or identified, whilst measurements from the larger fraction were not reproducible given the quantity of soil analysed. It is recognised however that larger magnetic particles may have caused the susceptibility measurements to be unrepresentative of the quantity of hammerscale in the smaller fractions.

Figure 2A shows magnetic susceptibility plotted against magnetic weight. There is a good correlation between these variables. However, the magnetic fraction of the soil is made up not only of highly magnetic hammerscale, but also fragments of slag, fired clay and naturally magnetic rock particles from the local ferruginous sandstone. As each of these materials possesses a different density and susceptibility it is to be expected that where hammerscale does not dominate, the ratio between magnetic susceptibility and weight of the magnetic fraction might vary. Expanding the lower part of Figure 2A to a larger scale (Figure 2B) shows that at low levels of magnetic susceptibility there is no longer as good a correlation with magnetic weight, however the trend is still present.

Forty-two samples were separated manually into the constituent magnetic materials, and the proportion of hammerscale present noted. Table 1 shows that high

magnetic susceptibilities and weights correlate with high proportions of hammerscale.

The majority of the hammerscale was in the form of flake hammerscale. Spheroidal hammerscale was present in most samples, but no method was devised to be able to quantify the different types. Options considered included counting and weight, but the overall quantities were too small and the errors would have been too large to achieve any valid results. Observations of hammerscale recovered from other sites also indicate that the quantity of flake hammer scale exceeds that of spheroidal hammerscale, both in weight and number.

4.1 Area outside the smithy.

Magnetic susceptibility readings outside the smithy ranged between 21 and 244 x 10^{-8} SI/kg, with the exception of samples from the area of the slag dump just south of the smithy (Contexts 2085 and 2171, maximum magnetic susceptibility 1510 x 10-8 SI/kg). The location of the transects is shown in Figure 1. There is no regular fall-off in magnetic susceptibility or in magnetic weight with distance; in fact readings from context 2107 at the extreme south of the excavated area are among the highest outside the smithy. Optical inspection of the magnetic fraction from this context revealed no hammerscale; the comparatively high readings are due to particularly high concentrations of fired clay in the area. No sample from outside the building contained more than 15% hammerscale.

4.2 Within the smithy.

There is a much broader range of readings of both magnetic susceptibility and magnetic weight within the smithy building, susceptibility ranging between 47 and 4018 x 10^{-8} SI/kg. A contour map (Figure 3) shows areas of high and low magnetic susceptibility. The contour map (Figure 4) of the magnetic weight fraction shows the same distribution which is to be expected as has already been shown (Figures 2A and 2B) there is a positive correlation between magnetic susceptibility and weight. These high magnetic susceptibility values also have a high weight of flake hammer scale (Table 1). The high values occur principally along the central part of the north wall of the building, in certain negative features within the building, and close to the central structure. Low values (comparable to those outside the building) occur at each end, particularly the east end, and inside the central structure. In general, however, both magnetic susceptibility and magnetic weight are higher inside the building than outside and these higher values are associated with higher proportions of hammerscale separated from the magnetic fractions.



Figure 2 A: Relationship between magnetic susceptibility and magnetic weight.

B: Low values on expanded scale.

		SA
Mag	netic susceptil	oility
100 units	100-200 units	200-300 units
300-	-1000 units 📓 > 100	00 units

Figure 3 Magnetic susceptibility contour plots within the smithy building



Figure 4 Magnetic weight contour plots within the smithy building.

5 Discussion.

All the results clearly demonstrate that there was a concentration of hammer scale around and in the building suggested as a smithy. This confirms the building as a smithy.

Within the smithy, high magnetic susceptibility correlates with high magnetic weight and a high proportion of extracted hammerscale. It seems, then, that the areas of high readings shown on the contour maps (Figures 3 and 4) give a true indication of hammerscale distribution. It is this distribution which must be explained.

It is to be expected that smithing residue should accumulate along wall-lines and slump into depressions, so the high readings corresponding to features such as context 2209 are not particularly significant. The aspects of the distribution which do require explanation are the area of uniformly higher readings in the central northern part of the building and the very low readings inside the central structure.

It is suggested that the central structure formed the focus of the smithing activity carried out within the building, that is, that the smith's hearth was situated here. This would explain the generally central distribution of hammerscale within the smithy. The lack of hammerscale in the immediate area may be explained by a comparison with surviving contemporary and historic smithing hearths and with depictions of hearths in early documents and carvings; such hearths were constructed at waist-level. The floor area immediately below the smithing operation would thus be protected from falling hammerscale, while immediately surrounding areas would receive the highest amount.

6 Conclusions.

This analysis of the distribution of hammerscale at Burton Dassett leads to several conclusions. Firstly, that the presence of hammerscale confirms that the building was a smithy.

Secondly, the high values found within the smithy suggest that magnetic susceptibility and analysis of the soil fraction between 500um and 1mm in size can give an indication of the presence of hammerscale, and thus of smithing activity.

Thirdly, that within the smithy, differences in the quantities of hammerscale recovered at floor-level suggest that the smithy floor was preserved, and thus that the well-defined distribution recovered bears some relation to the smithing activity.

Fourthly, analysis of the distribution leads to the suggestion that the hearth was centrally placed, and built at waist-height.

Fifthly, outside the smithy the quantity of hammerscale recovered is generally much lower, and shows no regular patterning. This may be due to the movement of hammerscale by trampling: however an insufficient number of samples were analysed from this area to draw any concrete conclusions. The wide variation in magnetic susceptibility measurements outside the smithy is due to local differences in the quantity of fired clay and other magnetic materials in individual contexts and bears little relation to hammerscale concentrations.

7 Suggestions For Further Work.

Further work should be carried out on the carefully sampled Burton Dassett material if it is to be of maximum use. The remaining sieved samples should be analysed, and all results correlated with the digitised plan. Detailed chemical and mineralogical analysis of the slags and hammer scale would also benefit our understanding of smithing slag formation processes.

In the future, further detailed technological analyses should be carried out in concert with excavation at other smithy sites. Sampling for technological information and the analysis of distribution should help establish guidelines for future excavation and analysis. A more detailed understanding of the formation and deposition of hammerscale on archaeological sites will aid the recognition of different types of smithy. It is necessary to find out how useful the experimental procedure developed here will be on sites with different soils (for example a sandy soil). In particular the potential of magnetic susceptibility measurements both on site and in the laboratory should be investigated further.

In terms of the possible identification of different types of smithing site, distributive and compositional analyses of hammerscale must be carried out hand in hand with analysis of other artefacts from the site, including finished items, slag and unidentified iron objects.

Table 1. Proportion of hammerscale in magnetic fraction from various contexts, ordered by north coordinate.

Sample	_	Sample Number
Sus/100	-	Magnetic Susceptibility per 100gms
Magwt/100	-	Magnetic Weight per 100gms
Flake%	-	Percentage of Flake Hammer Scale in Magnetic
		Fraction

8.1.Contexts outside the smithy

sample	sus/100	magwt/100	_ flake%
2107/0/5	215.20	.15	0
2151/0/3	114.56	.08	5
2176/0/1	68.37	.04	10
2175/0/2	129.01	.09	1
2175/0/16	244.26	.29	1
2171/0/1	103.69	.06	2
2085/0/2	1509.62	.53	10
2085/0/3	269.25	.14	10
2085/0/1	201.03	.17	10
2175/0/23	21.22	.02	0
2085/0/4	308.22	.06	2
2178/0/1	64.00	.03	15
2162/0/1	29.87	.01	10
2177/1/1	38.75	.04	0
2206/0/1	61.72	.03	10
2212/0/1	56.91	.03	10

2.2.Contexts inside the smithy.

sample	sus/100	magwt/100	flake%
2204/0/2	95.80	.13	15
2204/0/1	155.02	.15	25
2211/0/14	83.74	.05	30
2211/0/2	317.07	.13	5
2211/0/3	118.50	.11	10
2205/0/1	167.03	.10	20
2204/0/31	172.22	.10	30
2211/0/4	179.42	.09	15
2211/0/15	135.10	.07	10
2204/0/25	263.38	.26	30
2208/0/1	207.34	.13	15
2082/1/1	378.59	.16	10
2068/1/2	159.95	.07	40
2204/0/22	330.27	.20	40
2208/0/2	312.95	.14	25
2205/0/2	196.97	.10	30
2204/0/19	215.44	.16	30
2067/1/4	1083.65	.82	60
2197/1/1	126.49	.06	20
2069/1/1	576.92	.26	20
2207/0/4	47.17	.07	10
2204/0/13	140.27	.14	50
2067/1/2	218.95	.14	50
2168/0/3	1363.90	.83	60
2168/0/5	2675.49	1.78	50
2168/0/4	831.00	.49	55

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Appendix 1 Magnetic weights of each fraction for each analysed sample (1mm, 500 and 250 micron sieve sizes)

	coord	inates	weight of magnetic fraction per 100		per 100g dry soil	
Sample	East	North	1 mag/100	500mag/100	250mag/100	magsus/100
2067/1/1	741.466	971.016	3.14	1.19	1.33	1596.48
2067/1/2	741.443	972.136	0.49	0.14	0.13	218.95
2067/1/3	741.207	970.975	2.65	0.41	0.35	739.53
2067/1/4	741.725	971.077	4.26	0.82	0.69	1083.65
2068/1/2	743.550	970.978	0.29	0.07	0.10	159.95
2068/1/3	743.453	971.997	2.48	0.27	0.24	491.34
2068/1/4	743.145	971.868	0.58	0.23	0.20	326.22
2068/1/5	743.588	971.690	8.86	0.86	0.58	1468.23
2069/1/1	740.938	971.993	1.00	0.25	0.39	576.92
2069/1/2	740.948	971.465	0.72	0.16	0.16	228.98
2070/0/1	737.500	972.000	0.64	0.17	0.17	254.11
2070/0/2	737.500	971.000	0.93	0.14	0.17	294.53
2070/0/3	737.600	970.900	0.92	0.17	0.24	359.17
2082/0/1	742.916	970.969	1.22	0.16	0.24	378.59
2085/0/1	741.947	966.016	2.23	0.17	0.15	201.03
2085/0/2	743.970	966.005	6.85	0.53	0.50	1509.62
2085/0/3	744.977	966.008	3.17	0.14	0.09	269.25
2085/0/4	745.967	966.026	1.45	0.06	0.05	308.22
2086/1/1	739.581	969.521	0.05	0.06	0.12	190.50
2100/1/2	736.950	970.978	0.68	0.15	0.15	283.60
2100/1/1	736.950	971.993	0.34	0.09	0.12	203.72
2102/1/1	739.975	971.581	9.09	1.18	0.87	1894.84
2107/0/1	740.494	950.024	0.30	0.07	0.13	108.98
2107/0/2	740.486	951.041	0.31	0.12	0.12	124.52
2107/0/3	740.484	952.013	0.57	0.20	0.19	203.74
2107/0/4	740.484	952.971	0.65	0.15	0.17	167.59
2107/0/5	740.496	949.031	1.01	0.15	0.21	215.20
2107/0/6	740.468	948.019	0.52	0.17	0.17	232.16
2151/0/3	740.481	954.022	0.10	0.08	0.08	114.56
2162/0/1	732.451	966.250	0.10	0.01	0.02	29.87
2162/0/2	731.488	966.236	0.05	0.02	0.04	525.00

Sample	East	North	1 mag/100	500mag/100	250mag/100	magsus/100
2162/0/7	732.963	971.994	0.45	0.08	0.07	150.52
2162/0/3	730.500	966.250	0.14	0.03	0.03	46.60
2168/0/1	738.697	972.318	9.12	0.54	0.55	1482.89
2168/0/2	738.939	972.988	5.93	0.31	0.27	499.60
2168/0/3	740.513	972.480	6.54	0.83	0.65	1363.90
2168/0/4	740.493	973.022	3.17	0.49	0.63	831.00
2168/0/5	741.510	972.570	13.62	1.78	1.14	2675.49
2168/0/6	741.515	973.038	6.38	0.63	0.66	928.93
2171/0/1	746.946	965.996	0.33	0.06	0.05	103.69
2174/2/1	742.964	972.994	2.59	0.60	3.25	142.45
2175/0/1	740.465	957.034	0.22	0.09	0.10	138.19
2175/0/2	740.481	958.006	0.71	0.09	0.12	129.01
2175/0/3	740.470	959.002	0.27	0.06	0.04	61.49
2175/0/4	740.460	960.019	0.16	0.04	0.04	67.24
2175/0/5	740.457	960.998	0.16	0.03	0.04	39.39
2175/0/6	740.482	961.981	0.10	0.03	0.05	63.67
2175/0/7	740.464	963.006	0.09	0.04	0.03	36.06
2175/0/16	736.460	964.018	2.08	0.29	0.18	244.26
2175/0/17	736.475	963.010	0.04	0.03	0.01	23.57
2175/0/18	736.467	962.011	0.03	0.03	0.02	30.20
2175/0/19	736.458	961.012	0.38	0.10	0.06	112.99
2175/0/21	739.818	964.665	0.11	0.07	0.08	191.15
2175/0/22	739.955	965.994	0.07	0.03	0.03	50.26
2175/0/23	740.956	966.020	0.06	0.02	0.01	21.22
2176/0/1	740.467	954.999	0.04	0.04	0.04	68.37
2176/0/2	740.470	956.005	0.15	0.05	0.04	62.20
2177/1/1	739.461	966.256	0.06	0.04	0.02	38.75
2177/1/2	738.470	966.250	0.07	0.02	0.03	42.32
2177/1/3	737.500	966.266	0.53	0.08	0.08	120.48
2177/1/4	735.458	966.254	0.65	0.07	0.09	149.92
2177/1/5	736.467	965.963	0.23	0.04	0.05	71.36
2178/0/1	734.781	966.235	0.17	0.03	0.04	64.00
2197/1/1	745.443	971.986	0.32	0.06	0.09	126.49
2202/0/1	739.828	964.700	1.79	0.33	0.38	892.86
2204/0/1	736.944	969.288	0.11	0.15	0.16	155.02
2204/0/2	737.439	969.271	0.28	0.13	0.07	95.80

Sample	East	North	1 mag/100	500mag/100	250mag/100	magsus/100
2204/0/3	737.953	969.159	0.24	0.14	0.13	178.16
2204/0/4	738.467	969.105	0.24	0.14	0.11	146.59
2204/0/5	737.966	971.952	0.40	0.08	0.05	78.58
2204/0/6	737.962	972.460	0.29	0.14	0.15	192.34
2204/0/7	738.478	971.516	0.41	0.11	0.05	171.89
2204/0/8	738.465	972.026	0.56	0.15	0.14	195.32
2204/0/9	738.966	969.016	0.26	0.11	0.11	177.06
2204/0/10	739.447	968.970	1.17	0.44	0.41	647.28
2204/0/11	738.942	971.010	0.41	0.18	0.19	290.14
2204/0/12	738.964	971.504	0.30	0.10	0.10	157.25
2204/0/13	738.954	972.007	0.36	0.14	0.10	140.27
2204/0/14	739.449	969.999	0.05	0.06	0.04	59.96
2204/0/15	739.444	970.488	0.38	0.12	0.10	215.54
2204/0/16	739.459	971.006	0.35	0.21	0.20	266.35
2204/0/17	739.422	971.499	0.77	0.23	0.21	292.26
2204/0/18	739.436	972.009	0.19	0.09	0.10	116.43
2204/0/19	739.963	971.004	0.32	0.16	0.12	215.43
2204/0/20	739.942	971.994	1.35	0.20	0.22	324.93
2204/0/21	740.460	970.506	0.31	0.09	0.08	127.63
2204/0/22	740.440	970.986	0.58	0.20	0.17	330.27
2204/0/25	740.948	970.011	0.76	0.26	0.20	263.38
2204/0/27	740.968	971.007	0.31	0.16	0.21	305.65
2204/0/29	741.456	970.010	0.53	0.19	0.24	369.08
2204/0/30	741.951	969.995	0.43	0.25	0.29	466.10
2204/0/31	742.953	969.996	0.67	0.10	0.12	172.22
2205/0/1	737.961	969.989	0.37	0.10	0.11	167.03
2205/0/2	737.955	970.998	0.24	0.10	0.13	196.97
2205/0/3	738.466	970.998	0.24	0.19	0.19	314.52
2205/0/4	738.967	970.519	0.43	0.11	0.12	170.09
2206/0/1	740.458	967.015	0.05	0.03	0.04	61.72
2206/0/2	740.450	967.994	0.10	0.04	0.10	146.47
2207/0/1	742.125	971.003	0.49	0.14	0.18	255.42
2207/0/2	741.974	971.484	0.18	0.10	0.17	201.16
2207/0/3	742.455	971.493	0.32	0.11	0.14	141.34
2207/0/4	741.980	971.994	0.17	0.07	0.05	47.17
2207/0/5	742.421	971.997	0.21	0.04	0.04	54.31

Sample	East	North	1 mag/100	500mag/100	250mag/100	magsus/100
2207/0/6	742.949	970.519	0.07	0.04	0.07	88.48
2207/0/7	742.947	971.469	0.07	0.10	0.10	135.57
2207/0/8	742.975	971.991	0.13	0.01	0.01	58.94
2207/0/9	742.936	972.491	0.17	0.06	0.07	109.58
2208/0/1	743.964	970.499	0.40	0.13	0.12	207.34
2208/0/2	743.960	970.989	0.67	0.14	0.19	312.95
2208/0/4	743.920	972.011	0.97	0.07	0.08	164.88
2208/0/5	744.433	970.512	0.63	0.05	0.08	157.07
2208/0/8	744.440	971.998	0.28	0.07	0.08	116.52
2208/0/9	744.990	970.488	0.63	0.09	0.15	198.21
2208/0/11	744.945	971.496	0.14	0.07	0.08	122.92
2208/0/12	744.948	971.997	0.29	0.04	0.07	142.16
2208/0/14	745.441	970.995	0.18	0.04	0.07	141.93
2209/1/1	742.500	970.500	12.00	2.07	1.77	4018.34
2210/1/1	742.474	969.811	1.08	0.17	0.21	359.00
2211/0/1	743.975	970.007	1.11	0.23	0.17	352.79
2211/0/2	743.969	969.501	1.16	0.13	0.15	317.07
2211/0/3	744.463	969.510	0.39	0.11	0.07	118.50
2211/0/4	744.469	970.007	0.24	0.09	0.12	179.42
2211/0/5	744.965	969.514	0.60	0.30	0.27	246.21
2211/0/6	744.971	970.000	0.59	0.23	0.15	202.16
2211/0/7	745.487	969.515	0.22	0.06	0.09	136.56
2211/0/10	745.926	969.992	0.20	0.08	0.10	158.13
2211/0/12	745.933	970.993	0.46	0.11	0.10	142.08
2211/0/13	745.919	971.555	0.20	0.08	0.10	130.96
2211/0/14	746.421	969.497	0.08	0.05	0.08	83.74
2211/0/15	746.424	970.007	0.19	0.07	0.07	135.10
2211/0/16	746.412	970.526	0.70	0.09	0.10	176.43
2211/0/17	746.446	971.006	0.10	0.04	0.07	105.69
2211/0/18	746.465	971.484	0.09	0.05	0.08	86.41
2212/0/1	744.960	967.489	0.14	0.03	0.04	56.91
2214/1/1	740.273	969.995	4.59	0.67	0.76	1281.04
2215/0/1	746.966	969.516	0.74	0.21	0.25	376.25