Interpretation of JMHS excavation assemblage

The earliest ironwork was from Phase 2, although as noted above some of it may well be intrusive. There were four nails and two pieces of ironwork with agricultural associations: a sickle and the collar for some form of tool. The following phase, Phase 3, indicated an increase in the discard of nails, in particular; most of which was in pits. Some fragments of scrap and iron wire were also disposed of, as well as the iron buckle pin.

The majority of the metalwork recovered during the excavation, comprising 95 pieces, dated from Phase 4 or later, and came from the metalled surfaces to the north (34 pieces), east (4 pieces) and south (19 pieces) of the Structure 4 smithy. A further 11 pieces came from within the smithy – three from around the anvil-setting – and five from the wall-footing 185. Four nails were recovered from the wall-footings stub 430 of Structure 5.

Only three fragments came from the midden areas, although this may be in part a consequence of sampling policy; nevertheless the rubbish pits on the southeast side of the excavation area also yielded only three pieces of metalwork. This material can only be dated as Phase 4 – 13th century – or later. It is very probable that indeed the majority of this assemblage is in fact end of Phase 5 – mid 13th to 14th century – into Phase 6 – 15th century – although clearly smaller items such as horseshoe nails might have lodged between stones at any point.

There were not many such nails, although the small quantity recovered, as well as the shoes, indicates that a farrier used the smithy. As the manor served to provide for Canterbury scholars at Oxford and records indicate that monks from Canterbury made visitations into the 14th century to the manor as accounting exercises, it is unsurprising that horseshoes, shoe-nails, horse-gear and spurs were recovered from in and around the intervention areas.

The other ironwork might indicate either re-use of iron or modification of older objects. The relative paucity of objects complements the relatively small quantity of slag recovered from this period of use.

The Phase 5 material comprises a total of nine objects from four features: two ditches – 369 and 468, a gully 144/398 and pit 485. The assemblage was dominated by nails with ditch 369 yielding an oxshoe, a hinge pivot and a punch. The pit 494 dominated the Phase 6 assemblage comprising nails, scrap iron and a fragment of knife blade. The subsoil (102) yielded five objects: three nails and, a staple and a tanged knife blade.

The results of the excavation demonstrated a clear predominance of vernacular, domestic metalwork such as wood nails, horseshoe nails, with some particular metalworking tools – the punches – and two awls, which could function either for leatherworking, or indeed for woodworking.

The knife blades were possibly scrap metal for re-use, either as raw materials or to be reworked as knives. The notable finds include the sword chape, the spur rowel and the copper alloy suspension mount. The presence of these finer objects is reasonably unusual, although again it is more than likely that they may well comprise scrap metal for recycling.

It is possible that the nails from the Phase 4 or later external surfaces might be associated with dismantlement of the smithy after Phase 5, which appears to represent the last period when it was in use. During Phase 6 a large pit was dug to the south of the smithy, through the external metalling, suggesting that the building had already fallen out of use, and perhaps memory.

Despite the monastic connections of the manor with Canterbury and Oxford, the metalwork does not show any particular affinity with either city, although as noted above the horse-gear could easily be associated with visitations by Canterbury clerics reckoning accounts or merely stopping over en route to Oxford. As noted above in the historical background the limited documentary research means that it is not possible to be certain whether the manor was managed directly by Canterbury or farmed out to a tenant. Without this knowledge, the precise nature of the assemblage remains slightly obscure.

SOAG investigation

The small excavation trench carried out by SOAG yielded a range of similar finds to that recovered by JMHS. The SOAG trench was initially gridded using two numbers for the north/south co-ordinates and two numbers for the east/west for each grid square. However, it was not possible to ascertain the relationship of many finds to the features identified as there was no height taken on the finds spot.

Although no direct relationship can be made within the stratigraphic sequence, the ironwork and pottery can be associated. The date range for pottery from the SOAG intervention was heavily weighted to the excavation Phases 3 and 4, and can be said to be contemporary with the Structure 4 smithy and the succeeding phase of use. As a consequence, it is best practice to summarize the metalwork finds as a comparable group of material to the JMHS excavation, all the time aware of its limits as an assemblage.

The same broad categories of ironwork were represented as in the main excavation area. There was a marginally larger assemblage of objects which might be identified with metal-working, comprising one hot chisel, six punches and 24 bits of scrap and iron wire; furthermore a third awl was recovered from the SOAG excavation trench. Why these should be located at some small distance from the smithy is not readily apparent, although it is possible that the building partially excavated by SOAG was part of the smithing complex. An alternative explanation being, of course, that this structure was another craft building.

There were 26 nails, a bolt and a staple representing architectural ironwork; all of these could equally be from the building investigated as discard, or indeed dismantling. A further example of a key was also recovered, although it is not easy to make any unequivocal association with the building.

The farming-related assemblage included three horseshoes and a horseshoe nail as well as one oxshoe. It is interesting to note that there was one rowel spur (Fig. 35.6), lacking the rowel also recovered during the SOAG investigations.

The material from the SOAG investigation clearly complements that from the JMHS excavation, although too much weight cannot be given it, as the contextual information is not sufficiently complete. Nevertheless it forms an interesting and important adjunct to the main data recovered during the excavations by JMHS.

Metalworking/craft tools

Three was a small tool assemblage from the JMHS excavation which can be identified as being related to smithing activities. Some of this was fragmentary with many of the objects being quite corroded. The assemblage comprised four punches (**41**, **56**, **93** & **95**) – which were used in a range of industries, including wood and leather working; two awls (**39** & **40**) – which may have been for metalworking, or equally for other craft activities; and a small quantity of iron wire and scrap iron, which due to their potential to be related to smithing have been included in this section.

39. Awl, (506) – metalling E of S4; Phase 4; L=83mm; 10g. Rusted, rectangular in section, all sides tapering to one end, the point of which is missing (Goodall 2011, Fig. 6.3 E49-52, E55; Pritchard 1991, Fig. 3.16:30).

40. Awl, (493) – pit 494; Phase 6; L=60mm; 8g. Rusted, rectangular in section, all sides tapering to one end, the point of which is missing (Goodall 2011, Fig. 6.3 E49-52, E55; Pritchard 1991, Fig. 3.16:30).

41. Punch, (368) – ditch 369; Phase 5; L=93mm; 22g. Encrusted with rust, rectilinear in section, all sides tapering to blunt point (Goodall 2011, Fig. 2.6 A61-62; Pritchard 1991, Fig. 3.13:23).

56. Punch, (190) – metalling S of S4; Phase 4; L=76mm; 19g. Encrusted with rust and soil. All sides tapering to a point (Goodall 2011, Fig 2.6 A56-58; Pritchard 1991, Fig. 3.13:23).

93. Punch, (331) – metalling N of S4; Phase 4; L=109mm; 23g. Encrusted with rust and soil. All sides tapering to a point (Goodall 2011, Fig 2.6 A56-58; Pritchard 1991, Fig. 3.13:23).

95. Punch, (331) – metalling N of S4; Phase 4; L=130mm; 18g. Encrusted with rust and soil. All sides tapering to a point (Goodall 2011, Fig 2.6 A56-58; Pritchard 1991, Fig. 3.13:23).

A small number of pieces of iron were recovered which have been identified as iron wire – **32**, **62**, **120**, **154** – as well as a number of fragments of iron potentially comprising scrap for reworking – **4, 45**, **61**, **104**, **117**, **152** – which have been designated such, due to their having few or no formal attributes.

Architectural ironwork

The architectural metalwork assemblage consisted predominantly of iron nails. Many of these were too fragmentary, corroded and encrusted with rust to determine the processes employed in their production. Most of the nails were sufficiently intact to indicate that they were hand wrought, with all sides tapering to a point. Six hinge pivots (**21**, **33**, **34**, **52**, **54** & **102**) in addition to three U-shaped staples (**7**, **42** & **47**), two links (**14** & **94**), a locking pin (**96**) and a looped hook (**101**) were also recovered.

The hinges would have been used for windows or doors, the staples, links and hook for a range of hanging and fixing tasks to wood or to daub walls – although the links might be from chains – and the locking pin for bolting doors.

7. Staple, (336) – metalling N of S4; Phase 4; L=57mm, W=35mm, 25g. U-shaped, heavily encrusted with rust. One arm broken, the other tapering to a rounded point (Goodall 2011 Fig. 9.3 H29-34).

14. Ring/link, (336) – metalling N of S4; Phase 4; L=80mm, 34g (Goodall 2011, Fig. 11.15 J204).

21. Hinge Pivot, (190) - metalling S of S4; Phase 4; L=112mm, 78g. Heavily encrusted with rust. Broken hook rises from end of shank (Goodall 2011, Fig 9.15 H353).

33. Hinge fragment, (188) – Anvil; Phase 4; L=36mm, 4g. Heavily encrusted with rust. Remnant nail hole (Goodall 2011, Fig 9.23 H509-510)

34 Hinge fragment, (188) – Anvil; Phase 4; L=33mm, W30, 12g. (Goodall 2011, Fig 9.21 H438)

42. Staple, (102) – subsoil; Post Phase 6; L=49mm, 16g. U-shaped, heavily encrusted with rust. Both arms broken (Goodall 2011, Fig. 9.6 H117, H120).

47. Staple, (538) – pit 539; Phase 3; L=46mm, W=32mm, 20g. U-shaped, heavily encrusted with rust (Goodall 2011, Fig 9.6 H107-126).

52. Hinge terminal, (190) – metalling S of S4; Phase 4; L=68mm, 28g. Elongated and with a rounded point. Remnant of upturned eye (Goodall 2011, Fig 9.23 H509-51).

54. Hinge pivot, (190) – metalling S of S4; Phase 4; L=62mm, 20g (Goodall 2011, Fig 9.16 H378).

94. **Link,** (331) – metalling N of S4; Phase 4; L=42mm, 8g (Goodall 2011, Fig. 11.15 J204).

96. Locking pin, (331) – metalling N of S4; Phase 4; L=156mm, 119g. Heavily corroded pin or bolt for fastening a door shut; associated with remnant chain link, found in pierced hole through termination of pin. No other example has been found in the literature.

101. Looped hook, (461) – floor; Phase 4; L=78mm, 27g. Highly encrusted with rust (Goodall 1993, 155, Fig. 114 1225).

102. Hinge pivot, (475) – ditch 369; Phase 5; L=52mm, 8g (Goodall 2011, Fig. 9.12 H262-287).

Assorted nails
There were a number of nails and nail fragments – 71 in number, weighing 507g – which were recovered during the excavation. These are detailed below in Table 11.
1, 10, 22, 85, 87, 88, 92, 98, 99, 100, 103, 105, 106, 107, 108, 109, 110, 111, 112, 114, 115, 116, 119, 121, 122, 123, 124, 126, 127, 129, 130, 131, 132, 133, 134, 136, 137, 138, 139, 140, 141, 142,143, 145, 146, 147, 148, 150, 151, 156, 157, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 173,174, 175, 176.

Key

A single key (**18**) was recovered. This key can be dated typologically to the medieval period.

18. Iron Key (*Fig. 35.8)*, (317) – metalling N of S5; Phase 4; L=58mm, 14g. Forged from rectangular sheet iron with rounded bow. Shank is solid. (Goodall 2011, Figs 10.24 I398 - 10.25 I451).

Domestic metalwork

Many of the knife blades recovered during excavation were highly fragmentary and corroded. In the majority of cases it was difficult to ascertain knife type (**3**, **38**, **44**, **55**, **57**, **58** & **86**). A single whittle tang knife blade (**35)** was identified where both the back and cutting edge of the blade tapered to the tip. Knives of this type have been found in numerous archaeological contexts from the 12th century into the post-medieval period (Goodall 1993, 124-5). The remainder of the assemblage consisted of partial blades of an indeterminate type.

A single slotted spoon (**19**; Fig. 35.1) was also recovered. This was fragmentary but pierced holes in the end and base of the bowl could be identified. Perforated spoons were used to remove fat from the top of stews, but these tend to be much larger in size and fixed to a long wooden handle.

3. Knife tang, (336) – metalling N of S4; L=62mm, 14g. Encrusted with rust. Blade broken. Tang 12mm in width. Sides straight and parallel, then coming to a blunt point (Goodall 2011, Figs 8.20 G307; 8.21 G313).

19. Slotted spoon *(Fig. 35.1)*, (317) – metalling N of S5; Phase 4; L=82mm, 14g. Encrusted with rust. 82mm in length with pierced holes in the end and base of the bowl (Goodall 2011, Fig. 11.5 J37).

35. Whittle tang Knife blade, (102) – subsoil; post Phase 6; L=154mm, 49g. Encrusted with rust. Blade and tang broken. Back and cutting edge both taper to the tip. Knives of this type have been found in numerous archaeological contexts from the 12th century into the post-medieval period (Goodall 1993, 124-5; Goodall 2011, Fig. 8.2 G84, G95).

38. Partial knife blade, 185 – wall of S4; Phase 4; L=522mm, 13g. Encrusted with rust. Whittle tang attached (Goodall 2011, Fig 8.18 G257-260).

44. Partial knife blade, (493) – pit 494; Phase 6; L=51mm, 8g. Encrusted with rust. Whittle tang attached (Goodall 2011, Fig. 8.7 G4).

55. Knife blade (190) – metalling S of S4; Phase 4; L=71mm, 17g. Fragment, encrusted with rust (Goodall 2011, Fig 8.18 G257-260).

57. Knife blade (190) – metalling S of S4; Phase 4; L=30mm, 6g. Fragment, encrusted with rust (Goodall 2011, Fig 8.8 G41).

58. Knife blade (317) – metalling N of S5; Phase 4; L=40mm, 6g. Tip fragment, heavily encrusted with rust. Roughly 'D' shaped in section (Goodall 2011, Fig. 8.9 G63, G66).

86. Knife blade (424) – abandonment deposit; Phase 4; L=81mm, 21g. Fragment, encrusted with rust and highly fragmentary (Goodall 2011, Fig 8.7 ff).

Personal adornment items

An iron (**53**) and two copper alloy (**31** & **89**) buckles, a copper alloy hooked wire fastener (**17**) and an iron buckle pin (**43**) were recovered during the excavation. A single fragment of copper alloy plate (**90**) was also identified.

17. Double hooked wire fastener *(Fig. 35.2)*.(335) – metalling N of S4; Phase 4; L=30mm, 1g. Coiled copper alloy wire forming a double link from an item of jewellery or clothing (Margeson 1993, Fig. 9.88 (although undated); Goodall 1979, 111, Fig. 56.25 – central twisted part of copper fastener).

31. Buckle, (336) – metalling N of S4; Phase 4; L=25mm × W=20mm, 2g. Trapazoidal framed two-sided copper alloy buckle, snapped in half (originally rigid) with hinge for revolving pin arm (pin missing) and ridged decoration where pin would have sat. Buckles of this shape are known from the medieval period (Clay 1981, Fig 50.66 (in iron)).

43. Buckle pin, (326) – pit 327; Phase 3; L=22mm; 5g. Curved fragment of possible buckle pin in iron. Encrusted with rust (Goodall 1993, Fig 16.168, 170).

53. Buckle, (190) – metalling S of S4; Phase 4; L=52mm, 14g. Encrusted with rust. Oval in shape (Goodall 2011, Fig 12.4 K54).

89. Buckle *(Fig. 35.3)*. (511) – pit 510; Phase 4; L=25mm × W=20mm, 5g. Copper alloy D-shaped buckle with moulded knops. Similar to examples from Goltho (Beresford 1975, 91-2) and a buckle dated from 1275-1400 found during the Norwich Survey excavations (Goodall 1993, Fig 13.130-132).

90. Plate, (229) – gully 230; Phase 3; L=31mm × 19mm, 17g. Copper alloy plate with small plug for fixing it to another material such as wood or bone.

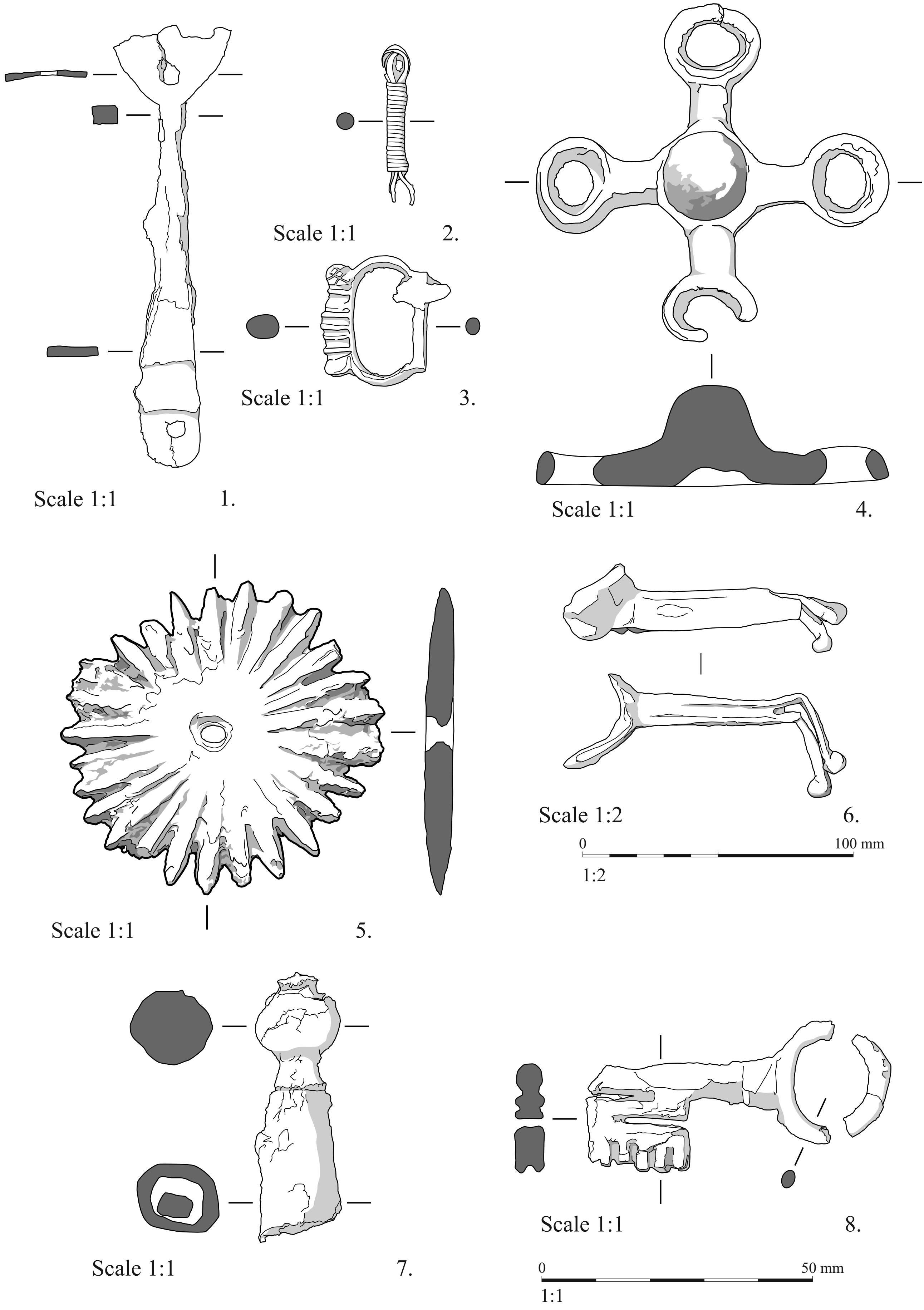


Figure 36. Selected metalwork.

Horse equipment

The horse equipment assemblage consisted of an iron rowel spur (**50** in SOAG section), a gilt iron spur rowel (**15**), a harness fitting (possibly a suspension mount) (**12**), a horse shoe (**26**) and horseshoe nails.

12. Suspension mount *(Fig. 35.4)*, (336) – metalling N of S4; Phase 4; L=66mm × W=63mm, 56g. Cruciform, with arms of near-equal length ('D' shaped in section), with domed boss at the central crossing of arms, terminating in pierced lobes. Suspension mounts were generally made from copper alloy and held decorative pendants suspended from the harness (Clark 2004, 62). A similarly cruciform mount was recovered in Norfolk (PAS record number: NMS-6FD2A2), although very different in decoration.

15. Iron spur rowel *(Fig. 35.5)***,** (320) – metalling N of S4; Phase 4; D=60mm, 45g. Encrusted with rust, although following cleaning traces of gilt are apparent. Originally 26 points separated only at their tips. The ovoid attachment point is 5mm in diameter. Large rowels of this type were popular during the second half of the 14th century (Ellis 1993, 223, Fig. 170.1805 citing Byrne 1959, 106-115; Clark 2004, 147, Fig. 106.361). It is worth noting the presence of a rowel spur from the SOAG intervention (see below).

26. Possible horse shoe (467) – midden deposit; Phase 4; L=95, 48g. Broken horseshoe, curved with one end tapering significantly, the other with a rounded termination (Goodall 2011, Fig 13.4 L19, L21).

Horseshoe nails
2, 5, 6, 8, 9, 11, 113, 118, 125, 128, 135, 144, 149, 153, 155, 158,
All the nails, except for find numbers 6 and 9, were type B (Goodall 2011, 364, Fig. 13.1). The exceptions were type D (*ibid*). Details in Table 11.

Farming equipment

A small assemblage of farming related finds were made including oxshoes (**20** & **59**), collars and fixings (**23**, **63** & **91**) and a sickle-blade (**60**) were recovered during the excavation.

20. Oxshoe, (317) – metalling N of S5; Phase 4; L=110mm, 101g. Broken and tapering slightly through wear (Goodall 2011, Fig. 13.4 L30, L32).

23. Collar, (207) – ditch 208; Phase 2; D=40mm, 64g. Circular collar, encrusted with rust and soil. (Goodall 2011, Fig 11.18 J298).

59. Oxshoe (475) – ditch 369; Phase 5; L=73mm, 47g. Fragment, tapering slightly towards one end (Goodall 2011, Fig. L32).

60. Sickle-blade, (385) – ditch 208; Phase 2; L=100mm, 55g. Curved and tapering towards terminals. Rounded terminal, distal end broken (Goodall 2011, Fig 7.9).

63. Socket for agricultural? tool, (319) – midden deposit; Phase 4; L=88mm × W=43mm, 190g. Folded sheet iron forming a hollow cylinder through which the handle would have been attached.

91. Collar, (331) – metalling N of S4; Phase 4; L=185mm × W=150mm, 808g. Roughly oval in shape, although also incomplete (Goodall 2011, Fig. 11.18 J285-286)

Weaponry

A single chape (**16**) was recovered during excavation. A chape was used to protect the tip of a sword when stored in a scabbard. No other items of weaponry were recovered.

16. Chape *(Fig. 35.7),* (335) – metalling N of S4; Phase 4; L=52mm, 22g. Hollow body produced by rolled sheet iron, tapering to a bulbous finial with a protruding flattened knob. Some remnant nonferrous plating/gilt on exterior. Probably dates from the mid to late medieval period based on similar examples (e.g. PAS record number: NCL-47E6D6 and PAS record number: LEIC-358205).

Find	Context	Frag count	Dims (mm)	Wt (g)	Comments	Date/ Phase	Feature	Reference
1	331	1	L=15	6	Nail	4	metalling N of S4	
2	336	1	L=27	6	Horseshoe nail; Type B	4	metalling N of S4	Goodall 2011, 364, Fig. 13.1
4	336	1	L=31	5	Scrap iron	4	metalling N of S4	
5	336	1	L=25	3	Horseshoe nail; Type B	4	metalling N of S4	Goodall 2011, 364, Fig. 13.1
6	336	1	L=25	1	Horseshoe nail; Type D	4	metalling N of S4	Goodall 2011, 364, Fig. 13.1
8	336	1	L=31	6	Horseshoe nail; Type B	4	metalling N of S4	Goodall 2011, 364, Fig. 13.1
9	336	1	L=41	3	Horseshoe nail; Type D	4	metalling N of S4	Goodall 2011, 364, Fig. 13.1
10	336	1	L=10	3	Nail fragments	4	metalling N of S4	
11	336	1	L=45	5	Horseshoe nail; Type B	4	metalling N of S4	Goodall 201, 364, Fig 13.1
22	194	1	L=15	14	Nail; type 10	6	internal abandonment	Goodall 2011, 164; Fig 9.1
32	188	1	L=74	11	Bar iron	4	Anvil	
45	493	1	L=45,	11	Scrap iron	6	494	
61	493	1	L=52, 50 and 28	15	Scrap iron	6	494	
62	336	1	L=98,	5	Bar iron	4	metalling N of S4	
85	424	1	L=42	5	Nail; type 1	4	abandonment deposit	Goodall 2011, 164, Fig. 9.1
87	457	1	L=58	10	Nail; type 10	4	558	Goodall 2011, 164, Fig. 9.1
88	491	1	L=40	8	Nail; type 10	4	492	Goodall 2011, 164, Fig. 9.1
92	331	1	L=125	35	Nail; type 7	4	metalling N of S4	Goodall 2011, 164, Fig. 9.1
98	506	1	L= 50	11	Nail; type 1	4	metalling E of S4	Goodall 2011, 164, Fig. 9.1
99	506	1	L=43	7	Nail; type 8	4	metalling E of S4	Goodall 2011, 164, Fig. 9.1
100	373	1	L=67	14	Nail; type 6	3	230	Goodall 2011, 164, Fig. 9.1
101	461	1	L=78	27	Looped hook	4	Floor	Goodall 1993, 155, Fig. 114 1225
102	475	1	L=52	8	Hinge pivot	5	369	Goodall 2011, Fig. 9.12 H262-287
103	538	1	L=67	17	Nail; type 10	3	539	Goodall 2011, 164, Fig. 9.1
104	538	1	L=50	15	Scrap iron	3	539	Goodall 2011, 164, Fig. 9.1
105	538	1	L=49	8	Nail; type 6	3	539	Goodall 2011, 164, Fig. 9.1
106	331	1	L=38	5	Nail; type 1	4	metalling N of S4	Goodall 2011, 164, Fig. 9.1
107	331	1	L=42	4	Nail; type 1	4	metalling N of S4	Goodall 2011, 164, Fig. 9.1
108	331	1	L=58	4	Nail; type 3	4	metalling N of S4	Goodall 2011, 164, Fig. 9.1
109	399	1	L=27	4	Nail; type 1	5	398	Goodall 2011, 164, Fig. 9.1
110	399	1	L=36	3	Nail; type 1	5	398	Goodall 2011, 164, Fig. 9.1
111	129	1	L=22	4	Nail; type 3	2	106	Goodall 2011, 164, Fig. 9.1
112	458	1	L=43	6	Nail; type 10	4	558	Goodall 2011, 164, Fig. 9.1
113	462	1	L=15	4	Horseshoe nail; Type B	4	Floor	Goodall 2011, 364, Fig. 13.1
114	462	1	L=22	2	Nail fragments	4	Floor	Goodall 2011, 164, Fig. 9.1
115	462	1	L=43	6	Nail fragments	4	Floor	Goodall 2011, 164, Fig. 9.1
116	462	1	L=39	4	Nail fragments	4	Floor	Goodall 2011, 164, Fig. 9.1
117	462	1	L=7	1	Scrap iron	4	Floor	
118	423	1	L=42	3	Horseshoe nail; Type B	3	130	Goodall 2011, 364, Fig. 13.1
119	474	1	L=28	2	Nail; type 3	5	468	Goodall 2011, 164, Fig. 9.1
120	450	1	L=59	5	Bar iron	3	120	
121	430	4	L=26, 37, 26 & 20	11	4 x nails	4	wall stub	Goodall 2011, 164, Fig. 9.1
122	504	1	L=30	7	Nail; type 10	3	505	Goodall 2011, 164, Fig. 9.1
123	357	1	L=36	2	Nail; type 6	3	505	Goodall 2011, 164, Fig. 9.1
124	265	1	L=25	4	Nail fragment	2	168	Goodall 2011, 164, Fig. 9.1
125	316	2	L= 31 and 37	7	Horse shoe nail & nail	4	metalling N of S5	Goodall 2011, 164, Fig. 9.1; 364, Fig. 13.1
126	190	1	L=21	3	Nail fragments	4	metalling S of S4	Goodall 2011, 164, Fig. 9.1
127	190	1	L=47	13	Nail; type 10	4	metalling S of S4	Goodall 2011, 164, Fig. 9.1
128	190	1	L=29	3	Horseshoe nail; Type B	4	metalling S of S4	Goodall 2011, 364, Fig. 13.1
129	190	1	L=45	10	Nail; type 10	4	metalling S of S4	Goodall 2011, 164, Fig. 9.1
130	190	1	L=14	2	Nail; type 10	4	metalling S of S4	Goodall 2011, 164, Fig. 9.1
131	190	1	L=31	2	Nail; type 10	4	metalling S of S4	Goodall 2011, 164, Fig. 9.1
132	190	1	L=41	5	Nail; type 8	4	metalling S of S4	Goodall 2011, 164, Fig. 9.1
133	190	1	L=34	5	Nail; type 8	4	metalling S of S4	Goodall 2011, 164, Fig. 9.1
134	190	1	L=25	3	Nail; type 7	4	metalling S of S4	Goodall 2011, 164, Fig. 9.1
135	190	1	L=30	3	Horseshoe nail; Type B	4	metalling S of S4	Goodall 2011, 364, Fig. 13.1
136	190	1	L=33	4	Nail; type 6	4	metalling S of S4	Goodall 2011, 164, Fig. 9.1
137	190	1	L=26	7	Nail; type 9	4	metalling S of S4	Goodall 2011, 164, Fig. 9.1
138	538	1	L=37	3	Nail fragments	3	539	
139	353	1	L=46	5	Nail fragments	5	369	
140	332	1	L=31	5	Nail; type 9	4	metalling N of S4	Goodall 2011, 164, Fig. 9.1
141	347	1	L=52	36	Nail; type 11	4	metalling N of S4	Goodall 2011, 164, Fig. 9.1
142	347	1	L=52	3	Nail; type 8	4	metalling N of S4	Goodall 2011, 164, Fig. 9.1

Find	Context	Frag count	Dims (mm)	Wt (g)	Comments	Date/ Phase	Feature	Reference
143	347	1	L=29	3	Nail; type 8	4	metalling N of S4	Goodall 2011, 164, Fig. 9.1
144	347	1	L=26	4	Horseshoe nail; type B	4	metalling N of S4	Goodall 2011, 364, Fig. 13.1
145	493	1	L=55	15	Nail; type 9	6	494	Goodall 2011, 164, Fig. 9.1
146	493	1	L=65	19	Nail; type 9	6	494	Goodall 2011, 164, Fig. 9.1
147	493	1	L=53	13	Nail; type 9	6	494	Goodall 2011, 164, Fig. 9.1
148	185	1	L=32	4	Nail; type 8	4	Wall	Goodall 2011, 164, Fig. 9.1
149	185	1	L=45	5	Horseshoe nail; type B	4	Wall	Goodall 2011, 364, Fig. 13.1
150	185	1	L=55	11	Nail; type 8	4	Wall	Goodall 2011, 164, Fig. 9.1
151	185	1	L=35	7	Nail; type 9	4	Wall	Goodall 2011, 164, Fig. 9.1
152	117	1	L=28	5	Scrap iron	3	118	
153	117	1	L=29	5	Horseshoe nail; type B	3	118	Goodall 2011, 364, Fig. 13.1
154	117	1	L=36	1	Bar iron	3	118	
155	318	1	L=27	5	Horseshoe nail; type B	4	midden deposit	Goodall 2011, 364, Fig. 13.1
156	167	1	L=37	2	Nail; type 3	2	168	Goodall 2011, 164, Fig. 9.1
157	167	1	L=48	5	Nail fragments	2	168	
158	317	1	L=20	1	Horseshoe nail; type B	4	metalling N of S5	Goodall 2011, 364, Fig. 13.1
159	317	1	L=36	8	Nail; type 9	4	metalling N of S5	Goodall 2011, 164, Fig. 9.1
160	317	1	L=27	2	Nail fragments	4	metalling N of S5	
161	317	1	L=22	5	Nail fragments	4	metalling N of S5	
162	317	1	L=102	17	Nail; type 7	4	metalling N of S5	Goodall 2011, 164, Fig. 9.1
163	317	1	L=28	11	Nail; type 9	4	metalling N of S5	Goodall 2011, 164, Fig. 9.1
164	102	1	L=34	2	Nail; type 7	Post 6	Subsoil	Goodall 2011, 164, Fig. 9.1
165	102	1	L=17	1	Nail fragments	Post 6	Subsoil	
166	102	1	L=40	2	Nail; type 8	Post 6	Subsoil	Goodall 2011, 164, Fig. 9.1
167	486	1	L=29	4	Nail fragments	5	485	
168	486	1	L=43	3	Nail; type 1	5	485	Goodall 2011, 164, Fig. 9.1
169	493	1	L=34	10	Nail; type 10	6	494	Goodall 2011, 164, Fig. 9.1
170	493	1	L=49	8	Nail; type 1	6	494	Goodall 2011, 164, Fig. 9.1
171	493	1	L=35	8	Nail; type 8	6	494	Goodall 2011, 164, Fig. 9.1
173	326	1	L=52	9	Nail; type 1	3	327	Goodall 2011, 164, Fig. 9.1
174	326	1	L=32	4	Nail; type 1	3	327	Goodall 2011, 164, Fig. 9.1
175	320	1	L=33	4	Nail; type 1	4	metalling N of S4	Goodall 2011, 164, Fig. 9.1
176	320	1	L=59	18	Nail; type 9	4	metalling N of S4	Goodall 2011, 164, Fig. 9.1

Table 11. Metal finds from JMHS excavation.

SOAG excavation

The results of the SOAG intervention are presented below. A significant issue in respect of the metalwork was that it had been stored for an unknown number of years in a poly-tunnel at the SOAG excavations at Gatehampton Farm, Oxfordshire. As a consequence some of the metalwork was extremely degraded.

Nevertheless there were 47 objects out of 68 contexts; the remaining 21 contexts yielded 122 fragments; in total 841g of ironwork were recovered. As stated in the introduction the contextual information is not sufficient for detailed analysis, and only a cursory description has been carried out.

The key interest is the corollary which can be observed between the JMHS and SOAG assemblages. In both cases there is a quantity of metalworking tools as well as horse-gear; indeed proportionally, the SOAG assemblage yielded a higher quantity of tools which could be used in smithing operations comprising six punches, a hot chisel and an awl. The latter could, of course, be used for woodworking, and so is more ambiguous as a tool exclusively for metalworking. As the building (Structure 3) also yielded a tuyère and no evidence of other metallurgical activity, this is potentially a store associated with the smith's home. This nevertheless is only conjecture.

The presence of the rowel spur and horse-shoes is not particularly diagnostic but falls within the overall parameters of potential stock material for re-working. The key could be equally for a door to the structure or scrap for re-use. The latter observation also applies to the small architectural assemblage.

As noted above, in and of itself the ironwork retained by SOAG is not significant. In the context of the associated finds both from the SOAG work and the JMHS intervention, it yields a larger picture of a manorial industrial complex and its decline.

Metalworking tools

Eight objects associated with metalworking or craft were recovered in the SOAG Trench II.

16. Punch, L=122mm, 45g (Goodall 2011, Fig 2.6 A56-58; Pritchard 1991, Fig. 3.13:23).
36. Awl, L=12mm, 28g (Goodall 2011, Fig. 6.3 E49).
40. Punch, L=90mm, 13g (Goodall 2011, Fig 2.6 A56-58; Pritchard 1991, Fig. 3.13:23).
46. Hot chisel, L=46mm, 14g (Goodall 2011, Fig. 2.5 A45).
62. Punch, L=31mm, 2g (Goodall 2011, Fig 2.6 A56-58; Pritchard 1991, Fig. 3.13:23).
70. Punch, L=55mm, 24g (Goodall 2011, Fig 2.6 A56-58; Pritchard 1991, Fig. 3.13:23).
77. Punch, L=44mm, 6g (Goodall 2011, Fig 2.6 A56-58; Pritchard 1991, Fig. 3.13:23).
79. Punch, L=80mm, 12g (Goodall 2011, Fig 2.6 A56-58; Pritchard 1991, Fig. 3.13:23).

In addition to the tools above there was a small assemblage of iron wire – **25, 27, 71** – and possible scrap iron – **18, 26, 28, 31, 32, 37, 39, 44, 47, 48, 55, 57, 58, 61, 63, 65, 66, 69, 73, 78, 80** – recovered during the SOAG excavations.

Architectural ironwork and furniture fittings

15. Bolt, L=115mm, 130g.
49. Staple, L=40mm × W=34mm, 7g (Goodall 2011, Fig 9.6 H107-126)

There were also 26 domestic nails recovered during the SOAG campaign: 19, 20, 21 ,22, 23, 24, 29, 30, 33, 34, 35, 41, 51, 52, 53, 54, 59, 60, 64, 68, 72, 74, 75, 76, 81, 82.

Horse equipment, farming and personal equipment

This section regroups the rest of the ironwork as only a couple of examples of each are represented.

50. Iron rowel spur *(fig. 35.6),* L=105mm, 63g (Ellis 1991 Fig. 19.23). Fragmented, heavily restored; some rust under Araldite; twisted. Both sides are curved to be worn under the wearer's ankles, the terminals are not present. The neck of the spur measures approx. 35mm in length and has been misshapen. The rowel bosses are prominent, the rowel itself is missing. It is difficult to date this typologically as it is corroded and its condition has not been improved by heavy conservation.

38, 43 & 56. Three horseshoes in poor condition (Goodall 2011, Fig 13.4 L19, L21)

42. One oxshoe L=120mm, 80g (Goodall 2011, Fig. 13.4 L30, L32).

14. One key L=115, 72g (Goodall 2011, Fig. 10.21 I337)

Find	Context	Frag	Dims (mm)	Wt (g)	Comments	Reference
18		1	L=65	26	Scrap iron	
19	208	1	L=35	4	Nail; type 9	Goodall 2011, 164, Fig. 9.1
20		1	L=54	3	Nail; type 8	Goodall 2011, 164, Fig. 9.1
21		1	L=60	4	Nail; type 7	Goodall 2011, 164, Fig. 9.1
22		1	L=60	4	Nail; type 7	Goodall 2011, 164, Fig. 9.1
23		1	L=54	4	Nail; type 7	Goodall 2011, 164, Fig. 9.1
24		1	L=38	2	Nail; type 4	Goodall 2011, 164, Fig. 9.1
29	194	1	L=28	2	Nail; type 8	Goodall 2011, 164, Fig. 9.1
25		1	L=57	3	Iron wire	
26	2	6		9	Scrap iron	
27	1	1	L=25	5	Iron wire	

Find	Context	Frag	Dims (mm)	Wt (g)	Comments	Reference
28	2	6		6	Scrap iron	
30	194	1	L=29	5	Nail; type 9	Goodall 2011, 164, Fig. 9.1
31	194	1	L=47	5	Scrap iron	
32	2	3		4	Scrap iron	
33	4	1	L=76	43	Nail; type 12	Goodall 2011, 164, Fig. 9.1
34	1	12	L=30	9	Nail; type 7	Goodall 2011, 164, Fig. 9.1
35	91	1	L=55	10	Nail; type 6	Goodall 2011, 164, Fig. 9.1
37	2	12		9	Scrap iron	
38	397	2	L=20	1	Horseshoe nail; type B	Goodall 2011, Fig 13.4 L19, L21
39	1	5		2	Scrap iron	
41	1	2	L=47	4	Nail; type 8	Goodall 2011, 164, Fig. 9.1
43	3	3	L=30	5	Horseshoe nail; type A	Goodall 2011, Fig 13.4 L19, L21
44	3	3		8	Scrap iron	
47	295	1	L=35	24	Scrap iron	
48	5	6		6	Scrap iron	
51	1	10		4	Nail fragments	
52	1	1	L=40	2	Nail; type 8	Goodall 2011, 164, Fig. 9.1
53	1	1	L=26	3	Nail; type 8	Goodall 2011, 164, Fig. 9.1
54	1	1	L=25	4	Nail; type 9	Goodall 2011, 164, Fig. 9.1
55	1	1	L=16	1	Scrap iron	
56	2	6	L=19	7	Horseshoe nail; type A	Goodall 2011, Fig 13.4 L19, L21
57	2	7		12	Scrap iron	
58	1	7		6	Scrap iron	
59	98	1	L=18	2	Nail; type 1	Goodall 2011, 164, Fig. 9.1
60	98	1	L=20	3	Nail; type 9	Goodall 2011, 164, Fig. 9.1
61	98	1		3	Scrap iron	
63	2	5		4	Scrap iron	
64	193	1	L=36	4	Nail; type 1	Goodall 2011, 164, Fig. 9.1
65	193	1	L=27	3	Scrap iron	
66	193	1	L=37	4	Scrap iron	
67	2	1	L=27	2	Horseshoe nail; type B	Goodall 2011, 364, Fig. 13.1
68	2	1	L=38	2	Nail; type 1	Goodall 2011, 164, Fig. 9.1
69	193	1	L=25	4	Scrap iron	
71	1	8	L=60	12	Iron wire	
72	95	1	L=28	5	Nail; type 1	Goodall 2011, 164, Fig. 9.1
73	296	3		1	Scrap iron	
74	2	1	L=32	4	Nail; type 8	Goodall 2011, 164, Fig. 9.1
75	2	1	L=36	3	Nail; type 5	Goodall 2011, 164, Fig. 9.1
76	97	1	L=30	3	Nail; type 1	Goodall 2011, 164, Fig. 9.1
78	2	4		3	Scrap iron	
80	2	7		4	Scrap iron	
81	195	1	L=47	4	Nail; type 8	Goodall 2011, 164, Fig. 9.1
82	1	5	L=32	5	Nail; type 8	Goodall 2011, 164, Fig. 9.1

Table 11a. Metal finds from SOAG excavation.

Ironworking residues & related material *by Brian Gilmour*
(Figs. 36-87; Tables 12-17; Appendix 1)

Introduction
The assemblage of ironworking residues and related material was recovered from a range of features in the vicinity of a medieval smithing complex, dating from after the late 11th century until the ?end of the 14th century. The remains comprised two smithies – an early Saxo-Norman smithy, the existence of which was revealed by metallurgical analysis of residues from associated features; and a later High Medieval building with evidence for an *in situ* hearth and anvil-setting as well as a potential bosh. Hammerscale was recovered from the floor surface of the latter structure showing potential working areas. The site was associated with a period of medieval settlement expansion during the Saxo-Norman period followed by later contraction, being abandoned sometime after the Black Death.

The waste material, which was excavated from a variety of contexts, was scattered across the excavated part of the site. Although the main focus was in and around the site of the later 13th-century smithy, during post-excavation analysis it became clear that much of the smithing-related waste material came from contexts clearly predating the smithy. Attention was subsequently focussed on an earlier post-fast structure dating from the 12th century. This building was only partially recovered in plan but would appear to form an antecedent smithy. This observation permitted the consideration of the whole as a manorial smithing complex, rather than merely a single phase High Medieval smithy.

Phasing and description of the assemblage
The material covered in this report comes from a sequence of medieval contexts consisting of layers – dumps or accumulations – plus a variety of features, pits, postholes, gullies, ditches and midden deposits. Nearly all these belong to a sequence of medieval phases of occupation and use of this settlement. The material derives from six phases of activity (Phase 1: 11th century; Phase 2: L11th - E12th centuries; Phase 3: E12th - 13th centuries; Phase 4: E13th - M14th centuries; Phase 5: M13th – L14th centuries; and Phase 6: L13th - L14th centuries).

However most of the ironworking related debris appears to be associated with the 12th to mid 14th century phases of occupation (designated here as Phase 2 to Phase 4). Although some of what was found in these contexts is likely to be residual, disturbed during this period from earlier contexts, most of it came from contexts which indicate a build-up of material during this final use of the smithy.

The close proximity of much of the slaggy waste supports the tentative interpretation of the open fronted, Phase 4 building, as a smithy, as does its open fronted layout. However, the distribution of the slaggy waste material through the sequence of contexts is indicative of there having been earlier phases of smithing activity, and presumably centred on an earlier phase of a similar type of smithy building very nearby, which has been identified as the Structure 1 smithy of Phase 3.

Context and overall nature of the assemblage
The assemblage consisted in all of approximately 54 kg of waste debris derived from ironworking on or near the site. Much if not all of it may relate to the operation of

one or other phase of late medieval smithy perhaps all occupying the same site and all in the form of an open fronted building. Material from associated features, cobbled surface(s) and the like, recovered during the excavations here – and dated by associated pottery – suggest a more or less continuous use of this part of the site as a black-smithy for approximately 300 years or so from about the mid 11th century.

This assemblage mostly consisted of a mixture of smithing slag fragments (of one kind or another), related hearth debris and hammer-scale, some of which has been subsequently separated out. In amongst this material were a few fragments of metallic iron as one might expect in the working debris from a blacksmithing workshop. This material has been scattered across the site and was recovered from some 115 different contexts, mostly from this campaign of excavation, although a small amount was saved during the SOAG excavation during the 1980s. However the bulk of this slaggy waste debris came from just a few pits or contexts (most notably contexts (326) and (370) from 327, and layer (347) and this material appears to relate to the first phase of the operation of the smithing complex.

Much of the material consists of lumps – approximately pea size up to bun size (~1-10 cm) – of irregular and still dirty slaggy waste, although some of the larger pieces have the appearance of (nearly) complete, roughly plano-convex smithing hearth bottoms (SHBs) as would be expected of a smithy.

Some material – from bulk sample analysis of the surviving floor of the smithy – had already been processed and the residue retained was found to contain a variable proportion of magnetic material, mostly flakes of hammer-scale, with some in a spheroidal form, together with a matrix of mixed gravelly material. The mixed slaggy waste and hammer-scale are all typical of blacksmithing activity with nothing being at all suggestive of smelting.

Examination and analysis

All the material examined could be divided into four main categories, with relatively little being uncertain. The bulk of the waste slaggy debris consisted of a mixture of relative dense, lumpy, uneven, partly vitrified material, either dark grey or rusty brown in colour, which varied from quite small amorphous lumps to larger lumps recognisable as roughly plano-convex lumps which have accumulated during a campaign of use near the base of the hearth in the hottest zone near where the air input nozzle or tuyére(s) would have been positioned. In Appendix 1 this material is referred to as either smithing hearth bottom slaggy (SHB) waste or plano-convex smithing hearth bottom (PCB) waste.

The second main category consisted of quite thin (approximately 10mm thick) flattish, almost sherd-like burnt clayey fragment containing a proportion of quite even sized gritty pieces of quartz. These pieces were relatively smooth on one side but very rough on the other. These pieces would appear to represent fragments of mixed clay and grit used to reline the hearth. In some cases these sherd-like pieces also contained fragments of ground up pieces of similar hearth relining material re-cycled from a previous phase of hearth repair.

The third main category of waste debris consisted of hammer-scale with both flakes and spheroids being present, although a much higher proportion of flake hammer-scale was found to be present.

There was also some less dense more porous, less iron coloured slaggy waste which appears to be fuel ash slag, formed during the operation of the hearth as a reaction between the charcoal fuel and the clay of the hearth wall in the hottest part of the hearth near the air blast input site.

Occurrence of ironworking waste by phase

Phase 1: 11th century

The fill of only one context (149; the fill of gully 150) could be assigned to this first phase of occupation here. It contained only a few fragments (16gm) of smithing hearth related material but significantly these fragments consisted of small sherds or 'biscuit' like fragments of partly vitrified gritty clayey material that had been used to line the hearth and had subsequently become detached and discarded (Figs 37-40). At first it was uncertain whether or not this was intended as a sacrificial lining from the outset, or whether it was exploited as this later. However in section it was clear that this lining consisted of a mixture of clay, fairly coarse quartz grit together with fragments of hammer-scale and small fragments of former hearth lining re-used as 'grog' to temper the clay (to reduce shrinkage). This shows clearly that the hearth (re)lining fragments contained residual material from an earlier phase of smithing hearth use.

Phase 2: Late 11th to early 12th centuries

The material from this period of occupation was from six contexts – five pits and ditch –totalling 3.434kg metalworking-related waste (Table 12), which consisted mainly of fragments of hearth wall, these having been recovered from two midden or dump deposits, as well as a smallish (11gm) fragment of smithing slag, possibly from a smithing hearth base/plano-convex base (SHB/PCB) of varying density. Further PCBs were recovered from pits 435 and 444, both of which were located on the east side of site, north of the enclosure ditch. Fragments of fused hearth-lining were also recovered from pit 435, in addition to what appeared to be a fragment of tap-slag.

Context	Feature	Description	Weight
167	168	Ditch fill	11g
211	212	Pit fill	860 g
470	571	Pit fill	114 g
471	573	Pit fill	89 g
348	435	Pit fill	1182 g
443	444	Pit fill	1178 g
		Total	**3.434 kg**

Table 12: Summary of smithing waste from Phase 2

Phase 3: Early 12th to 13th centuries

Much more smithing related waste debris (31.301 kg in all) kg was recovered from the 18 contexts in Phase 3 (Table 13), approximately 60% of the total metalworking-related waste from the site as a whole was recovered from contexts associated with occupation Phase 3 (Table 14). By far, the majority of this material (29kg) came from four pits (Table 13) and a variety of different of waste types was encountered although they generally fell into three types (Figs. 41 to 63). As might be expected the majority of the material from this, as with all the occupation phases dealt with here, was in the form of relatively dense and heavy lumps of smithing waste, some with a recognisable (if irregular) plano-convex form reflecting the way in which they have accumulated at the base of the smith's hearth during what would appear to be one campaign of use before the hearth was cleaned out to make it ready for the next campaign of use (Figs 41-44, 53-57, 61-63 and 67-69). Degraded fragments of charcoal and corroded small fragments of iron were also found amongst the pieces of smithing hearth base slag (Figs 53-57).

Context	Feature	Description	Weight
117	118	Pit fill	4 gm
125	130	Gully fill	40 gm
135	136	Square pit fill	15 gm
205	206	Gully fill	631 gm
326	327/351	Pit fill	10.791 kg
352	327/351	Pit fill	8.322 kg
366	327/351	Pit fill	224 gm
370	327/351	Pit fill	5.586 kg
336	505	Ditch fill	192 gm
346	(145)	Metalled surface	744 gm
373	230	Gully fill	46 gm
374	192	Gully fill	51 gm
418	192	Gully fill	135 gm
479	480	Pit fill	615 gm
481	482	Gully fill	641 gm
538	539	Pit fill	3.264 kg
		Total	**31.301 kg**

Table 13: Summary of smithing waste from Phase 3

There was also a fair quantity of rather biscuit like fragments of gritty clayey material often reddish on one side (the inside) with usually with a very dark slightly shiny, part vitrified lumpy surface. It seems clear that this represents waste pieces of material that has been used to line and perhaps reline – maybe repeatedly – the basic wall of the hearth, thus forming a sacrificial inner lining parts of which would come adrift from the wall of the hearth during use, but which could be readily patched or replaced in between smithing campaigns. What is especially noticeable about the make-up of this lining material is that the flattish biscuit-like fragments are typically about 10mm or less in thickness and consist of a clay matrix, which appears amorphous in section, mixed with filler material consisting of fine quartz gritty material, much hammer scale – flakes and spheroids – and occasionally small crushed pieces of former heath (re)lining material (Figs. 40, 47-48, 59-62 and 65-66).

In amongst the general debris there were a few pieces of what would appear to have been fragments of hearth wall to which would have been applied the upper or outer (sacrificial) surface layer which had a tendency to flake off in the biscuit-like fragments described above and illustrated below. Usually, or at least very often, these appear to have come away from the hearth wall during a smithing campaign and consequently have become incorporated into the mass – either one or more SHB/PCB lumps, or similar but looser fragments near the base of the hearth. As might be expected they are typically made up of a clayey matrix together with material added as a filler or grog, but unlike the material used as filler in the surface (re)lining material the grog in this case tends to contain much larger (but still quite small) fragment, often of quartz, but interestingly, also of re-used crushed pieces of smithing slag (ie fayalitic/glassy material) (Figs 44-51).

Also found - usually as smaller fragments or fused to, and therefore forming part of, lumps of smithing hearth base (SHB) waste material – was a small proportion of very porous lightweight part vitrified slaggy material which would appear to have formed as a reaction between the fuel (charcoal) and the hearth wall lining material, hence referred to here as fuel ash slag, light in weight because of the porous nature and partly because this material is rich in clay minerals rather than iron.

Phase 4: Early 13th to mid 14th century:
A total of 5.178kg of ironworking-related waste debris was recovered from 19 contexts (of a variety of different types) associated with Phase 4.

In marked contrast to the previous Phase 3 (E12th to 13th centuries) occupation/activity horizon hardly any – if any, at all – of the smithing waste debris from Phase 4 came from pits. Much of the area is occupied by traces of this period of the smithy building and associated outdoor (working) surfaces, and the associated waste material was recovered from a series of associated layers, floor or midden deposits, small ditches plus part of the wall matrix of the smithy itself (Table 14).

Context	Feature	Description	Weight
115	116	Ditch fill	100 gm
127	128	Post hole fill	71 gm
185		Wall matrix	259 gm
264		Midden deposit	26 gm
269	263	Ditch fill	112 gm
271	270	Ditch fill	16 gm
284		Midden deposit	236 gm
293	263	Pit fill	283 gm
318		Midden deposit	1.117 kg
319		Midden deposit	265 gm
333		Metalling	374 gm
355	369	Ditch fill	93 gm
367	369	Ditch fill	176 gm
368	369	Ditch fill	354 gm
375	376	Gully fill	114 gm
419	376	Gully fill	85 gm
458	558	Pit fill	680 gm
499	500	Ditch fill	807 gm
514	515	Rubbish pit fill	10 gm
		Total	**5.178 kg**

Table 14: Summary of smithing waste from Phase 4

Although the contexts from which it derived were very different, the 5.477kg of smithing waste debris found associated with the Phase 4 contexts was much the same as before in both type and the proportions in which it was found. Again the great majority was in the form of relatively heavy and dense pieces of slag that built up in the base of the smithing hearth (and it is assumed here the there was only one) during various campaigns of use during the life of this phase of smithy (Figs. 70-78). Mixed with this were many of the same fragmentary biscuit shaped pieces of hearth (re)lining as were found in the previous two occupation phases, plus a few lumps of hearth wall - characterised by the much coarser fragments incorporated as filler in the clay used – as well as some smallish, very porous lightweight fragments of fuel ash slag.

Phase 5: Mid 13th to late 14th centuries

Only three contexts were associated with the Phase 5 remains in the smithy, the majority of the material taking the form of small waste fragments making up the floor of the smithy (Table 15).

Context	Feature	Description	Weight
214		Smithy floor	952 gm
317		Cobbled surface	22 gm
486	485	Rubbish pit fill	32 gm
		Total	**1.006 kg**

Table 15: Summary of smithing waste from Phase 5

As might be expected this flooring material was found to contain a much higher proportion of hammer-scale than any other of the other deposits of waste smithing material found across the site. This was revealed by a systematic programme of selected fine sieving of numbered bulk samples of flooring material undertaken (the sampling at least) at the time of excavation (Table 16; Fig. 20). The sieving residue was found to contain both hammer-scale flakes and spheroids (Fig. 80). Although the smithy was constructed in the early 13th century, it is believed to have continued in use until the middle of the 13th century at least. Consequently, the floor surface (214) is treated as final use phase, rather than the phase of construction.

Sample number	Total weight	Smaller (<5mm) magnetic pieces	Larger (5-20mm) magnetic pieces	Smaller non-magnetic pieces	Larger non-magnetic pieces:		Charcoal	Comments
					(a) Slag, hearth lining etc	(b) Stony gravelly material		
1	222gm	5.5gm	9.5gm	129.0gm	12gm	63.2gm	0.5gm	bone (1gm)
2	177gm	0.9gm	0.3gm	117.0gm	7.2gm	59.0gm	0.3gm	
3	240gm	1.1gm	0.7gm	128.2gm	14.0gm	97.2gm	0.1gm	
4	158gm	1.9gm	0.7gm	97.8gm	11.5gm	41.9gm	0.1gm	burnt seed
5	274gm	6.6gm	4.0gm	132.8gm	27.9gm	99.1gm	0.3gm	burnt seed
6	177gm	2.2gm	0.1gm	99.7gm	10.0gm	63.6gm	0.9gm	
7	107gm	1.0gm	6.2gm	66.7gm	6.2gm	26.8gm	0.1gm	burnt seed
8	165gm	1.0gm	0.5gm	92.7gm	18.0gm	53.1gm	0.6gm	burnt seed
9	166gm	1.3gm	0.2gm	86.3gm	17.7gm	59.0gm	0.2gm	burnt seed
10	614gm	3.0gm	0.4gm	321.2gm	28.2gm	260.9gm	0.05gm	
11	177gm	1.6gm	0.6gm	108.9gm	6.0gm	49.7gm		
12	185gm	3.7gm	1.6gm	121.0gm	8.6gm	48.9gm	1.1gm	
13	198gm	3.7gm	3.6gm	151.2gm	13.9gm	24.1gm	1.0gm	
Totals	**2860gm**	**33.5gm**	**28.4gm**	**1652.5gm**	**181.2gm**	**946.5gm**	**5.25gm**	

Table 16. Phase 4 smithy bulk sample composition (in gm)

Phase 6: 15th century

In total 11.57kg of waste debris was recovered (Table 17), again mainly varying sized pieces of relatively dense and heavy, iron rich smithing slag that has built up at the base of the hearth over a number of campaigns during the latter part of its use and discarded between each campaign.

Nearly all of the material recovered from this phase had been recovered from the cobbled yard in front of the open side of the smithy. The extent to which it had been incorporated in, or used as make-up material as part of its use or during its final period of use/abandonment is not entirely clear. It could well be both. For this reason, the assemblage is treated as final phase.

The make-up and proportions of the waste material was much the same as in previous phases of use of the smithy although this time the context from which the waste material was recovered was quite different again, the final phase of use of the smithy being marked by the build-up of the cobbled working area.

The form of the smithing slag (Figs 81-83), biscuit shaped fragments of hearth relining material (Figs 85-86), occasional small fragments of hearth wall, and smallish pieces of fuel ash slag (Figs 85-86) were much as found in previous phases of use of the smithy on this site.

Context	Feature	Description	Weight
320	145	Yard build-up	108 gm
323	145	Yard build-up	466 gm
324	145	Yard build-up	212 gm
325	145	Yard build-up	22 gm
331	145	Yard build-up	50 gm
332	145	Yard metalling	67 gm
347	145	Yard metalling	10.605 kg
190		Yard metalling	14 gm
507	190	Yard metalling	26 gm
		Total	**11.570 kg**

Table 17: Summary of smithing waste from Phase 6

Discussion and conclusions

Most if not all the slaggy waste recovered from this site is consistent with the operation of an ironsmith's workshop or (black) smithy in the immediate vicinity. The way in which the SHB/PCB waste and hearth relining fragments occur through the stratified sequence of contexts is indicative of at least three phases of occupation or use of a smithy here over much of the three centuries from about the end of the 11th century to the end of the 14th century.

All these phases of use are marked by what appears to be a more-or-less continuous sequence of use and re-use with frequent repairs having been carried out to the most heat-affected parts of the hearth wall which would have been most susceptible to damage requiring repair during the operation of the smithy. It would appear from some of the bits hearth wall - that have dropped into the hearth during use or otherwise discarded - that the main fabric was made of clay with a filler of fine quartz gravel (approx 2-10mm in size) together with re-used crushed fragments of smithing slag.

It is quite possible much of the gravelly material that was separated with the pieces hammer-scale during the bulk sieving of the Phase 5 smithy floor was ultimately derived from an earlier phase; this might well consist of demolished hearth material from the earlier principal Phase 3 of the smithy. This was subsequently incorporated into the building of the new Phase 4 smithy, probably early in the 13th century. The sieved material from the smithy floor did not appear to contain much of either the characteristic biscuit like fragments of hearth relining material or the heavy dense smithing slag which together make up nearly all the waste material found elsewhere. This may indicate that the hearth was cleaned out before it was demolished, a process that would have been likely to remove all the slag and loose pieces of (sacrificial) lining from the hearth.

Once cleaned out, much of the material of the hearth wall of the earlier smithy – given that it would have come from the core of the hearth wall – would probably not have been at all 'fired' or vitrified and therefore would have been quite soft, and once demolished and spread around soon would have effectively become just a beaten gravelly, clayey earth floor into which hammer-scale from the final phase of use of the smithy would have been trampled.

Perhaps most striking of the assemblages of smithing related waste recovered from this site is how similar the material is right through the sequence of use, but conversely how different the contexts are from which it was recovered, at least from the three phases 3, 4 and 5 of the occupation and use of the smithy here.

Evidence for an inferred, post-late 11th century smithy at Newington

Unfortunately very little remained of a postulated first phase of smithy use, or at least very little could be separated stratigraphically, and a fair proportion of the waste material recovered from later contexts is likely to be residual. Despite this the small amount that was recovered, especially one fragment of biscuit-like hearth (re)lining debris with its incorporation of crushed re-used earlier hearth (re)lining material, there is clear evidence of the existence and operation of an early phase of smithy during the 11th century. There were over 2kgs of slag, including PCBs, from two pits: 435 and 444. It is possible that the material evidence for an early smithy simply means that it represents the first phase of use of the same smithy that was in use through the 12th century, perhaps after some minor modifications.

Evidence for the first, early 12th- to 13th-century, Phase 3 smithy

Not much evidence survives in the form of unambiguous building traces of the Phase 3 smithy, dating from the early 12th century onwards, here. Structure 1 has been identified as a smithy largely due to the mass of waste debris from various contexts. It is clear that a smithy must have existed and it seems likely that it was simply replaced by the early 13th-century Phase 4 smithy building, to the east, but within the same plot and presumably along much the same lines.

However, it is very noticeable that the great majority of the slag identified as belonging to the second phase of smithy was recovered from either of two pits which lie stratigraphically beneath contexts relating to the Phase 4 structure. This is quite different to the situation for the smithing waste from later contexts and one intriguing possibility is that these could represent 'closure' or 'good luck' deposits, signing off – as it were – the demolition of the previous smithy before the construction of the new one. It may thus be no coincidence that the majority of all the smithing debris recovered from the site at Newington came from one or other of these two pits and which, moreover, may explain their existence.

The early 13th century Phase 4 smithy

The first clear evidence of a smithy in the form of a building is the open fronted timber structure, the remains of which consisted of a U-shaped stone cill with three postholes at the front, marking out a rectangular structure, the remaining 'earth' floor of which may have been partly made from the demolished remains of the pre-existing (central) hearth structure, into which has been trampled a proportion of the hammer-scale generated by the smithing activities here. Bulk analysis of samples taken from the floor reveals a significantly higher proportion of hammer-scale than the various smithing waste deposits found elsewhere on the site (as indicated by magnetic separation).

Less than one quarter of the slag or related waste found in the five pits was found in the various contexts relating to the construction and use of this phase of smithy building. Moreover, the contexts were completely different in character, with waste debris more evenly distributed between the various gullies/ditches, postholes, midden deposits and other features contemporary with the use-life of the Phase 4 smithy.

Phases 5 and 6, mid 13th to late 14th century use of the smithy)

What evidence there is from this final medieval occupation phase here suggests that the existing smithy may have continued in use, perhaps in a modified form; whether this is due to some structural alterations or otherwise is not apparent. The proposed ore-roasting hearth was not used, nor was it properly decommissioned: rather it appears to have been left abandoned. The sequence of waste material types – again dominated by slaggy waste, rich in iron (silicate/oxide) which would have built up on the side of in the base of the hearth during use, but also found together with - and sometimes fused to - the flattish, biscuit-like fragments of hearth (re)lining material, plus a few small fragments of (inner) hearth wall and fuel ash slag.

In contrast to both the earlier Phases 3 and 4 of smithy use the waste material here was almost entirely found in association with cobbled yard metalling or similar layers associated with or accumulated during the later life/use of the building as a working smithy or its subsequent abandonment and proposed dismantlement.

Figure 37. Context (149) of gulley 150. Fragment of hearth (re-)lining with an uneven, semi-vitrified surface.

Figure 38. Section of above fragment showing the clayey matrix (grey towards the surface, and oxidised to red inside, below) containing filler material (grog), small fragments of whitish gritty quartz filler plus small (grey) fragments of relatively grit free earlier hearth lining and flakes of hammer-scale, especially noticeable in the more oxidised reddish (inner) zone.

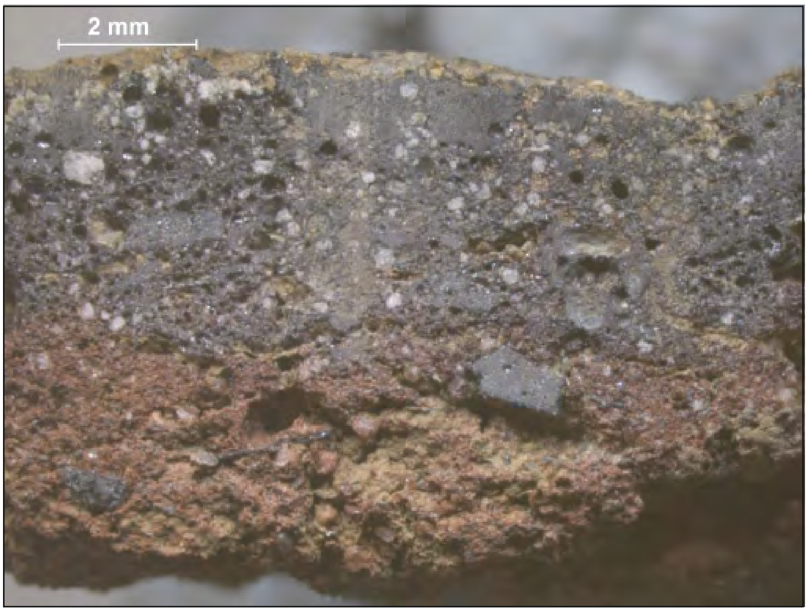


Figure 39. Detailed view of section through the same piece of hearth (re)lining showing the filler material of fine pale quartz grit (more visible in the darker grey area), crushed re-used fragments of relatively grit-free former hearth relining or repair material, plus flakes of hammer-scale, more visible in the inner reddish (more oxidised) area.

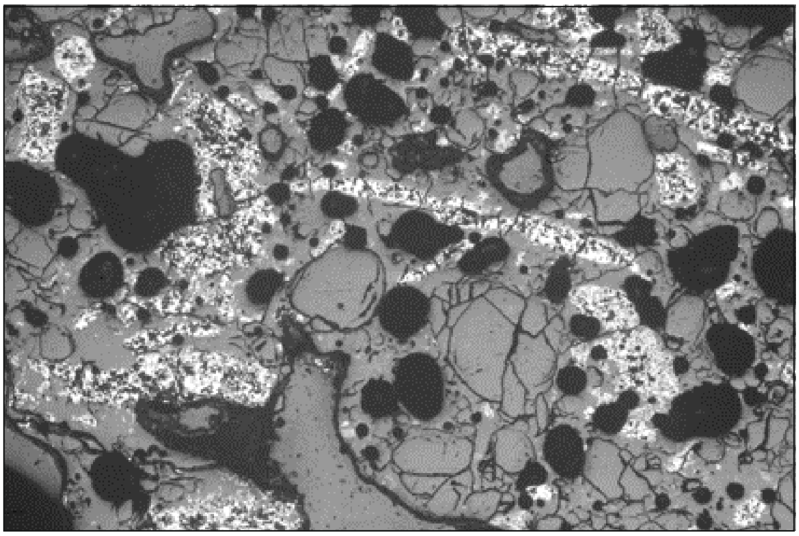


Figure 40. Optical micrograph of part of the same fragment of hearth (re) lining showing a concentration of (pale) hammer-scale fragments together with (heat-cracked) quartz grains in a more amorphous clayey matrix (image 1.5mm wide).

Figure 41. Context (366) of pit 327. Fragments of part-fused waste material of different types; pieces of irregular plano-convex base (PCB) (upper right), fused hearth lining flattish pieces of hearth (re-) lining material (lower part of this view), and lightweight fuel ash slag (upper left).

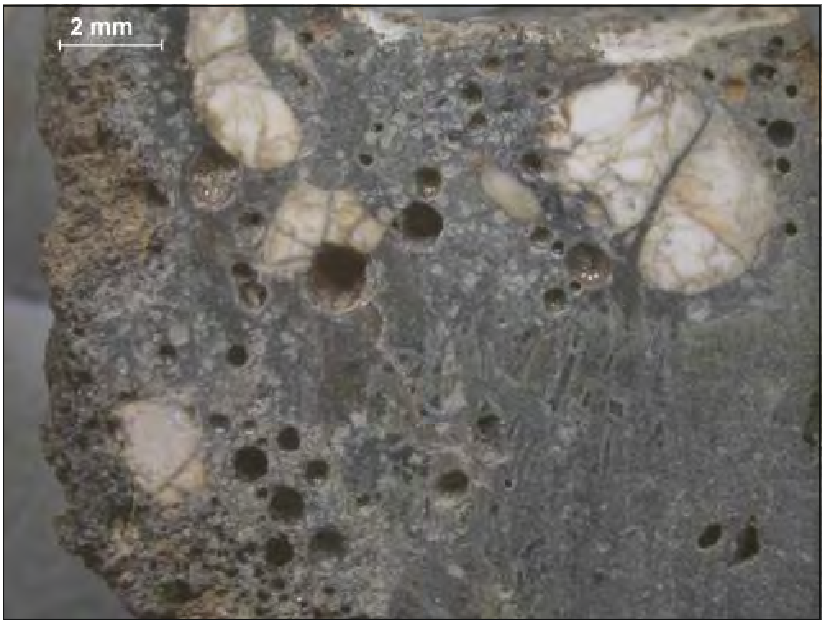


Figure 42. Context (366). Section from the upper rim of the larger PCB fragment (upper centre in Fig. 41) where fused to a fragment of hearth wall lining, the outer part containing heat shattered quartz grains in a clayey matrix with some (magnetic) hammer-scale flakes.

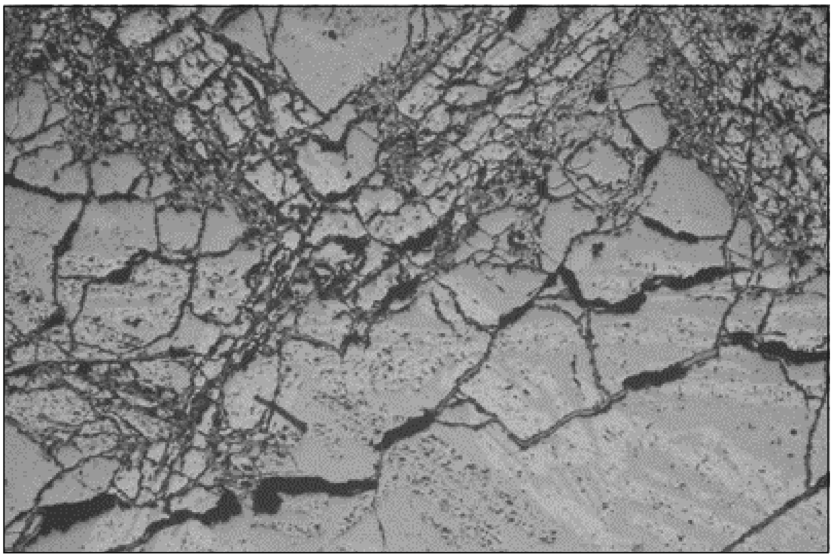


Figure 43. Optical micrograph of the same piece of PCB away from the rim, showing the main slag matrix of paler grey fayalite (iron silicate) laths in a darker background consisting of more glassy material, the whole piece being severely affected by cracking, the result of repeated heating and cooling cycles during one smithing campaign (magnification × 60).

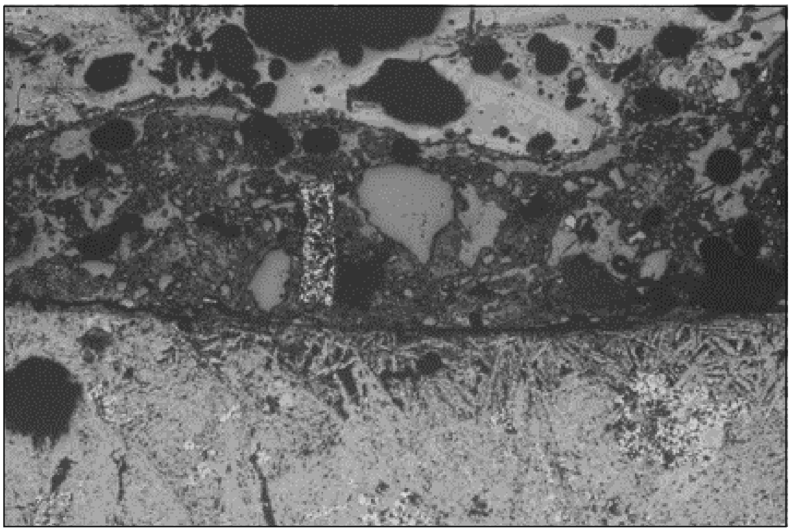


Figure 44. Optical micrograph of the same PCB showing the junction Between (top and bottom here) two separate stages of one smithing campaign showing 2-phase slag with gas voids, with a layer of gritty material with a flake of hammer-scale trapped between (magnification × 60).

Figure 45. (Context 366) Polished mounted section of a fragment consisting of a mixture of fayalitic iron rich slag (lower left here), fused to which is a fragment of probable fallen hearth wall (above, with larger heat-shattered quartz fragments), both of which are fused to part of the hearth wall lining, the curved line of which is marked by fine pale quartz grit particles, and the reddish inside part of which is also visible (on the right).

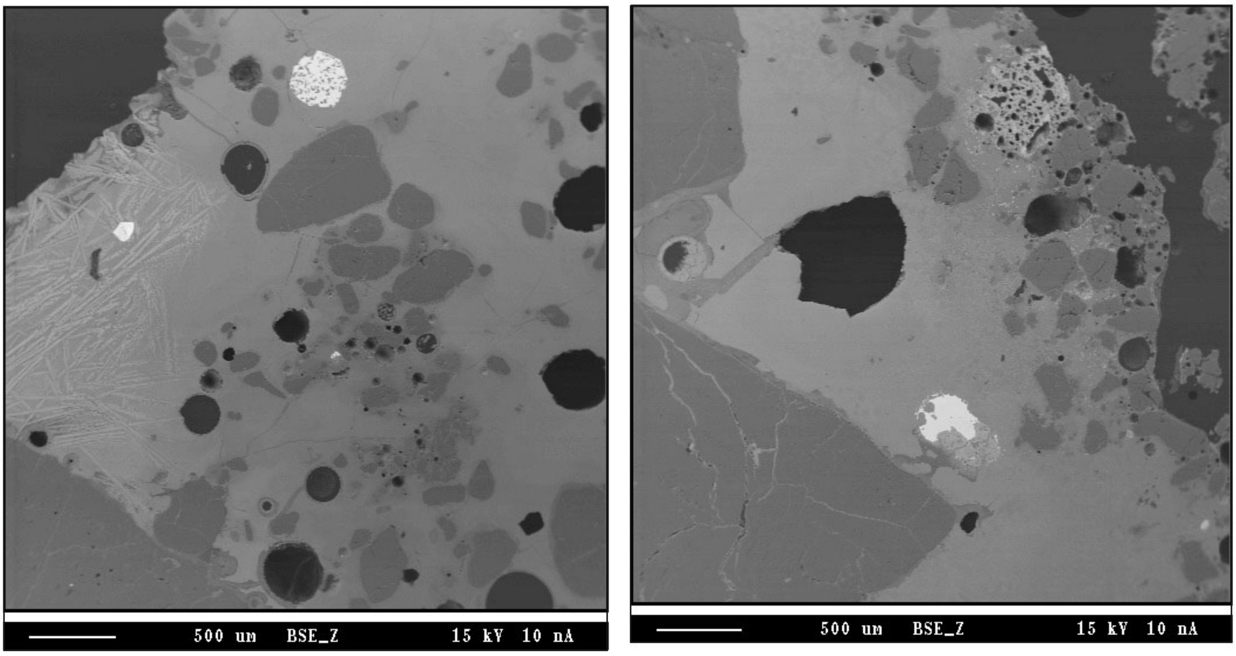


Figure 46. SEM back-scattered electron views of two parts of the same section showing the very mixed nature of this apparent fragment of smithing hearth slag which can be seen here to contain a lath-like fayalitic slag structure together with a small fragment of iron (left side of left image), large heat -cracked fragments of quartz in a clayey matrix derived from the hearth wall (lower left and central in both views), plus hammer-scale spheroid (upper centre left) a corroded piece of iron (lower centre, right image). Also visible (right side of right hand image) is an area of hearth wall (re)lining with noticeably finer porosity and smaller quartz gritting.

Figure 47. Context (366) Section through a fragment of hearth (re-)lining material (illustrated lower right in fig. 2) showing the clayey matrix (slightly redder, more oxidised away from the surface, below as shown here) containing filler material, again small fragments of whitish gritty quartz filler plus small (grey) fragments of relatively grit free earlier hearth lining and flakes of hammer-scale.

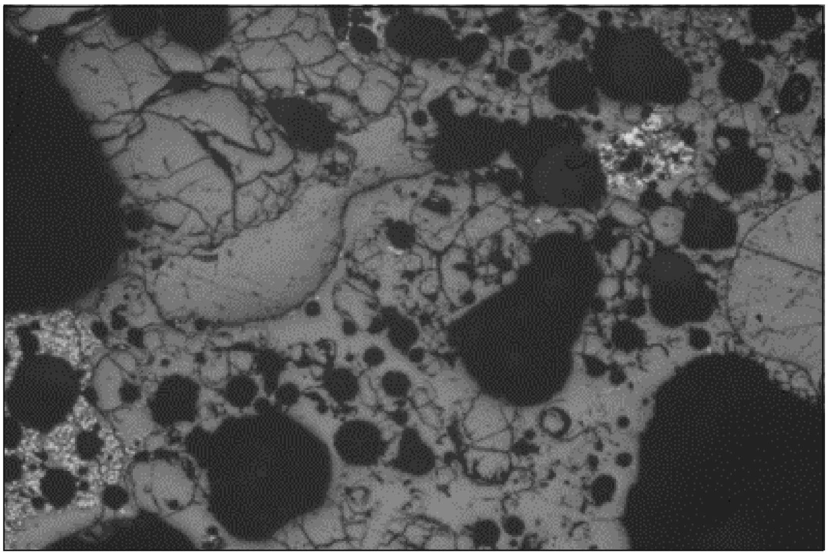


Figure 48. Optical micrograph of this same fragment of hearth (re-)lining in the more oxidised (red zone towards the inside of the sample with heat -shattered quartz fragments plus some hammer-scale, in a clayey matrix with many voids or gas holes (image 1.5mm wide).

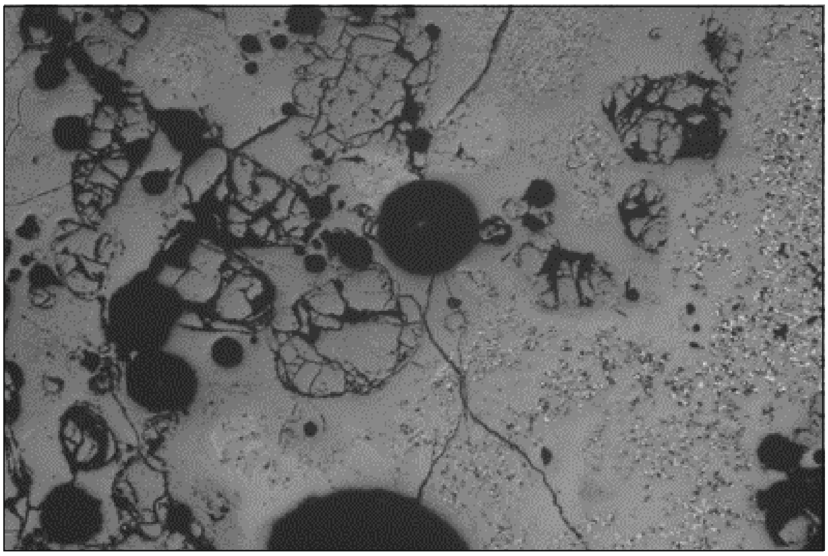


Figure 49. Optical micrograph of the same fragment of hearth (re-)lining in the more vitrified (grey) zone towards the surface of the sample with some partially absorbed heat-shattered quartz fragments plus broken up and dispersed/dissolved fragments of hammer-scale, in a clayey matrix with gas holes voids/voids (image 1.5mm wide).

Figure 49. Optical micrograph of the same fragment of hearth (re-)lining in the more vitrified (grey) zone towards the surface of the sample with some partially absorbed heat-shattered quartz fragments plus broken up and dispersed/dissolved fragments of hammer-scale, in a clayey matrix with gas holes voids/voids (image 1.5mm wide).

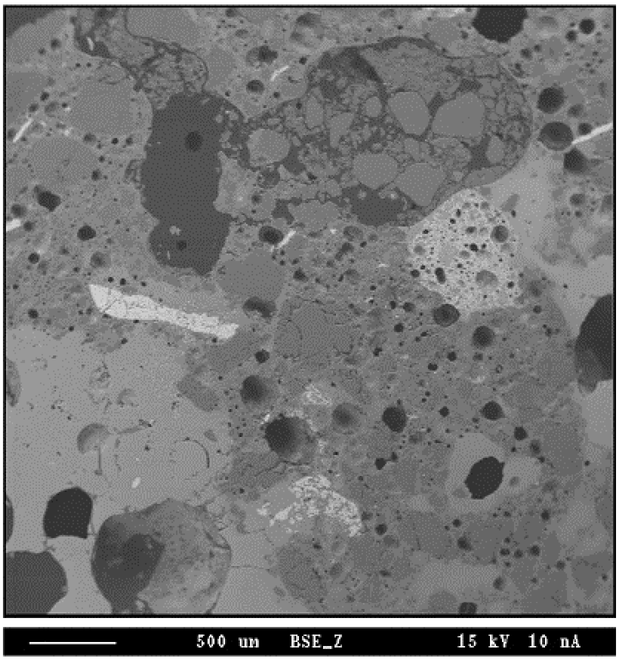


Figure 51. SEM backscattered electron image of the same section showing8 3 here two very porous fragments fused together with fayalite-rich smithing slag with a grit filled void (cave-like gap) in between (scale bar = 500microns/0.5mm).

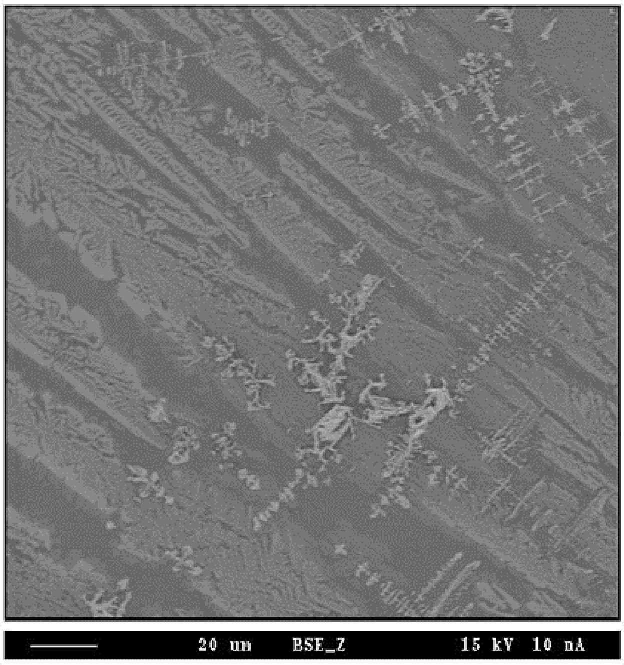


Figure 52. SEM backscattered electron image of the same section through the8 3 same fragment of hearth wall showing the 3-phase slag structure of the one of the small plain grey pieces of re-used smithing slag: a fine pale grey dendritic network of wüstite (iron oxide) superimposed on a medium grey, lath-like dispersion of fayalite (iron silicate) in a darker grey glassy matrix (scale bar = 20 microns).

Figure 53. Context (205) from gully 206. More-or-less complete pieces of smithing slag, three in the form of PCBs, and one more amorphous piece.

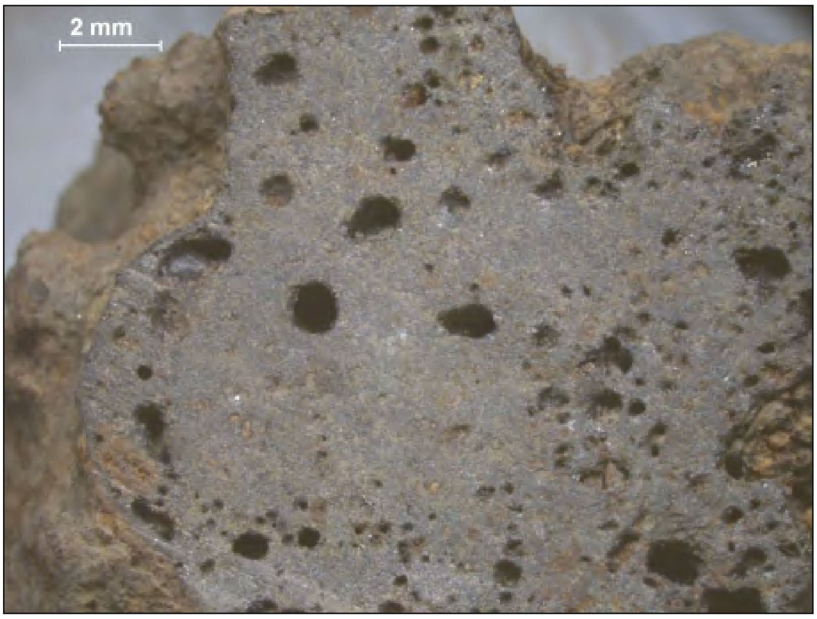


Figure 54. Section through part of one of these PCBs consisting of a dense matrix of mixed iron oxides (partly magnetic) with some porosity (gas holes) and some fine gritty material.

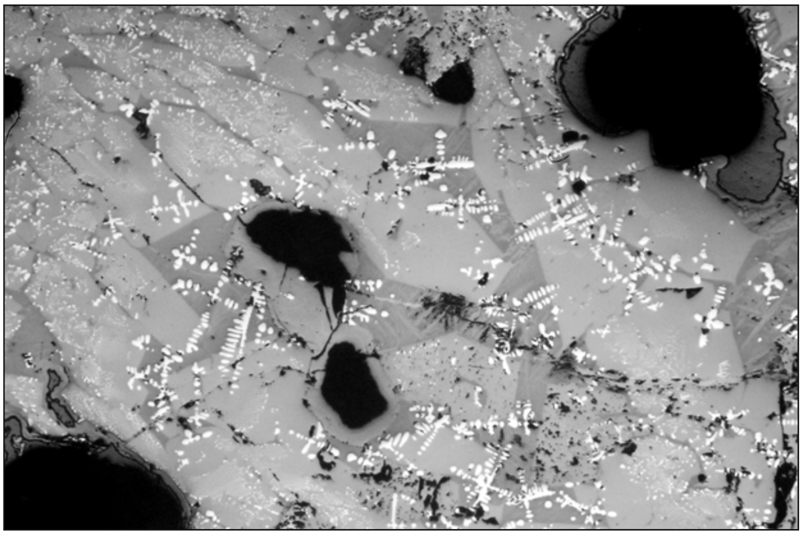


Figure 55. Optical micrograph showing the 3-phase of the main matrix of this part of the PCB, with fine pale wüstite (iron oxide) visible against a background of grey fayalite (iron silicate) laths with a darker grey infill of glassy material (image 1.5mm).

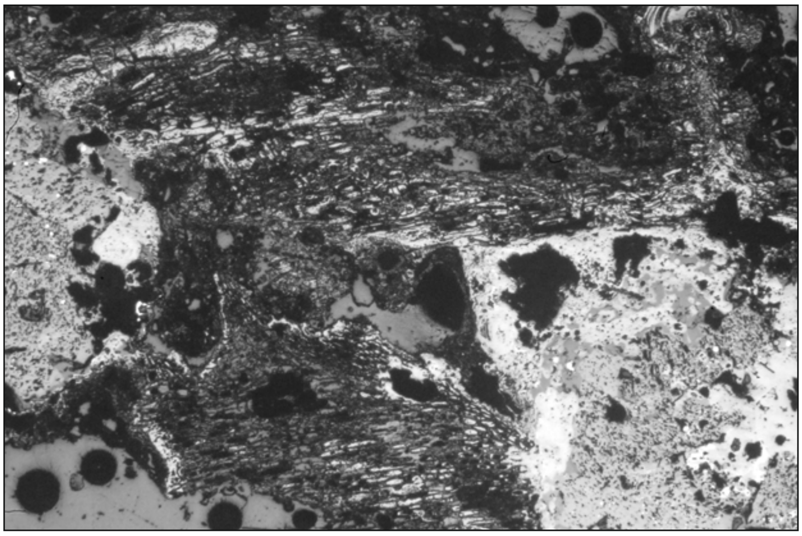


Figure 56. Optical micrograph of a different part of the same section showing a degraded charcoal fragment between two mainly corroded fragments of iron (image 1.5mm).

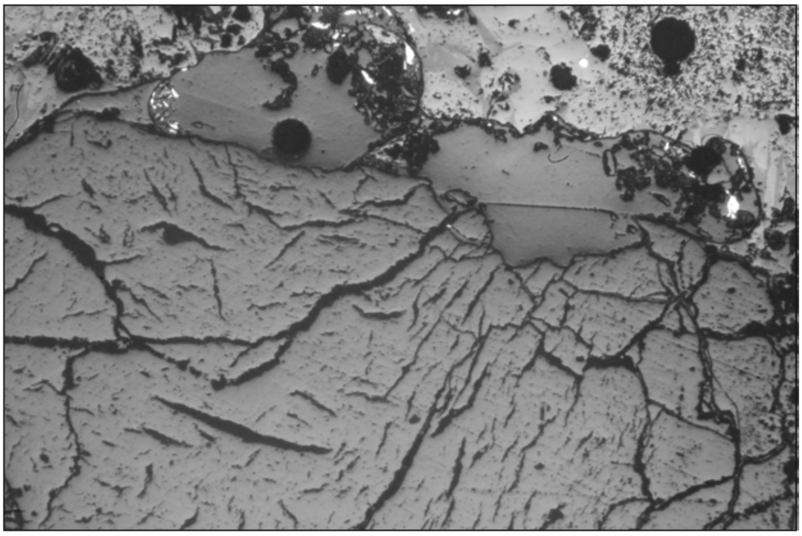


Figure 57. Optical micrograph of the same section showing a large piece of heat cracked quartz grit above which are the corroded remnants of two small pieces of iron adhering to which (above right) is a small area of fayalitic smithing slag, with more porous clayey material, top right and top left in this view (image 1.5mm wide).

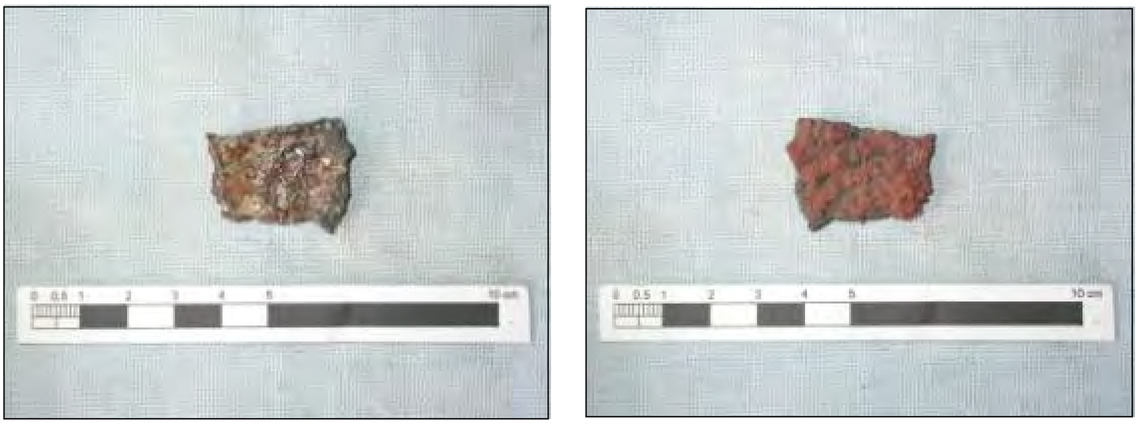


Figure 58. Context (205). Front and back views of a single fragment of hearth (re-)lining material showing the dark grey-brown, part vitrified shiny outer surface contrasting with the rough, reddish (oxidised) appearance of the inside 'surface'.

Figure 59. Section through the same fragment of hearth relining showing 8 7 the fine clay dark grey or red matrix containing small fragments of whitish gritty quartz filler, with some flakes of hammer-scale also visible, as are a few small dark grey fragments of crushed re-used hearth wall lining material.

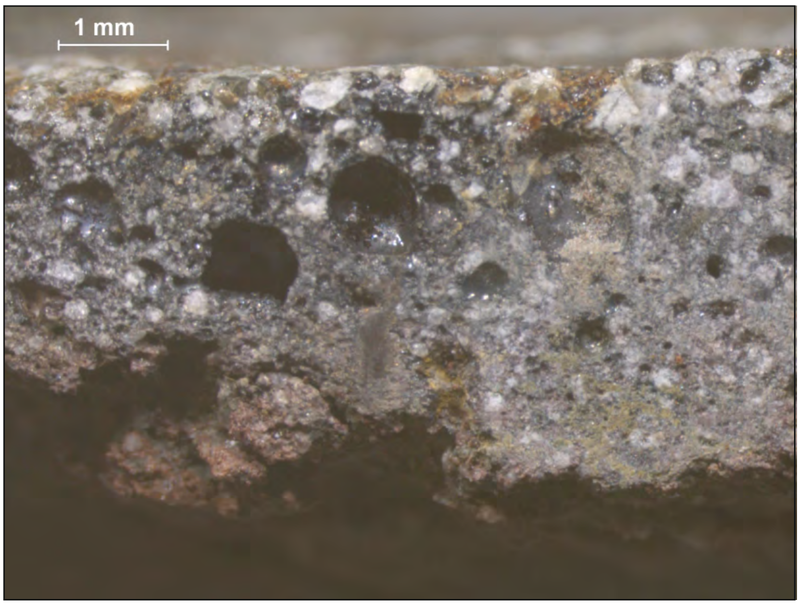


Figure 60. Enlargement of central part of the same view, showing the part vitrified clayey matrix near the outer surface (top here), as well as the rougher, reddish (more oxidised) material on the inside.

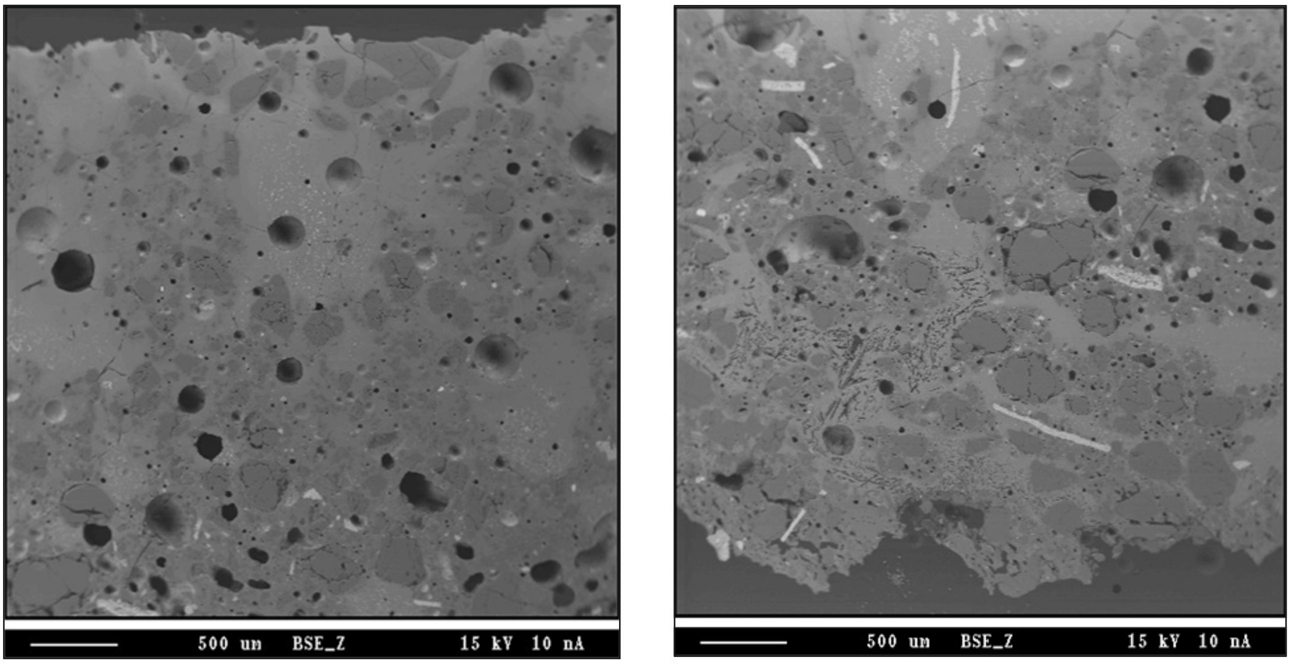


Figure 61. SEM backscattered electron images of the same section showing a progressive decrease of vitrification away from the outer surface (left hand image) where almost no (pale) hammer-scale pieces survive and less (darker grey) quartz particles are visible the rest having been absorbed into the surrounding clayey matrix, whereas these are less affected further into the hearth lining (right hand image).

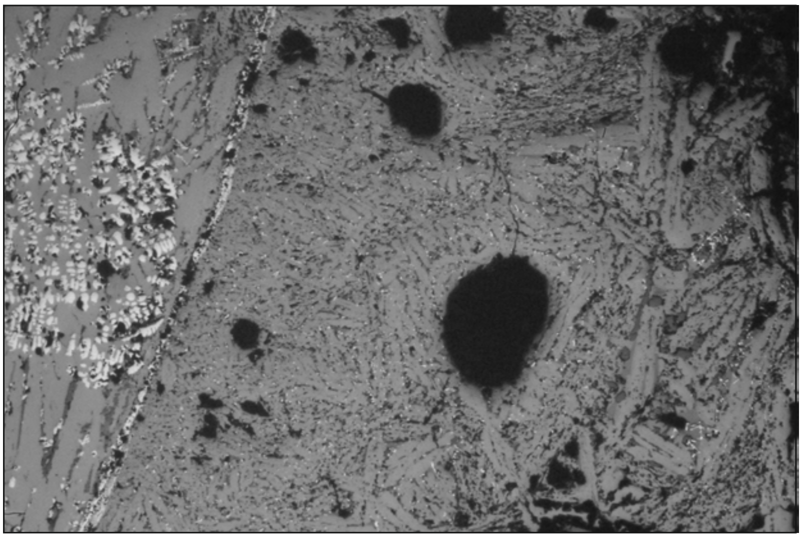


Figure 62. Optical micrograph of a section through a lump of smithing slag showing three successive stages in one campaign of smithing, firstly (left) a three phase structure with pale wüstite (iron oxide) dendrites visible against a background of grey fayalite (iron silicate) laths with a darker glassy infill then, separated by an iron oxide band, a fine two phase fayalitic structure (centre), separated by a dark boundary from a coarser two phase fayalitic slag structure (right) (image 1.5mm wide).

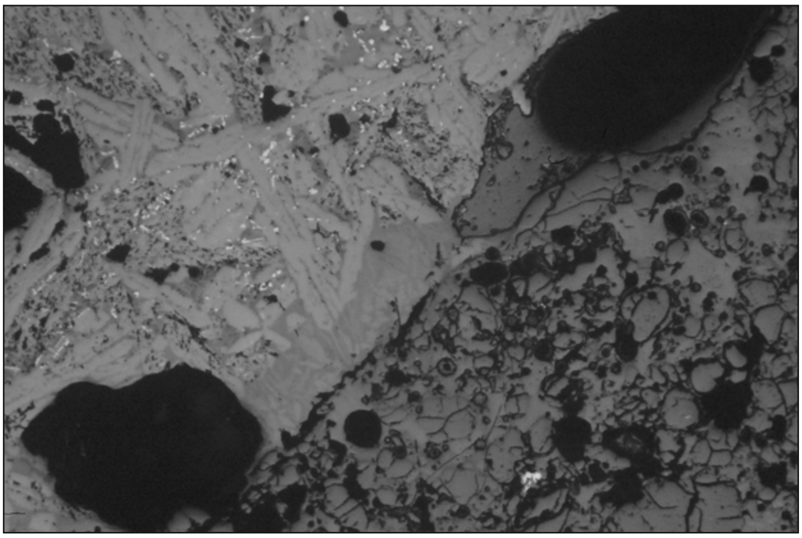


Figure 63. Optical micrograph of the adjacent region of the same section again showing (right hand in previous image) a coarser fayalitic structure but here with a few pale wüstite speckles (incipient iron oxide dendrites) more clearly visible, this smithing slag being fused to a fragment of hearth lining, here with fine quartz grit visible in a clayey matrix, on the right of the image (image 1.5mm wide).

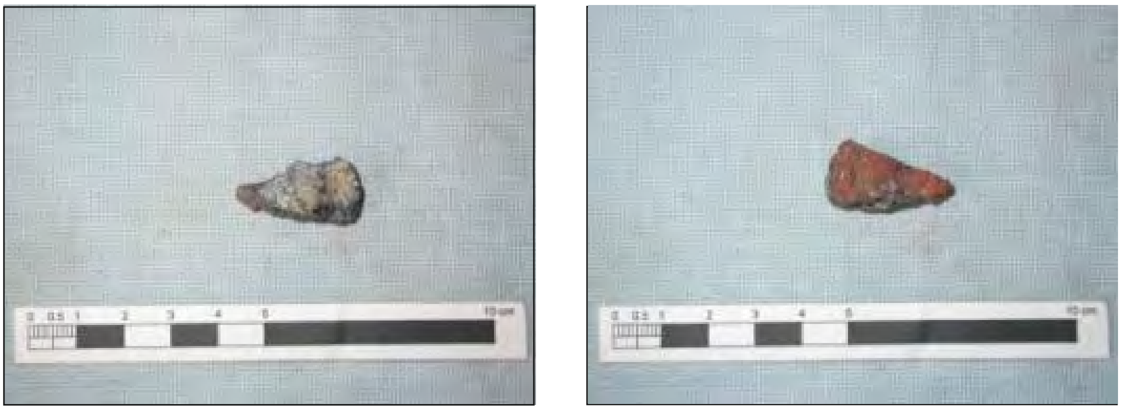


Figure 64. Context (135) of pit 136. Fragment of hearth (re)lining, showing (on left) a part vitrified dark glossy surface, and (right) the reddish (oxidised) rough inner surface.

Figure 65. Unmounted section across this same piece of relining material showing the fine clay dark grey or red matrix containing small fragments of whitish gritty quartz filler. The lower right hand corner is made up of a re-used rectangular fragment of relatively grit-free grey fired clay, possibly a sherd of pottery, which might explain why it is that it is flat on both sides.

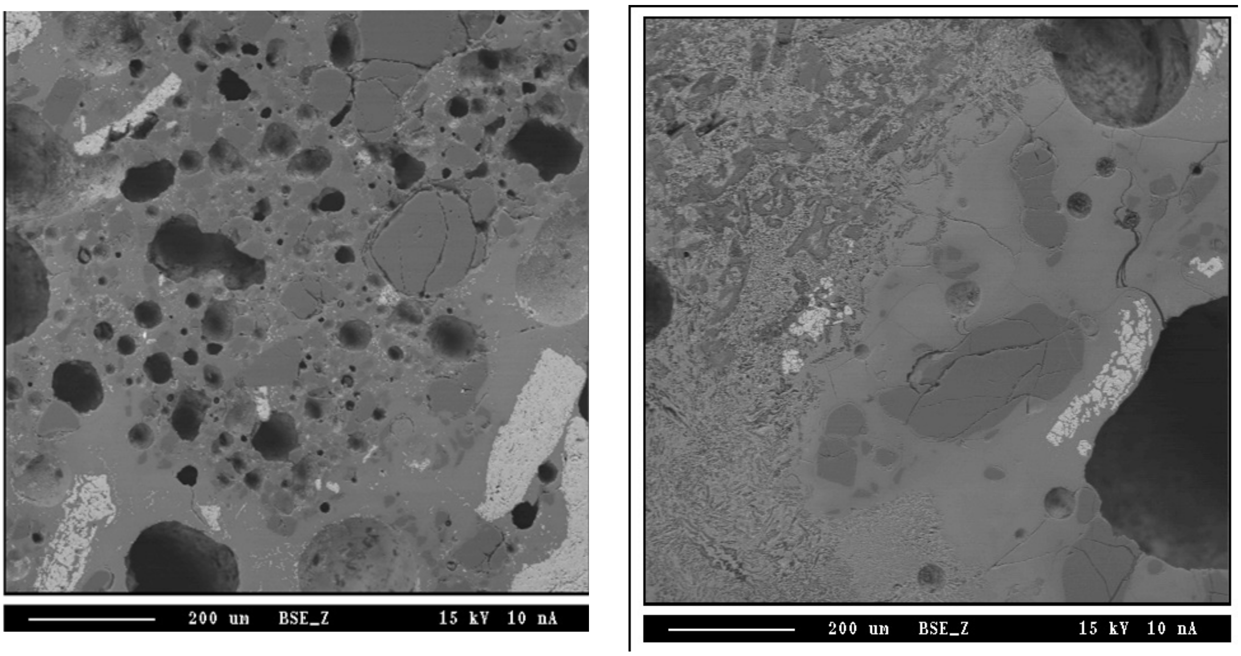


Figure 66. SEM images of the same hearth (re-)lining fragment section, the left hand image showing the inner structure of heat-cracked quartz grains plus (pale) hammer scale fragments in a porous grey clayey matrix, showing a progressively less porous/more vitrified structure from right to left in these two images.

Figure 67. Context (538) of pit 539. Dense lump, part SHB/PCB and part hearth wall, with a concave semi-vitrified upper surface, the hearth wall forming an upwards projecting, curved rim visible to the upper right here.

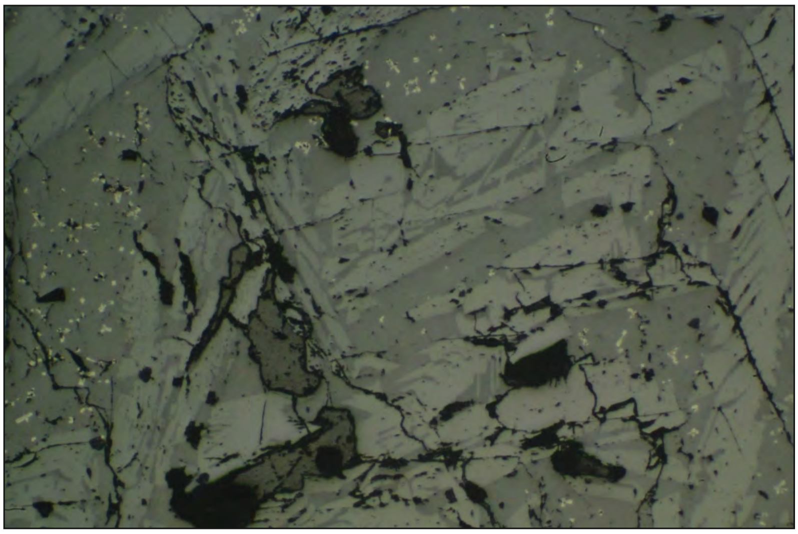


Figure 68. Optical micrograph of a section through part of this PCB/SHB showing a mixed, mainly two phase (fayalite/glass) slag structure with some incipient wüstite (iron oxide) dendrite showing as pale speckles, the very dark area being voids (image 1.5mm wide).

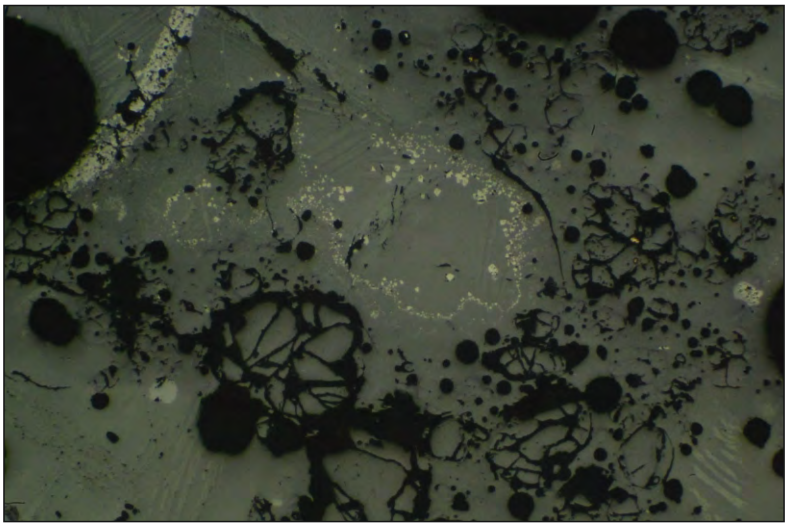


Figure 69. Optical micrograph of part of the same section showing the structure of the hearth wall lining to which the PCB/SHB is fused to on one side, showing a part vitrified gritty (quartz) clayey structure with some part dispersed hammer scale evidently mixed with some small pieces of two phase smithing slag reused as filler (grog) material, the whole mass now being part vitrified (image 1.5m wide).

Figure 70. Context (284) of midden. Very dense smithing slag: a PCB/SHB evidently showing a high degree of vitrification.

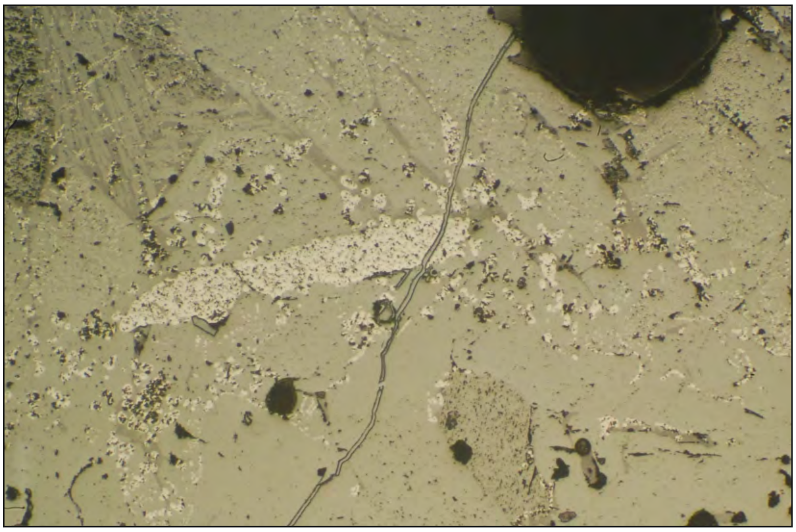


Figure 71. Optical micrograph of a section through part of the same PCB/SHB showing a region where slag two/three phase slag from the smithing process has reacted with part of the wall of the smithing hearth showing a blocky structure where the two have interacted. A large hammer-scale flake survives here quite well although other, smaller pieces of hammer-scale nearby have become more dispersed (image 1.5 mm).

Figure 72. Context (293) of pit 263. A nearly complete, roughly regular PCB/SHB which has formed at the base of a smithing hearth during one campaign of use (? a single day).

Figure 73. Section from one side of this same PCB/SHB with varying sized holes where slag formed during smithing but did not fully compact.

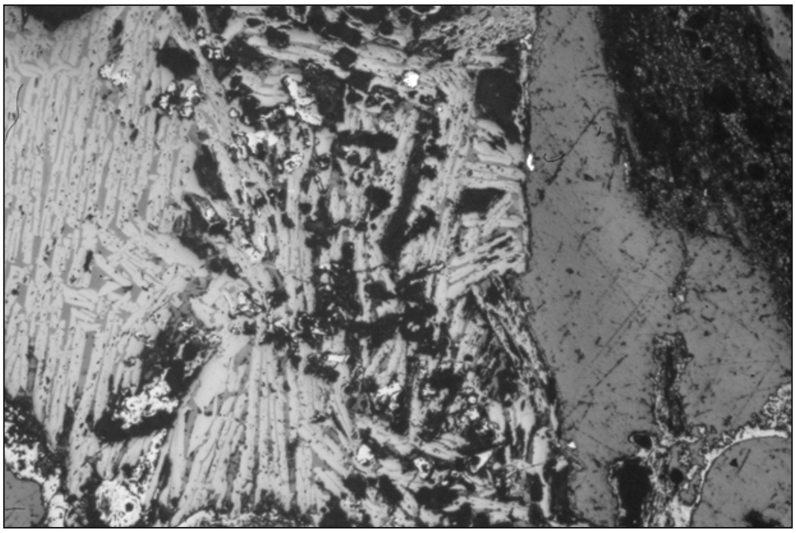


Figure 74. Optical micrograph of a section through part of the same piece of slag, mainly showing (centre and left) a partly corroded two-phase structure of paler grey fayalite laths in a darker glassy matrix, plus a few small fragments of iron and a little iron oxide; with a large void (right) partly filled with featureless mounting resin (grey here) and some degraded charcoal to the upper right (image 1.5mm wide).

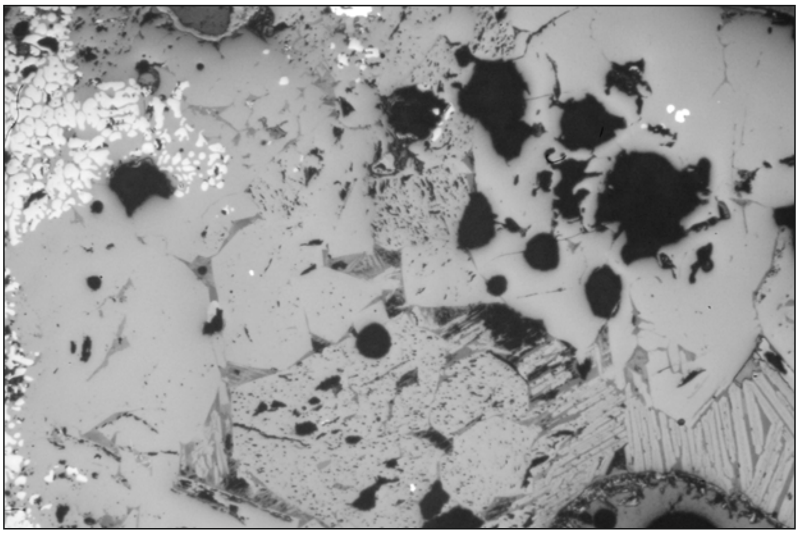
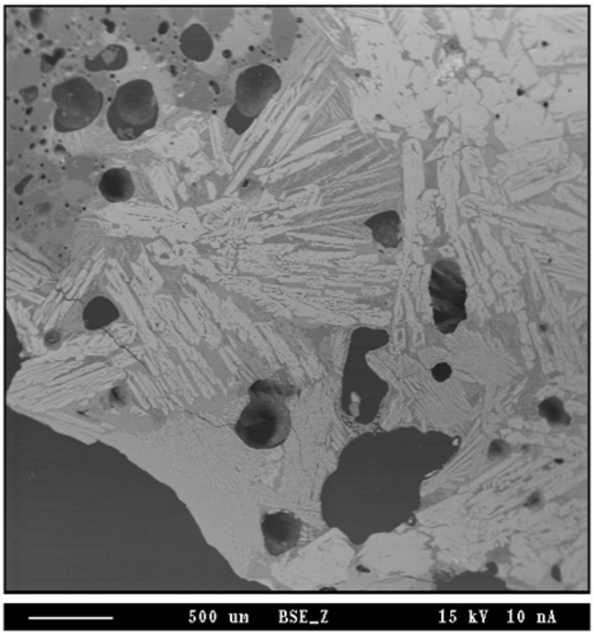


Figure 75. Optical micrograph of a different part of the same section near the edge of the slag block where the slag has interacted with the hearth wall showing here mainly porous clayey material with partially dispersed paler particles of hammer-scale (magnetic iron oxide) plus (lower left here) a small lath-like fayalitic/glassy area of smithing slag, possibly a fragment from a previous smithing campaign forming part of the filler (grog) material in the clayey lining of the hearth wall at this point.

Figure 76. Context (318) midden deposit. Irregular SHB/PCB which has formed near the base of the hearth smithing.

Figure 77. Section cut through a small detached fragment of this SHB/PCB96 showing a mainly fayalitic structure and many voids.



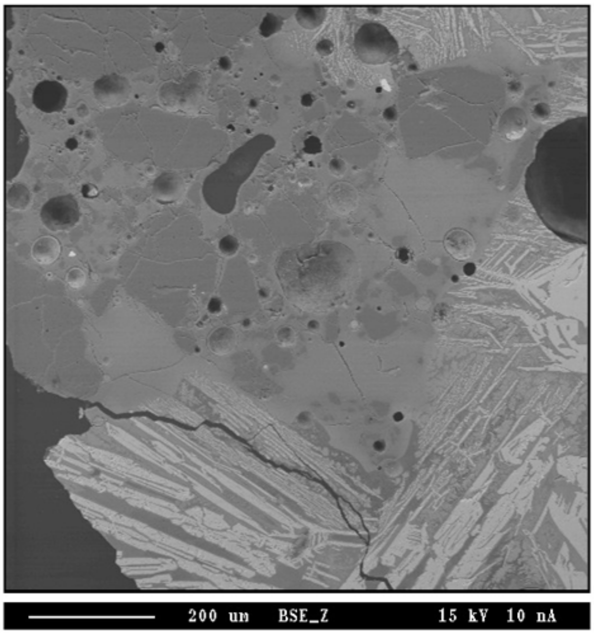


Figure 78. SEM images of a similar area of one side of the same SHB/PCB showing at progressively higher magnifications (left to right) with a 2-phase mainly fayalitic structure towards the right which is adhering to a fragment of partially fused hearth wall seen here on the left, with cracked darker quartz grains visible in a paler, more amorphous clayey matrix with many bubbly voids.

Figure 79. Context (514) from pit 515. Section through a small fragment of97 low density/lightweight fused fuel ash slag/hearth wall, the least altered part of which is the reddish part towards the inner part of the hearth wall, visible here towards the bottom of the fragment.

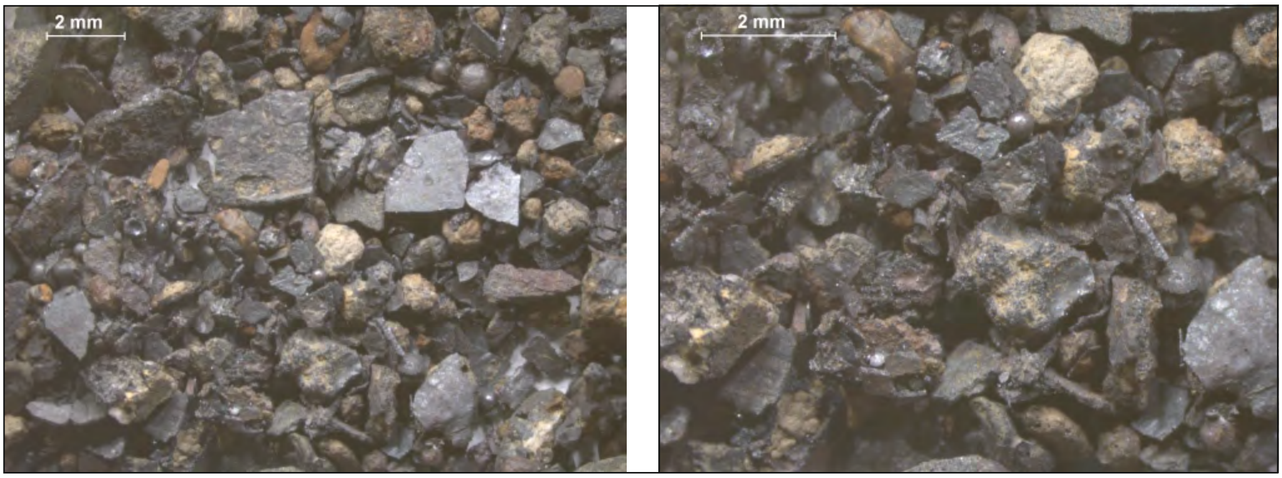


Figure 80. Context 214 (smithy floor). General view (upper image) plus detail of cleaned and part sieved material containing both flake and spheroidal hammer-scale mixed with a matrix of stony gravelly material.

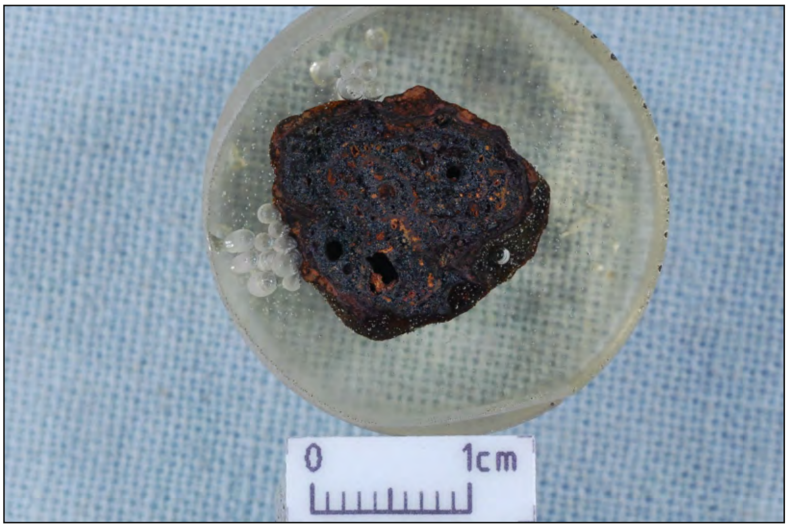


Figure 81. Context (347) (yard metalling). Fragment of SHB/PCB.98

Figure 82. Context (347) Optical micrograph of this same fragment of smithing hearth slag showing a build-up - from left to right in this view – of corroded mainly 2-phase (fayalitic/glassy) slag during successive phases of one smithing campaign with three distinct areas visible plus some voids (image 1.5mm wide).

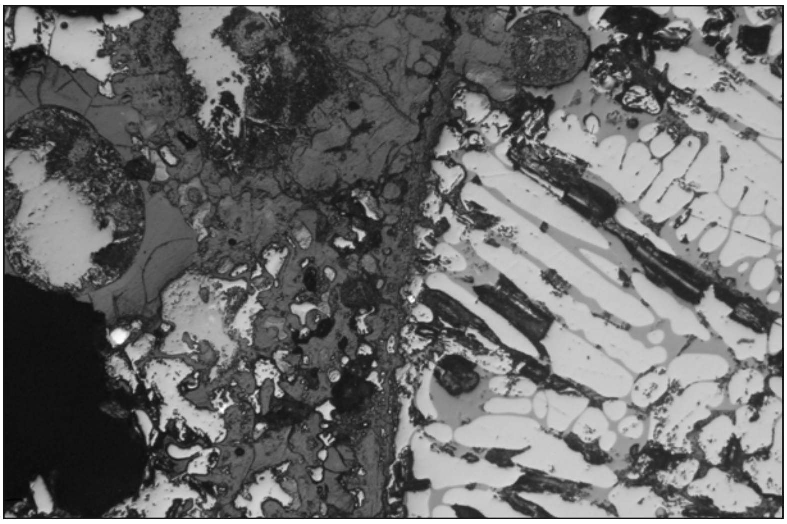


Figure 83. Detailed area of the same section showing the boundary between two areas of slag build-up during successive stages of this smithing campaign. Note the small white prill of iron next to the void towards the left of this view (image 0.75mm wide).

Figure 84. Context (347). Fragment of hearth (re)lining, with hammer -scale flakes visible (as darker flakes) in the fabric on the inner, reddish side (lower part here), although these are largely absent where they have re-dissolved near the outer surface (upper darker part here) where they have dissolved during partial vitrification at the surface.

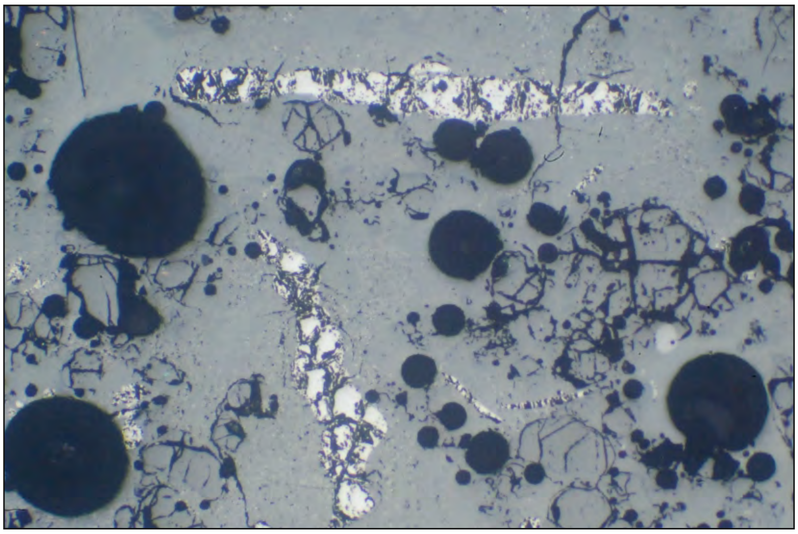


Figure 85. Central part of the same section of hearth (re) lining showing where both quartz grains and hammer-scale flakes (all extensively heat-cracked) have begun to react with and dissolve in the more amorphous clayey matrix due to vitrification in the hotter part near the surface of this part of the hearth (image 2mm wide).

Figure 86. Context (507) (yard metalling). Lightweight, porous (fuel ash) slag formed under intense heat by chemical reaction of some of the hot fuel with the clayey hearth lining.

Figure 87. Section through the same piece showing a very porous, semi-vitrified dark matrix plus small gritty fragments of quartz derived from the material used to line the hearth.

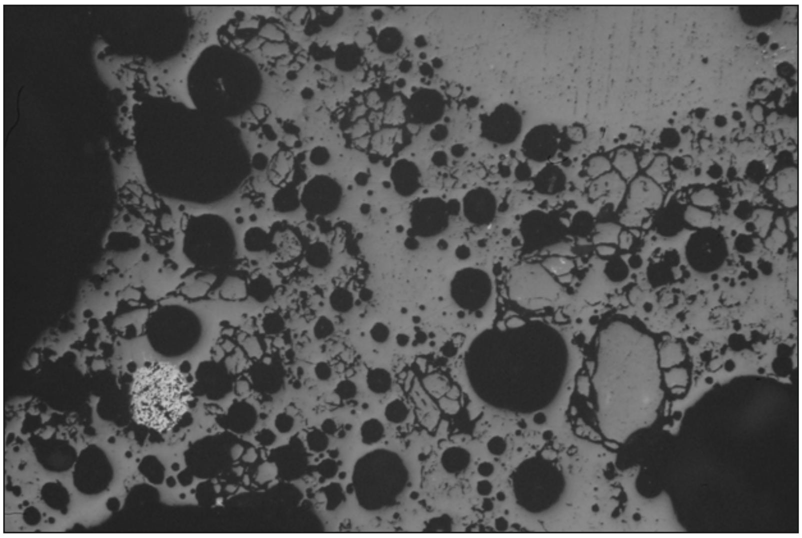


Figure 88. Optical micrograph of part of the same section showing small gritty fragments of quartz in a more amorphous and very porous clayey matrix, together with a single spheroidal (pale coloured) particle of hammer scale visible towards the lower left here (image 1.5mm wide).

Other finds *by Gwilym Williams and Jenny Winnett*

Whetstones (Figure 89.1-2; Table 18)
Five whetstones were recovered during the excavation. These are fine- to medium fine-grained limestones, from at least three different sources, and are typical of finishing tools. As such at least one example was also used for sharpening blades. Whetstones are one of the indices proposed by Grenville Astill (1995, 187) for the identification of smithing.

Context number	Small Find number	Weight (g)	Dimensions
185	83	573	156 × 72 × 39
190	30	94	77 × 40 × 21
493	81	136	97 × 29 × 29
524	82	354	110 × 42 × 40
506	64	498	84 × 83 × 35

Table 18. Whetstones.

Whetstone 83, a medium fine-grained pinkish piece of limestone, has score-marks on one the upper surface, indicating the direction in which blades were sharpened, which itself is well-worn into a slight hollow (Fig. 89.1). This hone comes from the wall 185 of the Structure 4 smithy and, in which case, is more than likely to date from the earlier phase of smithing associated with the Structure 1 smithy.

The small fragment of whetstone 30, found on the southern external metalling (190) was a fine-grained piece of limestone. It was slightly worn into a hollow. No score-marks were present.

The irregular cylindrical whetstone 81 from the fill (593) of the 15th-century pit 594 to the south of the Structure 4 smithy was medium fine-grained and was worn smooth, with some irregularities. It may well have been opportunistic rather than planned use.

The large fragment of whetstone 82 (Fig. 89.2) was a medium-grained limestone, recovered from fill (524) of the terracing 519 for the palaeochannel adjacent to the midden area. There was extensive wear on two sides. No score marks were present.

It is likely that the whetstone 64 recovered from the eastern external metalling (506) may well be a reused quern stone of purple phyllite. The underside has a rounded bevelled edge, and it much more uniform in thickness and shape, suggesting it has broken off a much larger flat rounded stone. The fragment of quern has been used as a whetstone, although faint knife-marks are also present.

Ceramic discs (Fig. 89.3; Table 19)
Two fragments of reworked roof-tile were recovered. These appear to be either lids for a small container or perhaps counters, although they seem to small for the former and too large for the latter. Both objects were recovered from deposits dating after the middle of the 13th century; the smaller, ceramic disc 177 (Fig. 89.3), came from a midden deposit on the east side of the site, while the larger ceramic disc 178, was recovered from the yard surface north of the Structure 4 smithy.

Context number	Small Find number	Weight (g)	Dimensions (mm) L×B×T
521	177	68	63 × 62 × 14
325	178	88	77× 74 × 14

Table 19. Ceramic discs

Similar tile discs were recovered from the excavations at Bordesley Abbey (Astill 1992, 127-9), where their function could not be explained either. Whether these were used during smithing- or foundry-related activities is unclear, but the presence of the discs on both sites is notable, even if the significance remains uncertain as yet.

Spindlewhorl (Fig. 89.4; Table 20)
A single partial spindle whorl was recovered from the Phase 2 ditch 166. This example is made from a fine-grained calcite mudstone. It has a single flat face, typical of spindle whorls from the 10th to early 12th centuries with a curved shoulder and lathe-turned hole of *c* 8mm diameter (Pritchard 1991, 165; Fig. 3.49 No 171).

Context number	Small Find number	Weight (g)	Dimensions (mm) L×B×T
266	48	7	37 × 16

Table 20. Spindlewhorl

The stone, the shape and the diameter of the hole are similar to the London examples, which have also been found in Gloucester, Hereford and Thetford (*ibid.*). Pritchard (1991, 165) suggests these to have been part of a specialised industry due to the homogeneity of production and lack of debris in London. A 12th-century date corresponds with the pottery-derived date for the ditch 166.

Roof Tile
A total of 236 roof tile fragments, weighing 17,112g, were recovered during excavation (Table 21). This does not represent the entire assemblage from the site, as the retention of tile was not uniform during excavation. The majority of the tile fragments fell into one of two fabric categories. The first of these was a red/orange firing sandy fabric often containing large pale grog and/or occasional quartzite and other stone inclusions. The second was produced from a pale orange/pink firing sandy clay with occasional small stone and/or grog inclusions. No significance could be assigned the different fabrics.

The majority of the roof tiles were of the flat, peg-hole type, although the fragmentary nature of the assemblage meant that the majority of the examples did not have a peg hole present. The plain peg-hole tile appeared first in the late 12th to early 13th centuries in London (Cherry 1991, 194) extending quickly throughout southeast England over the course of the 13th century (Drury 1981, 130-1).

The tiles were commonly produced using sanded moulds, and tend to have sand on their base and sides, with strike marks on the uppermost surface where a wire was drawn across the top of the mould to remove excess clay.

The assemblage also contains some ridge tile. This is relatively common on medieval sites. Like the flat peg hole tiles these were produced in sanded moulds and generally have a single peg hole.

Context	Cut	Frags.	Wt (g)
`	104	1	55
(129)	106	1	147
(133)	134	1	63
(142)	142	1	368
(143)	144	2	387
(145)	Y	20	1093
[185]	W	2	183
(190)	Y	32	1726
[193]	W	5	352
(251)	252	1	137
(293)	M	1	93
(316)	L	1	99
(317)	L	33	1967
(318)	L	3	263
(319)	L	4	140
(326)	327	5	160
[330]	W	9	642
(335)	M	4	173
(354)	Y	1	116
(355)	369	5	636
(357)	505	1	8
(381)	382	17	290
(383)	384	3	184
(399)	398	1	74
(419)	376	1	82
(423)	130	1	30
(424)	L	8	654
(428)	427	5	341
(442)		5	35
(448)	L	1	89
(483)	484	1	70
(493)	494	26	3064
(503)	L	9	1065
(504)	505	7	569
(521)	519	5	408
(524)	519	3	373
(540)	541	1	38
(542)	543	1	83
(544)	L	1	124
(545)	L	2	53
(546)	L	3	260
(548)	550	2	418
Total		**236**	**17112**

Table 21. Roof tile

Roof tile recovered from Barentin's Manor, Chalgrove was suggested to have been manufactured in the Chilterns at Nettlebed to the southeast (Robinson 2005, 115). It is however, also noted that at Penn, Bucks., which was to prove an important centre for floor-tile production during the 14th century and even into the early 15th century (Green), ridge-tile was already being fired and distributed during the late 13th century (Jope 1951, 88).

Industrial tile *by Jenny Winnett*; Table 22)

Two partial industrial tiles, weighing a total of 308g, were recovered (Table 22).

Context	Type	Frags.	Wt (g)	Dimensions	Fabric	Glaze/Decoration	Comments
544	Floor	1	213	90 × 74 × 21	Pale orange fabric containing numerous grog and small stone inclusions.	White slip-like substance on top and inside pierced holes; no decoration	6 holes 6mm in diameter – malt drying tile
296	Gully cut	6	95	65 × 55 × 15	Grey with pale clay mottling	No glaze; regularly scored lines	Overfired and vitrified on one edge

Table 22. Industrial tile.

The tile from context (544), which sealed the palaeochannel, would have been used in the floors of malt-drying kilns used in beer production. The tiles were perforated to allow the flow of warm air to pass evenly through the malt. The temperature of malting kilns is comparatively low –*c* 100° C – and the soft fabric used for this tile showed no evidence of high heat-treatment.

Post-medieval tiles for this purpose have been described by Patrick (1995; 1997, 61) as being twelve inches square with five perforations in a cruciform shape per main round hole. Belford and Ross described late 18th to early 19th-century malt drying tiles as having several pierced holes that were wide at the bottom and narrowing to a tiny aperture at the top (Belford & Ross 2004, 219).

The tile from Newington House differs from these examples in that the pierced holes are uniform in diameter throughout the body of the tile. Although the example is incomplete, 6 holes 6mm in diameter were pierced through the tile at regular intervals and it has been assumed this pattern was repeated over the entire tile. Perforated tiles similar to this one were used in malt kiln floors until the end of the 20th century (Conway-Jones & Higgs, 2008, 3; Patrick n.d., 2).

The second example of industrial tile, which comes from the small gully 296 on the east side of plot 3, is highly fragmentary and incomplete. It consists of a sandy grey, over-fired fabric with shallow, regular scored lines on one side. The score marks are approximately 1mm in width and have a square profile. There are no traces of material adhering to the tile although one edge is friable and highly vitrified.

The tile appears to have been used in some industrial process, possibly involving intense and repeated firing. It is possible the tile was used during iron-working. It was located just to the north of the postulated ore-roasting hearth, although from Phase 3, rather than Phase 4. It may however be intrusive. Crossley (1981, 31) refers to the highly vitrified lining of 14th-century iron smelting kilns excavated North Yorkshire.

Stone roof-tile *by Jenny Winnett* (Table 23)

Three pieces of stone roof-tile were recovered. Two of these are both a similar coarse-grained limestone and are associated with the Structure 4 smithy; fragment 29 was recovered from the wall footing 185, while 46 came from the anvil setting 188. The third piece, 25, is fine-grained and pinkish in colour, and came from the gravel bank (448) associated with Structure 5 and the ore-roasting oven 447.

Context number	Find number	Weight (g)	Dimensions (mm) L×B×T
188	46	214	134 × 90 × 14
185	29	356	140 × 86 × 23
448	25	21	62 × 56 × 23

Table 23. Stone roof-tile

Brick (Table 24)

A total of 5 fragments of brick, weighing 1,402g, were recovered during the excavation. Due to the fragmentary nature of the assemblage it is impossible to date with any certainty. The general principles of the production process have varied little since the 13th century, when the brickmaking industry came into being. Although statutes were promulgated, particularly from the 16th century onwards, concerning brick-size, the limited remains do not permit comment on the size of the bricks represented. All examples from Newington House were made from red clay with haematite inclusions and some sand.

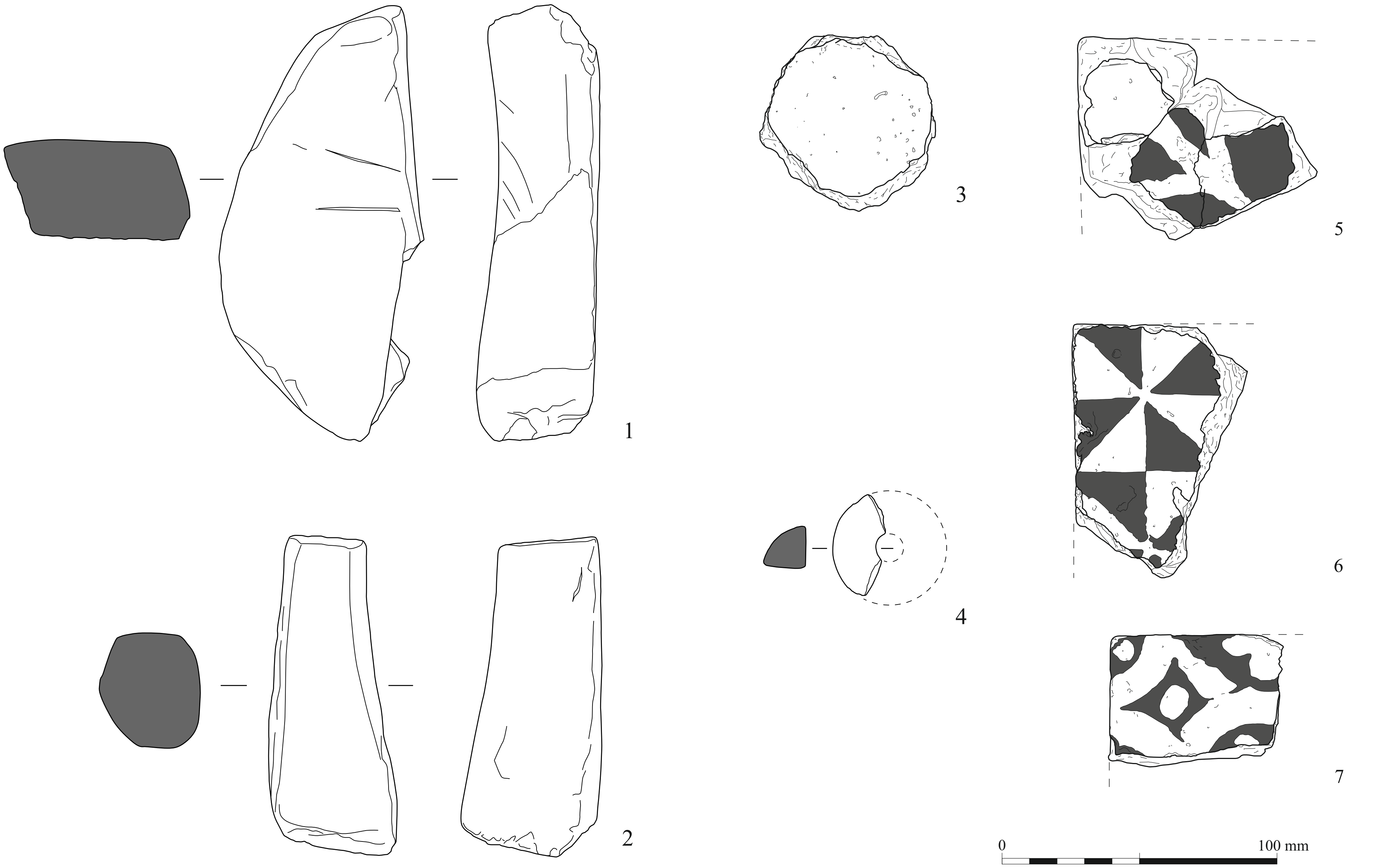


Figure 89. Other finds.

Brick was re-introduced to Britain in the 12th century when it was a high status material. Coggeshall Abbey, Essex as well as a number of other places in the east and southeast of England adopted the use of brick either for details or for structures (Smith 1985, 2) and by the 14th century was reasonably widespread (Moore 1991, 212). Locally, brick was used at Stonor Park, Ewelme from the early 15th century.

Context	Frags.	Wt (g)	Dims (mm) L×B×T	Date
(347)	1	50		15th C
(428)	1	156		15th C
(442)	1	32		
(504)	1	50		13th C
(544)	1	1114	105×95×60	
Total	5	1402		

Table 24. Brick.

A single example of an almost complete brick, weighing 1114g, was partially vitrified. This might suggest its having been used in a kiln or other high temperature industrial environment, such as a furnace. It is impossible to be certain whether its provenance being the same as the malting kiln tile fragment is significant.

In the context of the apparent abandonment of the site by the 15th century and the limited quantity of brick it is not possible to ascribe too much significance to the vast majority of brick fragments.

Decorated floor tile *by Gwilym Williams* (Fig. 88.5-7)

Extensive research on the medieval decorated floor tile in Oxford, Oxfordshire and Buckinghamshire has been carried out since the 1930s (Haberley, 1937; Hohler 1941; Hinton, 1968; Emden 1969; Eames 1980; Cotter 2006). The glazed floor tile from Newington House, Newington comprises eight fragments, weighing 625g (Table 25). There are five fragments, weighing a total of 205g, of ‘Stabbed Wessex’ style tile, which dates from the end of the 13th century. The rest of the tile – four fragments weighing 420g – comprised printed tile in the Penn tradition. Penn is 25km east of Newington, although Penn tile was shipped by boat on the Thames (Green 2003).

Where feasible the designs have been compared with Hohler (1941). Three of the pieces do not conjoin with any other tile fragment; two fragments from (190) conjoin but the motif is not easily identifiable; a further two fragments from (190) conjoin with a piece from the midden layer (493). All pieces show reasonable to extensive wear, and the small size of the fragments and their frequently abraded edges indicates that their provenances were secondary, rather than primary, deposits. This seems to indicate that following abandonment the Structure 4 smithy was the focus of rubbish-dumping.

Ti1e, comprising a fragment from fill (493), in pit 494, conjoining with a fragment from the metalling (190) on the south side of the Structure 4 smithy was recovered (Fig. 88.5). The tile was an inlaid ‘Stabbed Wessex’-style tile (Hohler 1941, W/28), which was part of a four-tile pattern, comprising a cross formed of four fleur-de-lys in a quatrefoil with trefoil ornament in the outer angles – found – in addition to Oseney Abbey and St Frideswide’s Priory – at Brightwell Baldwin, approximately 7km east of Newington. This tile dates from after the late 13th century, although the contexts from which both fragments are derived are 15th-century, or later. A further triangular fragment of 'Stabbed Wessex' style tile was recovered from midden layer (284). The metalling (190) yielded a further three fragments of tile – one 'Stabbed Wessex, and two conjoining fragments of Penn-style printed tile.

Context	Frags.	Wt (g)	Dims (mm) L×B×T	Comments	Type (Fig)	Date
(190)	2	120	82×69×17	Two edges present one piece; not very worn, decoration not identifiable	N/A	14th c.
(190)	2	119	83×75×20	Two edges present; 'Stabbed Wessex' style base; broken in antiquity; very worn	Hohler W/28 (Fig. 88.5)	13th c.
(190)	1	44	53×36×17	'Stabbed Wessex' style – evidence for point on fracture; very worn; slip still present; vegetable decoration	N/A	13th c.
(284)	1	42	64×40×16	'Stabbed Wessex' style, triangular piece, glaze on edges	N/A	13th c.
(318)	1	158	89×65×20	One croix gironée (also Gyronny Cross) in the corner of the tile, a second is clearly adjacent but incomplete	LH CVII Eames 2028 (Fig. 88.6)	14th c.
(347)	1	72	63×49×20	Geometric design with dots and lines; not identifiable	(Fig. 88.7)	14th c.
(493)	1	70	51×45×17	One edge present Conjoins with 190	Hohler W/28	13th c.
Total	9	625				

Table 25. Decorated floor tile.

The later examples include a fragment of printed tile, LH CVII, with a gyronny cross (Figure 88.6) dating from the 14th century onwards; this Penn-style tile was recovered from the midden deposit (318) north of the Structure 4 smithy. Three examples were recovered from the demolition of Barentin's manor, Chalgrove (Robinson 2005, 114); a similar example was also recovered from Merton College (Cotter 2006, 298). The fabric is also similar to the Merton example.

The final fragment of tile (Fig. 88.7) is the corner of a printed tile, which clearly formed part of a four tile group which has not been recognised. The tile comprises a partly geometric design of a dot, in the corner, with a concave square on the angle between the two sides; there is a dot in the centre of the concave square and a line extends from one – possibly both of the corners of the square on the inside of the tile; there appears to be a trefoil or quatrefoil on the external side of the tile.

None of the seven fragments from Great Bowling Field conjoin, although it is apparent that at least three fragments are from a similar source. All fragments are abraded, which given that they were retrieved during fieldwalking is not surprising. None of the designs are particularly clear. These were previously believed by SOAG to indicate the presence of a manor building in Great Bowling Field.

However, given the presence of further fragments in Park Field, and the apparent limited quantity recovered, such an hypothesis is no longer quite so tenable. The absence of any significant building on the 1595 Hovenden map also militates against such an interpretation, as the manor house preceding Newington House, and the rectory have always stood overlooking the Thame, rather than lying at the foot of Great Bowling Field. It is possible that these fragments derive from either the church of St Giles, or indeed from a manorial building erected prior to the present Newington House. The presence of the tile in later 15th-century contexts, which are assumed to have functioned for rubbish disposal, may well be indicative of works carried out at either house of church.

6.2 ENVIRONMENTAL REMAINS

The Animal Bone *by Claire Ingrem* (Fig. 90; Tables 26-47; Appendices 4 & 5)

An assemblage of animal bone was recovered from medieval and post-medieval deposits during a watching brief in advance of the construction of a lake in the grounds of Newington House, Newington Oxfordshire by John Moore Heritage Services in 2006 and 2007. Most of the bone came from enclosure ditches that were laid out during the late 11th to early 12th centuries, a period in which midden management also began.

A variety of other feature produced smaller amounts of bone, including rubbish pits associated with the 12th - 13th century smithy, which was erected after the enclosures were divided into plots. During the early 13th century, the plots were modified and the original smithy was replaced by another (the main) smithy which is thought to have continued in use up until the late 14th century. Rubbish pits and a metalled surface are also associated with this phase. The site continued in use into the 15th when there is evidence for demolition, abandonment and the use of the site for waste disposal (Williams *pers. com*).

The phases referred to in the animal bone report are those used elsewhere in the main report.

Methodology
The animal bone was recovered primarily by hand collection. In addition, a small number of specimens were recovered during flotation for carbonised remains from samples washed through 10mm and 2.5mm sieves onto a 500µm mesh. Anatomical elements were identified to species using morphological criteria (as outlined in various atlases such as Schmid, 1972 & Hillson, 1996) and the authors' personal reference collection, with the exception of ribs and vertebrae which were assigned to animal size categories.

Mandibles and limb bones were recorded using the zonal method developed by Serjeantson (1996) to allow the calculation of the minimum number of elements (MNE) and individuals (MNI); this is based on the most numerous zone of a single element taking into account side**.** In addition, all bone fragments over 10mm were recorded to species or size category to produce a basic fragment count of the Number of Identified Specimens (NISP). Fragments categorised as large mammal are likely to belong to horse or cattle, those in the medium mammal category to sheep or pig.

The presence of gnawing, butchery and burning together with the agent responsible was recorded. Measurements were taken according to the conventions of von den Driesch (1976) and Payne and Bull (1982) for mammals. Withers height was calculated for cattle by combining the factors given for steers and cows by Matolcsi, 1970 (in Boessneck & von den Driesch, 1974).

The wear stages of the lower cheek teeth of cattle, caprines and pig were recorded using the method proposed by Grant (1982) and age attributed according to the method devised by Payne (1973) for sheep/goat, Legge (1982) for cattle and O'Connor (1988) for pigs. The fusion stage of post-cranial bones was recorded and age ranges estimated according to Getty (1975). Equids were assigned to species according to the criteria of Davis (1987). Horse premolars and molars were distinguished using the criteria of Lavocat (1966). Measurements of the crown height of horse teeth were recorded and age estimated according to the method of Levine (1982).

	Phase 2 L11th –E12th	**Phase 3** E12th -13th	**Phase 4** E13th-M14th	**Phase 5** M13th –L14th	**Phase 6** 15th	**Total**
Cattle	26	35	86	21	22	**190**
Sheep	1	4	13	1	1	**20**
Sheep/goat	13	40	52	11	4	**120**
Pig	4	19	26	8	5	**62**
Horse	4	7	16	3	9	**39**
Dog			1			**1**
Cat *(Felis spp.)*		1	1			**2**
Cat *(Felis silvestris)*			1			**1**
Cat *(Felis catus)*				1		**1**
Goose *(Anser anser)*		1	1		1	**3**
Galliform		1	1	1		**3**
Bird	1	13	1		1	**16**
Large mammal	46	74	139	11	39	**309**
Medium mammal	14	32	32	6	4	**88**
Small mammal		1	1			**2**
Unidentifiable	81	166	205	54	28	**534**
Total	**190**	**394**	**576**	**117**	**114**	**1391**
Total identifiable	**48**	**108**	**198**	**46**	**42**	**442**
% identifiable	***25***	***27***	***34***	***39***	***37***	***32***

Table 26. Taxa representation according to period including unidentifiable specimens assigned to animal size categories (NISP)

A selected suite of elements was used to differentiate between sheep and goat (Boessneck, 1969; Payne 1985; Prummel, & Frisch, 1986: the distal humerus, proximal radius, distal tibia, distal metapodials, astragalus, calcaneus and deciduous fourth premolar. No elements were positively identified to goat so for the purposes of this report the caprine remains are referred to as sheep in the text and in all tables except Table 1 as this provides information on the number of elements specifically identified as sheep and those assigned simply to the sheep/goat category. Cat (*Felis spp.)* and goose *(Anser spp.)* bones were assigned to species on the basis of size and in comparison with modern reference skeletons.

Metrical data is given in Appendix 5 and where possible has been compared with data recovered from contemporary sites and held on the Animal Bone Metrical Archive Project (ABMAP) (http://archaeologydataservice.ac.uk/archives/view/abmap/).

Table 27. Minimum number of elements and individuals belonging to major domestic mammals

i) Cattle	**Phase 2** L11th –E12th		**Phase 3** E12th -13th		**Phase 4** E13th-M14th		**Phase 5** M13th –L14th		**Phase 6** 15th	
	Left	*Right*	*Left*	*Right*	*Left*	*Right*	*Left*	*Right*	*Left*	*Right*
Mandible	2	2	2	2	6	2	1		2	1
Scapula	1	1		1	4	1	1			
Humerus			1	1	2	1		1		
Radius			1		3		1	1		
Ulna						2	1			
Pelvis		1	1	2	1		1			1
Femur	1	1	1		3	2				1
Tibia			1		5	1				1
Astragalus		2			2		1		2	
Calcaneum			2			1				
Metacarpal	2		1	1	2		1	1	1	1
Metatarsal		4	1	1		1			1	1
MNI	4		2		6		1		2	

ii) Sheep	**Phase 2** L11th –E12th		**Phase 3** E12th -13th		**Phase 4** E13th-M14th		**Phase 5** M13th –L14th		**Phase 6** 15th	
	Left	*Right*	*Left*	*Right*	*Left*	*Right*	*Left*	*Right*	*Left*	*Right*
Mandible		1	1		3	1				1
Scapula			2		1					
Humerus			1	1	1	2				1
Radius			1		3	2				
Ulna	1				1			1		
Pelvis	1	1	1	1	1	1				
Femur				1	1					
Tibia		1	3	2	7	2	2	2	2	1
Astragalus						1				
Calcaneum						1				
Metacarpal						1				
Metatarsal		2	1	1	1	1	1			
MNI	2		3		7		2		2	

iii) Pig	**Phase 2** L11th –E12th		**Phase 3** E12th -13th		**Phase 4** E13th-M14th		**Phase 5** M13th –L14th		**Phase 6** 15th	
	Left	*Right*	*Left*	*Right*	*Left*	*Right*	*Left*	*Right*	*Left*	*Right*
Mandible			1	1			1			
Scapula		1		1		1				
Humerus			2	1	1	1		1	1	1
Radius					1	3	1			
Ulna			1		1	2				
Pelvis						1				
Femur		1			1	1				1
Tibia								1		
Astragalus			1							
MNI	1		2		3		1		1	

iv) Horse	**Phase 2** L11th –E12th		**Phase 3** E12th -13th		**Phase 4** E13th-M14th		**Phase 5** M13th –L14th		**Phase 6** 15th	
	Left	*Right*	*Left*	*Right*	*Left*	*Right*	*Left*	*Right*	*Left*	*Right*
Mandible		1			1					
Scapula			2							1
Humerus			1							
Radius			1		1	1		1		1
Ulna										
Pelvis		1								1
Femur		1			1	1			1	
Tibia	1								1	
Astragalus						1				
Metacarpal			1		1					
MNI	1		2		1		1		1	

Data

A total of 1,391 fragments of animal bone were recovered from deposits spanning the 11th to 15th centuries of which 442 are identifiable to species or taxon (Table 26). The largest assemblages are from early 12th - 13th century (Phase 3) and early 13th – mid 14th century (Phase 4) deposits with smaller samples recovered from contexts dated to the late 11th – early 12th centuries (Phase 2), the mid 13th – late 14th (Phase 5) centuries and the 15th century (Phase 6).

	Phase 2 L11th –E12th	**Phase 3** E12th -13th	**Phase 4** E13th-M14th	**Phase 5** M13th –L14th	**Phase 6** 15th
Pig	4	19	26	8	5
Sheep	14	44	65	12	5
Cattle	26	35	86	21	22

Table 28. Number of Identified Specimens (NISP)

The major domestic food animals (cattle, sheep and pig) are all present but in respect of their relative frequency a discrepancy exists between the NISP and MNI data (Tables 26 & 27, Fig. 90). Overall, the NISP figure indicates that cattle are the best-represented species whilst the calculation of MNI shows sheep to be slightly more numerous (Table 28 & 29). Pig is relatively scarce whichever method of quantification is used.

	Phase 2 L11th –E12th	**Phase 3** E12th -13th	**Phase 4** E13th-M14th	**Phase 5** M13th –L14th	**Phase 6** 15th
Pig	1	2	3	1	1
Sheep	2	3	7	2	2
Cattle	4	2	6	1	2

Table 29. Minimum Number of Individuals (MNI)

MNI was not calculated for other species but according to the specimen count, horse is more common than any of the other minor domestic animals including dog, cat (*Felis spp.)*, goose *(Anser anser)* and galliform (probably domestic fowl) which are all present in low numbers.

Seventeen specimens were recovered from sieved samples but as only two are identifiable (a shaft fragment belonging to a bird ulna from an early 12th-13th century deposit and a cattle maxillary molar from mid 13th – late 14th century deposit) these have been included with the hand collected material listed in Table 26.

2.1 Phase 2: Late 11th – early 12th century

Deposits dated to the late 11th – early 12th centuries produced 48 identifiable specimens. The samples belonging to individual taxa are small with cattle (n=26) the best represented species according to both NISP and MNI, followed by sheep (Table 26 & 27, Fig. 90). Pig is relatively scarce whichever method of calculation is used. The only other domestic mammal present is horse which is represented by four specimens. A shaft fragment belonging to a bird (probably an immature galliform) is also present.

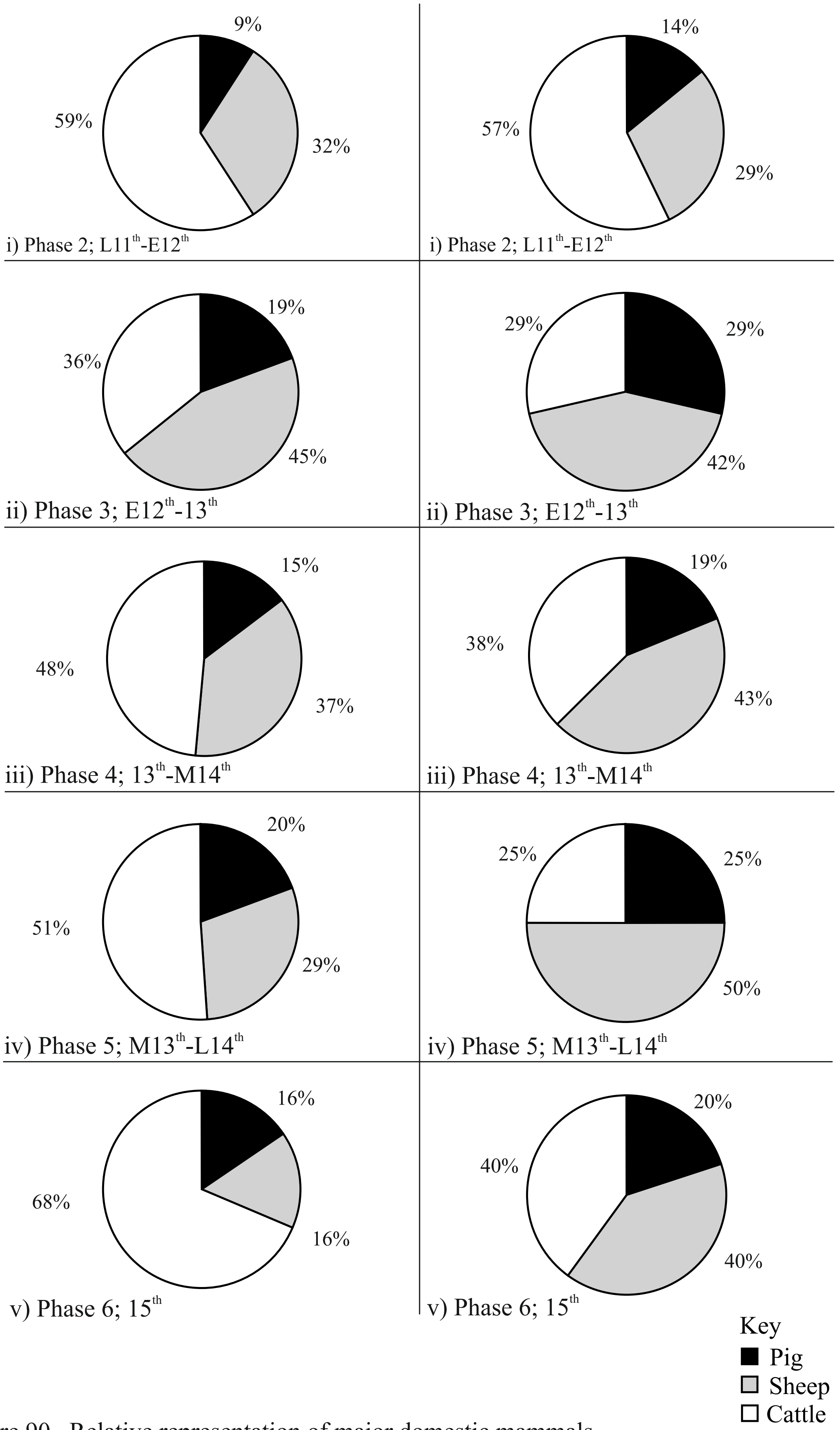


Figure 90. Relative representation of major domestic mammals according to phase (see Tables 28 & 29).

	Cattle	Sheep	Pig	Horse	Large mammal	Medium mammal	**Total**
Horn core	1	1					**2**
Incisor	1	1	1				**3**
Upper molar		4					**4**
Lower molar	1						**1**
Lower premolar	1						**1**
Mandible	7	1		1	3		**12**
Axis	1						**1**
Scapula	2		1				**3**
Ulna		1			1		**2**
Pelvis	1	2		1	3		**7**
Femur	2		1	1	1		**5**
Tibia		1		1	1	2	**5**
Astragalus	2						**2**
Calcaneum	1						**1**
Metacarpal	2						**2**
Metatarsal	4	3					**7**
Metapodial			1				**1**
Thoracic vertebra					1		**1**
Rib					1	3	**4**
Skull fragment						1	**1**
Limb bone fragment					3	3	**6**
Rib fragment					4	4	**8**
Total	**26**	**14**	**4**	**4**	**11**	**5**	**64**

Table 30. Anatomical representation of major taxa (NISP) (Phase 2; L11th-E12th)

Despite the small size of the assemblage, cattle, sheep and pig are represented by elements from most parts of the body – head, major limbs and feet (Table 30). Mandibles are clearly the most numerous cattle bone according to NISP although a consideration of MNE suggests that metatarsals are present in similar numbers.

Horse is represented by bones from the head and upper hind limb. Several rib fragments belonging to large and medium size animals are also present as is a large mammal thoracic vertebra.

	P4	M1	M2	M3	Estimated age
Cattle	(k)	j	f		15-26 months
Cattle		k	g	g	26-36 months

Table 31. Estimated age according to tooth eruption and wear data (NISP) (Phase 2; L11th–E12th)

Ageing data is scarce but two cattle mandibles provide evidence for the slaughter of at least one animal aged between 15-26 months and another between 26-36 months (Table 31).

Epiphyseal fusion data (Appendix 1i) is also limited but the presence of a calcaneus and femur with unfused proximal epiphyses provides evidence that some cattle were culled before reaching skeletal maturity.

The only ageing data for sheep comes from a pelvis with a fused acetabulum belonging to an animal that was older than 5 months when it died (Appendix 1ii).

	Phase 2 L11th –E12th		Phase 3 E12th -13th		Phase 4 E13th-M14th		Phase 5 M13th –L14th		Phase 6 15th	
	n	%	n	%	n	%	n	%	n	%
Cattle	3	12	1	3	9	10	2	10		
Sheep	1	8	1	3	4	6	1	9		
Pig			2	11	2	8	2	25		
Horse			1	14					1	11
Goose *(Anser anser)*									1	100
Large mammal									2	5
Total	**4**	**4**	**5**	**2**	**15**	**4**	**5**	**8**	**4**	**4**

Table 32. Incidence of taphonomy: gnawed (NISP and percentage of bones identified to relevant taxa/species)

Two pig bones provide epiphyseal fusion data: a distally fused scapula indicates that one animal survived past 12 months whilst an unfused metapodial indicates that one (possible the same individual) was below two years old at the time of death.

There is no evidence for immature horse.

	Phase 2 L11th –E12th					Phase 3 E12th -13th				Phase 4 E13th-M14th				Phase 5 M13th –L14th		Phase 6 15th			
	chop	cut/ chop	cut	**total**		chop	cut	**total**		chop	cut	**total**		cut		chop	cut	**total**	
				n	**%**			**n**	**%**			**n**	**%**	n	%			**n**	**%**
Cattle	3	1	1	**5**	**19**	1		**1**	**3**	3		**3**	**3**	1	5	2		**2**	**9**
Sheep			1	**1**	**8**					2		**2**	**4**						
Pig			1	**1**	**25**		1	**1**	**3**	1		**1**	**4**						
Horse											1	**1**	**6**						
Goose (*Anser anser*)							1	**1**	**100**										
Large mammal						1		**1**	**3**								1	**1**	**3**
Total	**3**	**1**	**3**	**8**	**7**	**2**	**2**	**4**	**9**	**6**	**1**	**7**	**2**	**1**		**2**	**1**	**3**	**4**

Table 33. Incidence of taphonomy: butchered (NISP and percentage of bones identified to relevant taxa/species)

Three cattle, one sheep and one horse bone display evidence for gnawing by canids (Table 32). Four cattle specimens display evidence for butchery in the form of chop marks and one of these also has a cut mark. Cut marks are preserved on one cattle, one sheep and one pig bone (Table 33).

	ditch		pit		gully		posthole		midden pit	
	n	%	n	%	n	%	n	%	n	%
Cattle	18	*69*	4	*15*	1	*4*	3	*12*		
Sheep	12	*92*					2	*15*		
Pig	4	*100*								
Horse	1	*25*			2	*50*			1	*25*
Large mammal	18	*39*	12	*26*	12	*26*	4	*9*		
Medium mammal	13	*93*	1	*7*						
Total	**66**	***61***	**17**	***16***	**15**	***14***	**9**	***8***	**1**	***1***

Table 34. Relative frequency of major domestic mammals according to feature type (NISP & %NISP) (Phase 2; L11th–E12th)

The majority of the assemblage came from ditch deposits including more than two-thirds of the cattle and almost all of the sheep, pig and medium mammal assemblages (Table 34); the remainder were recovered from pits, gullies and postholes. Odd bones belonging to horse were recovered from linear features (ditches and gullies) and a midden pit.

Metrical data is given in Appendix 2 and where possible has been compared with ABMAP data. A cattle metacarpal allows the calculation of withers height and indicates that one animal was approximately 1.21 metres high at the shoulders.

2.2 Phase 3: E12th – 13th century

The assemblage from early 12th – 13th century deposits comprises 108 identifiable specimens (Table 26). In addition to the major domestic mammals (cattle, sheep and pig) and horse, single bones belonging to cat (*Felis spp.*), goose *(Anser anser)* and galliform are present.

	Cattle	Sheep	Pig	Horse	Large mammal	Medium mammal	**Total**
Premaxilla			1				**1**
Incisor			2				**2**
Canine			1				**1**
Upper molar	2	3					**5**
Lower molar	2	7	1				**10**
Lower premolar	1	1	1				**3**
Maxilla	1		2				**3**
Mandible	7	7	3		1		**18**
Atlas					1		**1**
Scapula	1	2	1	2			**6**
Humerus	2	3	3	1	3	2	**14**
Radius	2	2		2	1	1	**8**
Ulna			1				**1**
Pelvis	4	2			2		**8**
Femur	1	1			1		**3**
Tibia	1	9			1	1	**12**
Cuneiform	1						**1**
Astragalus			1				**1**
Calcaneum	2						**2**
Navicular cuboid	1						**1**
Metacarpal	3			1			**4**
Metatarsal	2	5					**7**
Metapodial	1	1	1				**3**
1st phalanx		1		1			**2**
2nd phalanx	1		1				**2**
Cervical vertebra					1		**1**
Lumbar vertebra						2	**2**
Skull fragment						1	**1**
Limb bone fragment					4	10	**14**
Vertebra fragment					10	1	**11**
Rib fragment					11	11	**22**
Total	**35**	**44**	**19**	**7**	**36**	**29**	**170**

Table 35. Anatomical representation of major taxa (NISP) (Phase 3; E12th- 13th)

In contrast with the previous phase, the NISP data indicates that sheep are more numerous than cattle and that pig is fairly well represented although still less numerous than cattle. The calculation of MNI supports the slightly higher frequency of sheep and suggests that pigs were also more numerous at the expense of cattle (Table 27, Fig. 90).

The cattle assemblage includes elements from all parts of the body with mandibles clearly the most numerous element according to NISP and the calculation of MNE, followed by the pelvis (Table 35). A similar pattern occurs for sheep although the tibia is more numerous than the mandible and loose teeth are fairly frequent. Upper hind limb bones belonging to pig are absent although the lower limb is represented by an astragalus. Horse is represented solely by forelimb bones and a 1st phalanx. A humerus shaft fragment belongs to a cat *(Felis spp.)*. In addition, domestic goose (*Anser anser)* is represented by a scapula and galliform by a tarsometatarsus.

Taxa	P4	M1	M2	M3	Estimated age
Cattle	C	k	g	g	26-36 months
				g	26-36 months
Sheep	(g)	d			6-12 months
	(l)				12 -36 months
	E	g	e	c	2-3 years
				e	3-4 years

Table 36. Estimated age according to tooth eruption and wear data (NISP) (Phase 3; E12th- 13th). Wear stages in brackets indicate tooth is deciduous

Tooth eruption and wear data is scarce but a cattle mandible and an isolated mandibular third molar both belong to animals that died between 26-36 months (Table 36). Most of the cattle limb bones are fused except for a distally unfused metatarsal thereby providing evidence for the slaughter of both immature and adult animals (Appendix 4).

The small sample of dental data for sheep indicates that culling took place at various ages between 6 months and 4 years (Table 36). A distal femur and proximal tibia are the only late fusing bones present and both are unfused which lends support for the culling of animals aged less than 42 months (Appendix 4).

An unfused proximal 2nd phalanx and distal metapodial indicate that at least one pig died before reaching 12 months (Appendix 4).

There is no evidence for immature horse.

	Phase 2 L11th –E12th		**Phase 3** E12th -13th	
	n	%	n	%
Large mammal	1	1		
Medium mammal	1	3	2	33
Total	2	1	2	3

Table 37. Incidence of taphonomy (calcined)

A few bones display evidence for gnawing and include specimens belonging to cattle, sheep, pig and horse (Table 32). Four bones preserve evidence for butchery with chops visible on cattle and large mammal bones and cuts present on a pig bone and the goose scapula (Table 33). The only evidence for burning occurs on fragments belonging to a large and a medium size mammal, both of which are calcined (Table 37).

Just over half the assemblage is derived from pits with smaller amounts recovered from linear features and miscellaneous deposits (Table 38). In comparison with cattle, a particularly high proportion of sheep (64%) and pig (58%) came from the pits, at the expense of their representation in the ditches and midden deposits. Even so, more than half the cattle assemblage came from pit deposits and a significant (31%) proportion was recovered from ditches.

	pit		ditch		gully		midden deposit		Other	
	n	%	n	%	n	%	n	%	n	%
Cattle	18	*51*	11	*31*			5	*14*	1	*3*
Sheep	28	*64*	9	*20*	2	*5*	4	*9*	1	*2*
Pig	11	*58*	3	*16*	2	*11*	2	*11*	1	*5*
Horse	2	*29*			1	*14*	3	*43*	1	*14*
Large mammal	37	*50*	19	*26*	11	*15*	5	*7*	2	*2*
Medium mammal	18	*56*	2	*6*	8	*25*	1	*3*	3	*9*
Total	**114**	***54***	**44**	***21***	**24**	***11***	**20**	***11***	**9**	***3***

Table 38. Relative frequency of major domestic mammals according to feature type (NISP & %NISP) (Phase 3; E12th–13th)

Metrical data is in Appendix 2 and where possible compared with ABMAP data. One measurement falls outside the range – a horse radius with a distal breadth 1.4mm larger than previously recorded.

2.3 Phase 4: E13th –M14th century

The largest assemblage of animal bones came from deposits dated to the early 13th–mid 14th centuries and comprised 198 identifiable specimens (Tables 26). There is a discrepancy between the NISP and MNI data with NISP suggesting that cattle are slightly more numerous than sheep whilst the calculation of MNI indicates the opposite (Tables 27, Fig. 90). Pig and horse are present in smaller numbers.

Dog is represented by a canine tooth; cat by a proximally and distally unfused ulna and a proximal femur in the process of fusing whose size suggests it belongs to a wild cat *(Felis silvestris).* In addition, a goose ulna and two galliform femora are present, one of which contains medullary bone suggesting that at least one hen was in lay.

Bones from most parts of the cattle, caprine and pig skeleton are present however cattle mandibles and sheep tibiae are noticeably over-represented according to both NISP and MNI, whilst phalanges belonging to caprines and pig are absent. The sample of horse remains is small but includes elements from the head, forelimb, hind-limb and feet (Table 39).

The small sample of dental ageing data (Table 40) indicates that some cattle were slaughtered between 6 – 36 months and between 6 – 8 years. All the limb bones that have fused epiphyses are elements that fuse before the animal reaches 30 months of age (Appendix 4).

	Cattle	Sheep	Pig	Horse	Large mammal	Medium mammal	**Total**
Horn core		6					**6**
Frontal		1	1				**2**
Zygomatic	1						**1**
Premaxilla	1						**1**
Incisor	1	1	4	1			**7**
Upper molar	3	3					**6**
Lower molar	5	2	1	3			**11**
Lower premolar	3			1			**4**
Upper premolar	1	1		2			**4**
Maxilla	1		1				**2**
Mandible	21	5		1	19		**46**
Axis		1					**1**
Scapula	6	1	1		4		**12**
Humerus	3	4	2		3		**12**
Radius	3	7	4	2	1		**17**
Ulna	2	1	3		1		**7**
Pelvis	3	4	1				**8**
Femur	8	2	2	2	1	2	**17**
Tibia	8	14			3		**25**
Fibula			1				**1**
Astragalus	2	1		1			**4**
Calcaneum	1	2					**3**
Navicular cuboid		2					**2**
Distal fibula		1					**1**
Metacarpal	3	3		1			**7**
Metatarsal	1	3					**4**
Metapodial	2		1				**3**
Lateral metapodial			3				**3**
1st phalanx	3			2			**5**
2nd phalanx	1						**1**
3rd phalanx	3						**3**
Tooth fragment			1				**1**
Limb bone fragment					12	22	**34**
Vertebra fragment					2	1	**3**
Rib fragment					8	5	**13**
Total	**86**	**65**	**26**	**16**	**54**	**30**	**277**

Table 39. Anatomical representation of major taxa (NISP) (Phase 4; E13th-M14th)

According to the dental data, caprines were slaughtered at various ages although there is no evidence for the death of animals in their first year. Similarly, the very early fusing bones are all fused and there is evidence that some caprines died before reaching 20 months (Appendix 4).

An unfused distal humerus and two proximal radii provide evidence for the death of at least one pig in its first year (Appendix 4). There is no evidence for immature horse with dental data indicating that all specimens derived from animals aged between six and fourteen years; similarly all the horse limb bone epiphyses are fused.

A few bones (4%) display evidence for dog gnawing with cattle, sheep and pig all affected (Table 32). A smaller proportion (2%) display evidence for butchery with chop marks more numerous than cuts (Table 37).

Taxa	P2	P3	P4	M1	M2	M3	Estimated age
Cattle			(j)				6-26 months
					f	E	15-26 months
					j	d	26-36 months
				o	l	l	6-8 years
						l	6-8 years
Sheep					d	U	12-24 months
				g	f		2-3 years
						e	3-4 years
			j	l	g	g	4-6 years
Horse		61.5					6-8 years
*		45.2					8-11years
*				37	40.2	36.9	9-14 years
	26.3						11-14 years

Table 40. Estimated age according to tooth eruption and wear data (NISP) (Phase 4; E13th-M14th)
(probably same individual) Wear stages in brackets indicate tooth is deciduous*

Animal bone was recovered from a variety of feature types although the largest samples came from metalling deposits, pits and gullies (Table 41). There is considerable variation in the relative representation of individual taxa according to feature type with pig (62%) better represented in the metalling deposits than either cattle (37%) or sheep.

	metalling		pit		gully		midden layer		layer		other	
	n	%	n	%	n	%	n	%	n	%	n	%
Cattle	32	*37*	19	*22*	12	*14*	7	*8*	4	*5*	12	*14*
Sheep	32	*49*	11	*17*	4	*6*	9	*14*	3	*5*	6	*9*
Pig	16	*62*	6	*23*	1	*4*	2	*8*			1	*4*
Horse	5	*31*	3	*19*	5	*31*	1	*6*			2	*12*
Large mammal	72	*52*	27	*19*	22	*16*	1	*1*	3	*2*	14	*10*
Medium mammal	12	*38*	2	*6*	3	*9*	6	*19*	6	*19*	3	*9*
Total	**169**	***46***	**68**	***19***	**47**	***13***	**26**	***7***	**16**	***4***	**38**	***11***

Table 41. Relative frequency of major domestic mammals according to feature type (NISP & %NISP) (Phase 4; E13th–M14th)

Almost half (49%) of the sheep remains are also associated with metalling deposits with the remainder derived predominantly from pits (17%) and midden layers (14%). A significant proportion of the cattle assemblage came from pits (22%) and gullies (14%). Once again, horse bones came from a variety of feature types.

Metrical data is in Appendix 5 and where possible compared with ABMAP data. A cattle metacarpal indicates that one animal was approximately 1.07 metres high at the shoulders.

2.4 Phase 5: M13th – L14th century

Forty-six identifiable specimens came from mid 13th–late 14th century deposits. The sample is too small to support detailed analysis and once again there is a discrepancy between the NISP and MNI data concerning the relative frequency of cattle and sheep (Tables 26 & 27, Fig. 90). According to NISP, cattle comprise over half and sheep less than a third of the major domestic mammal assemblage, whereas MNI indicates that sheep account for half of this assemblage and cattle a quarter. Horse, cat *(Felis catus)* and galliform are also present.

	Cattle	Sheep	Pig	Horse	Large mammal	Medium mammal	**Total**
Zygomatic	1						**1**
Incisor			2				**2**
Upper molar	3	2					**5**
Lower molar	2	1	1				**4**
Mandible	1		1				**2**
Hyoid	1						**1**
Atlas		1			1		**2**
Axis	1						**1**
Scapula	2						**2**
Humerus	1		1				**2**
Radius	2		1	2			**5**
Ulna	1	1					**2**
Pelvis	1						**1**
Tibia		6	1		2	1	**10**
Astragalus	1						**1**
Metacarpal	2						**2**
Metatarsal		1					**1**
1st phalanx	2			1			**3**
Skull fragment			1				**1**
Limb bone fragment					3	3	**6**
Vertebra fragment						1	**1**
Rib fragment					1	1	**2**
Total	**21**	**12**	**8**	**3**	**7**	**6**	**57**

Table 42. Anatomical representation of major taxa (NISP)(Phase 5; M13th-L14th)

Despite the small size of the samples, cattle, sheep and pig are represented by elements from most parts of the body although phalanges are absent for sheep and pig. Sheep tibiae are noticeably over represented according to both NISP and the calculation of MNE (Table 42). Horse is represented by two radii and a 1st phalanx and cat by a calcaneus whose size suggests it belong to domestic cat *(Felis catus)*. The only bird bone is a galliform femur.

Taxa	M3	Estimated age
Cattle	e	26-36 months
Pig	b	Adult

Table 43. Estimated age according to tooth eruption and wear data (NISP) (Phase 5; M13th-L14th)

Ageing data is scarce. A cattle mandible provides evidence for the death of an animal aged between 26-36 months (Table 43). Epiphyseal fusion data also provides evidence that some animals survived past 24 months and for the death of a skeletally immature individual (below 48 months) (Appendix 4).

The only ageing data available for sheep comes from a distally fused tibia indicating that one animal was older than 15 months when it died (Appendix 4).

A pig mandibular third molar is from an adult (Table 43) and a proximally fused radius indicates that at least one pig survived past its first year (Appendix 4).

Evidence for gnawing is preserved on five specimens (8%) with cattle, sheep and pig all affected (Table 32). A single cattle bone displays a cut mark (Table 33).

The samples of animal bone derived from individual feature types are small and in most cases consist of just a few specimens belonging to each species (Table 44). The largest samples came from metalling (n = 22) and ditch deposits (n= 14) with the former producing over a third of the cattle, sheep, pig and horse remains from this phase.

	metalling		ditch		layer		midden layer		gully		pit	
	n	%	n	%	n	%	N	%	n	%	n	%
Cattle	7	*33*	4	*19*	1	*5*	4	*19*	4	*19*	1	*5*
Sheep	7	*58*	2	*17*	2	*17*			1	*8*		
Pig	3	*38*	1	*13*	2	*25*	1	*13*			1	*13*
Horse	3	*100*										
Large mammal	2	*18*	3	*27*	4	*36*	2	*18*				
Medium mammal			4	*67*	1	*17*					1	*17*
Total	**22**	***36***	**14**	***23***	**10**	***16***	**7**	***11***	**5**	***8***	**3**	***5***

Table 44. Relative frequency of major domestic mammals according to Phase 5 feature type (NISP & %NISP) M13th–L14th

Metrical data is comparable with measurements taken from other medieval assemblages held on the ABMAP database with the exception of a cattle metacarpal which has a proximal breadth 1.8mm larger than previously recorded (Appendix 5).

2.5 Phase 6: 15th century

The 15th century assemblage consists of 42 identifiable specimens and consequently, once again the samples belonging to individual taxa are too small to provide reliable information concerning taxa representation (Table 26).

According to NISP, cattle are the most numerous taxa, followed by horse and with caprines and pig equally represented (Table 26, Fig. 90). The majority of the assemblage derives from a single feature (Table 47) pit 494 which can be associated with the abandonment-phase of the site.

The calculation of MNI also shows an increase in the frequency of cattle but to a slightly lesser degree with cattle and sheep equally represented and more numerous than pig and horse, both of which are represented by a minimum of one individual (Table 27, Fig. 90).

	Cattle	Sheep	Pig	Horse	Large mammal	Medium mammal	**Total**
Upper molar	1						**1**
Mandible	4	1			2		**7**
Atlas				1			**1**
Scapula				1			**1**
Humerus		1	3		2		**6**
Radius				1			**1**
Pelvis	1			3	2		**6**
Sacrum				1	1		**2**
Femur	1		1	1		3	**6**
Tibia	2	3		1	2		**8**
Astragalus	2						**2**
Metacarpal	2						**2**
Metatarsal	4						**4**
Metapodial	2						**2**
1st phalanx	1		1				**2**
3rd phalanx	2						**2**
Tooth fragment					1		**1**
Vertebra fragment					1		**1**
Rib fragment					7	1	**8**
Total	**22**	**5**	**5**	**9**	**18**	**4**	**63**

Table 45. Anatomical representation of Phase 6 (15th century) major taxa (NISP)

Cattle are represented by most parts of the skeleton apart from upper forelimb bones with the mandible the most common element according to both NISP (Table 45) and MNI. Foot bones are absent for sheep and no elements derived from the heads of pigs present. Apart from an atlas and sacrum, all the horse remains are major limb bones.

Taxa	P4	M1	M2	M3	Estimated age
Cattle	e	l	j	g	26-36 months
Sheep	l	l	k	j	8-10 years

Table 46. Estimated age according to tooth eruption and wear data (NISP) (Phase 6; 15th century)

The small sample of tooth eruption and wear data (Table 46) includes a cattle mandible belonging to an animal aged 26 – 36 months. Epiphyseal fusion data is also scarce with a fused 1st phalanx and distally fused tibia providing evidence that at least one animal was aged over 20 months when it died (Appendix 4).

A sheep mandible is from an animal aged 8 – 10 years (Table 46).

An unfused 1st phalanx indicates that at least one pig died before reaching 24 months (Appendix 4).

A few (4%) bones display evidence for gnawing (Table 32) including one each belonging to horse and goose *(Anser anser).* Two cattle bones preserve evidence for butchery in the form of chop marks and a fragment of large mammal bone displays a cut mark (Table 33).

	pit		midden layer		palaeochannel	
	n	%	n	%	n	%
Cattle	14	*64*	6	*27*	2	*9*
Sheep	5	*100*				
Pig	5	*100*				
Horse	9	*100*				
Large mammal	35	*90*	4	*10*		
Medium mammal	4	*100*				
Total	**72**	***86***	**10**	***12***	**2**	***2***

Table 47. Relative frequency of major domestic mammals according to Phase 6 (15th century) feature-type (NISP & %NISP)

The majority (86%) of the animal bone came from pits including almost two thirds of cattle and all the sheep, pig and horse bones (Table 47). A few cattle bones were recovered from a midden layer and palaeochannel.

Metrical data is given in Appendix 5 and where comparison was possible all specimens fall within the size ranges recorded for material from contemporary sites held on ABMAP.

Interpretation and discussion

The animal bone assemblages recovered from medieval deposits at Newington House are small and therefore the interpretations put forward in this report should be treated with caution. The problem of small sample size is compounded by indications (a predominance of dense bones such as cattle mandibles and sheep tibiae) that the assemblage has suffered considerable bias as a result of density mediated taphonomic processes. As a result, it is extremely likely that smaller and/or less dense bones, including those belonging to juveniles, have suffered preferential destruction. The majority of the assemblage was recovered by hand so it is possible that the assemblages have been further biased as a result of small bones such as tarsals, carpals, phalanges and those belonging to foetal/neonatal animals, being missed during excavation.

The type of features and areas excavated at a site can also cause considerable bias due to activity related disposal practices (Maltby 1985a; 1985b). For instance, primary butchery activities are often carried out on the outskirts of settlements with the resulting waste disposed of in ditches whereas waste from cooking and consumption tends to be disposed of in more centrally located areas, often in pits. Differences in cooking practices related to animal size can also influence deposition as the meat from medium size animals such as sheep and pig is more likely to be cooked on the bone, or even spit roasted whole, with the waste discarded in a convenient pit in the area where it was consumed. This may have been the case at Newington during the early 12th -13th centuries since a higher proportion of sheep, compared to cattle remains came from pits. However, pits produced more than half of the total cattle assemblage dating to this period so clearly the waste from large animals was also commonly disposed of in them. This practice appears to have continued during the early 13th – mid 14th centuries as pit deposits produced a higher proportion of cattle than sheep.

The preservation conditions of a feature/context will also depend on the nature of the soil matrix, the pH and the degree of exposure to the elements and scavengers. As a result of their enclosed nature, pits offer better conditions for preservation than exposed ditches and consequently small, fragile bones have a greater chance of survival. Most of the late 11th – early 12th century material came from ditch deposits which contained larger proportions of the sheep and pig assemblages than it did cattle. As a result of the relatively poor preservation conditions offered by ditches, bones belonging to small and medium size animals are likely to have been preferentially destroyed thereby reducing not only the survival, but also the identifiability of sheep and pig bones.

It is difficult to discern the exact cause of the discrepancies that exist between the NISP and MNI data relating to the 13th to 14th century assemblages but as metalling deposits produced over a third of the bone recovered from both these phases it may be related to the type of deposit excavated. The bones of large mammals are less likely to remain whole during butchering, food processing and trampling than those belonging to smaller mammals (Klein 1989, 374) and therefore, deposits containing bones that have been subjected to these processes will produce inflated fragment counts for cattle and other large mammals. Evidence for differential survival also suggests that sheep and pig may have been originally more numerous relative to larger mammals than their remains suggest.

Despite the discrepancies, it is clear that the assemblages from all phases of occupation are comprised predominantly of cattle and sheep which is not surprising given that these two animals were the mainstays of the medieval economy (Sykes, 2006). Agreement between the two methods of quantification for the first two phases of occupation, indicates that the importance of cattle during the late 11th – early 12th century economy was short lived with a change occurring during the early 12th -13th century when the emphasis shifted to sheep. For the later phases of occupation, a consideration of the taphonomic evidence suggests that the MNI data presents a more accurate reflection of species frequency than the NISP data and consequently that sheep were present in greater numbers than cattle.

The continued importance of sheep at Newington throughout the 13th and 14th centuries would not be surprising since a large increase in the proportion of caprines relative to cattle is generally evident in the 13th century (Albarella & Davis 1994; Maltby 1979; O'Connor 1982) in response to the demand for wool and, suggests that the diet of the population was to some extent dictated by economic trends. Following the Black Death, the severe reduction in the population resulted in widespread abandonment of the countryside and much land returned to pasture (Fryde 1996, 145). The small 15th century assemblage from Newington with its increase in cattle and decrease in sheep also appears to reflect general trends whereby the size of sheep flocks declined and there was a growing demand for prime beef and veal (Sykes 2006, 59).

Historical evidence suggests that following the Norman Conquest a considerable amount of pasture was converted into arable land in order to increase cereal production and feed the growing urban population and as a result the need for adult cattle to provide traction and manure would have increased. The importance of secondary products at this time is evidenced at a variety of contemporary sites including Exeter (Maltby 1979, 31), Eynsham Abbey (Ayres 2003), West Cotton (Albarella & Davis 1994) and Guildford Castle (Sykes 2005, 122) by a predominance of adult and mature cattle.

Ageing data is limited at Newington but indicates that, in contrast to the national trend, most cattle were slaughtered whilst immature and that the inhabitants had access to choice cuts of meat from animals kept solely to provide prime beef. During the early 13th – mid 14th century there is evidence for a few older cattle which would previously have provided milk, traction and/or been kept for breeding.

During the medieval period, changes in the rural economy also took place in response to the development of the wool trade and between the late 12th and mid 14th centuries wool production reached its height (Ryder 1983, 455-7). The increasing importance of wool is apparent in the sample from West Cotton (Albarella & Davis 1999) where in the later medieval period a higher proportion of caprines over the age of two years were slaughtered than in the early phase. Similarly at Eynsham Abbey (Ayres *et al* 2003) and other medieval sites in Oxfordshire such as the Hamel (Wilson 1980), Middleton Stoney (Rahtz & Rowley 1984) and Barentin's Manor (Wilson 2005), data for caprines indicates that most were older than two years old.

At Newington, most of the sheep remains similarly belong to animals that were over two years old and these would have provided several clips of wool prior to being slaughtered for mutton. There is evidence for a few younger animals, which may have been slaughtered purely to provide high quality lamb/mutton. Very young animals are absent and although this might be partly due to poor preservation or recovery bias, economic factors may also be responsible with Sykes (2006, 62) noting that 'from the mid 11th century onwards animals below six months became less abundant on rural sites such as West Cotton (Albarella & Davis 1994) and Marefair (Harman 1979) due to the increasing demand by townsfolk for lamb and veal'.

The relative frequency of pig fluctuates throughout the sites occupation but is lowest in the early and late phases of occupation and highest in the early 12th -13th when MNI suggests it accounts for more than a quarter of the major domestic mammal assemblage. This variation is probably, at least partly the result of the various taphonomic factors that have affected the assemblage, and as with sheep it is likely that pig remains were originally more numerous than their remains suggest. According to the MNI estimates for the 13th–14th centuries, pigs represent 20% of the major domestic mammal assemblages which is very similar to that seen at the majority of medieval and post-medieval sites from across central England (Albarella 2006, 73).

Pigs provide few secondary products other than manure and are generally raised solely for meat and fat since they are extremely productive and unselective in terms of their food intake (Albarella 2006, 72). On most sites, pig remains are generally ranked third in frequency after cattle and sheep but a consideration of relative body size suggests pork was eaten more often than mutton. High status sites tend to produce the highest frequencies of pig (Sykes 2005, 122) and although medieval peasants tended to subsist on a vegetarian diet, when they could afford meat it was usually pork (*ibid*, 73). The predominance of immature and sub adult pigs at Newington, is therefore unsurprising given their role as meat providers although some pork most likely came from adults kept as breeding stock, probably at the site itself.

Despite the small size of the assemblages, elements from all parts of the body are generally present for the major domestic taxa (cattle, caprines and pig) in all periods, suggestive of the animals arriving at Newington on the hoof. It is likely that livestock was raised nearby even though there is no evidence for foetal or neonatal remains as their absence most probably reflects either the relative ease with which porous young bones are destroyed or the effects of recovery bias.

Bones belonging to adult equids are quite numerous at Newington. A similar proportion was recorded at West Cotton where it was suggested that they may have been used as plough animals. According to Grant (1988) horse power is more efficient than ox power on light soils but as the underlying geology at Newington is clay it seems more likely that horses were valued as transport and/or pack animals. In this context the recovery of the neck of a costrel which is a vessel used by travellers to carry drink is interesting, as is the recovery of Pottersbury ware which originates in the iron-extracting region of Northamptonshire (Williams *pers. comm.*). Transverse cut marks preserved on the distal shaft of a metacarpal are indicative of skinning and when combined with evidence that some horse bones were gnawed suggests that, after death, they were treated similarly to the major food animals.

The remains of other animals are scarce. In addition to the canine tooth recovered from early 13th-mid 14th century deposits, evidence for the presence of dogs in all phases comes from gnaw marks preserved on a few bones and indicates that not all waste was immediately buried. Cats, both wild and domestic were probably also attracted to the site by the rich pickings on offer and may have been deliberately encouraged to remain in the vicinity to control vermin.

Metrical data indicates that most animals were within the range of those from contemporary sites, and comparison of the greatest length of cattle astragali and distal breadth of sheep tibiae suggest they were similar in size to those at sites such as West Cotton (Albarella & Davis 1994) and Eynsham Abbey (Ayres *et al* 2003).

Conclusion

The animal bone assemblage recovered from medieval deposits at Newington is clearly biased by the effects of density mediated taphonomic processes and sample sizes are generally small. However, in many respects it conforms well to the pattern noted at contemporary sites, particularly if sheep were originally as numerous as the calculation of MNI suggests and so became increasingly numerous at the expense of cattle, up until the 15th century. This shift in emphasis reflects the changes that were taking place in the economy and the increasing importance of the wool trade.

In contrast, there is little to suggest that cattle became increasingly important as providers of traction during the medieval period as is generally the case at this time; whilst horses would have been more suitable for transport or as pack animals.

Carbonised Plant Remains *by Mark Robinson (with a contribution by Hayley McParland)*

Quantification of Material
Sixteen samples totalling 550 litres were taken for carbonised plant remains. Following processing, these are now in the form of dried flots.

Methods
The samples were floated onto a 0.5mm mesh and the flots dried. The flots were then scanned under a binocular microscope for charcoal and other carbonised remains. The charred seeds (and any chaff) observed were identified and an estimate made of their abundance. Charcoal from the flots was broken transversely and examined at up to ×50 magnification. This enabled the majority of the charcoal, *Fagus* and *Quercus*, to be identified. High-power incident light microscopy was used to establish the identity of the remaining taxa. The quantity of each taxon in each sample was estimated. The results for charred remains other than charcoal are given in Table 48 and for charcoal are given in Table 49.

Results for Carbonised Plant Remains
Carbonised seeds were present in all of the samples except for fill (352) from the pit 327. Chaff, however, was absent. The concentration of remains was relatively low, with no sample containing more than 1.1 seeds per litre and only five samples with more than 0.5 seeds per litre.

The assemblages showed a similar character with cereal grain, particularly short free-threshing grains of *Triticum* (rivet or bread-type wheat) predominating, often a few seeds of cultivated legumes and usually a few seeds from plants that readily grow as arable weeds.

The other cereals represented were *Secale cereale* (rye), hulled *Hordeum* sp. (hulled barley) and *Avena* sp. (oats). The only cultivated legume which could be identified with certainty was *Pisum sativum* (pea) but *Vicia sativa* (fodder etch) and *V. faba* (field bean) could also have been present. The weed seeds included *Vicia* or *Lathyrus* sp. (vetch or tare), *Rumex* sp. (dock) and *Anthemis cotula* (stinking mayweed).

In addition to the carbonised remains, the flot from fill (409) of pit 408, contained silicious plant material, silica phytoliths. Awn fragments of *Triticum* or *Secale* sp. (wheat or rye) were present. Plant silica phytoliths are formed from the silicification of monosilicic acid in the cells of some plant species during transpiration, these cells have a genetic or environmental propensity to silicification, and in the case of Poaceae, are identifiable to species level (Ball, Gardiner and Anderson 1999; Parry and Smithson 1958; Smithson 1958; Twiss, Suess and Smith 1969).

It is likely that the phytoliths have been released into the deposit following burning and it is likely this sample probably contained burnt cereal chaff and straw. Though the hydroliths have been subjected to burning, it is unlikely that these have been melted by the heat, for which extremely high temperatures above 1000°C would be required, at this high temperature, distortion may take place (Piperno 2006, 89).

Samples taken specifically for phytolith analysis are usually taken from the deposit direct and subjected to a different processing methodology to recover material down to 10 µm. It is therefore likely that the potential for phytolith analysis was greater than those morphotypes recovered as processing of bulk samples through a 500 µm mesh will have resulted in the loss of phytolith material. The material recovered is therefore not fully representative of the assemblage as a whole. Full phytolith analysis is not routinely used in commercial archaeology at present.

Results for Charcoal

Charcoal was present in thirteen of the samples. *Fagus sylvatica* (beech) was best represented, being present in nine of them. The *Fagus* charcoal included both small-diameter and large-diameter wood. Charcoal of *Quercus* sp. (oak) was found in several of the contexts and there was much in fill (349) from stakehole 361, cut into the side of pit 327. There was also a slight presence of charcoal of Pomoideae (hawthorn, apple etc) and *Corylus avellana* (hazel).

Discussion of the Results

The carbonised seeds were probably derived from the accidental burning of crops during processing possibly including the heating of wheat grain to dry it prior to grinding. This material had probably become mixed and scattered over the site. The crop assemblages from Newington were typical of rural medieval settlements in the region. Wheat, hulled barley and oats were all probably major cereal crops with rye of less importance. It is possible that some of the wheat grain was from *T. turgidum* (rivet wheat) as well as *T. aestivum* (bread wheat) but it is not possible to determine this in the absence of rachis fragments. The occurrence of cultivated legumes was also usual for the medieval period.

The predominance of beech and oak amongst the charcoal suggests that the site was exploiting a woodland fuel source rather than cutting thorn shrubs from scrub and hedgerow. In particular the occurrence of so much beech charcoal raised the possibility that wood was being obtained from the beechwoods of the Chilterns. It is very possible that the beech was used as fuel for smithing. Unfortunately, the charcoal was rather broken up to establish whether it was coppiced wood. The presence of both large and small diameter wood makes it seem more like either trimmings from timber production or branches from pollards were being burnt.

The results provide a useful local crop record and it is also of interest that fuel was apparently being obtained from the Chilterns.

	Sample	16	17	2	20	5	10	11	12	21	13	9	14	18	19	17
	Feature	312			361	369	376	208	382	408		192	427	485	487	
	Context	313	322	340	349	368	375	379	381	409	415	418	428	486	488	511
	Sample Volume (litres)	30	40	40	10	40	40	40	40	30	40	40	20	40	40	40
	Feature Type															
	Phase															
CEREAL GRAIN																
Triticum sp. - short free-threshing grain	rivet or bread wheat	+	++	+	+	++	++	++	-	-	+	++	-	++	++	++
Secale cereale L.	Rye	-	-	-	-	-	-	-	-	+	-	-	-	-	-	+
Hordeum sp. - hulled	hulled barley	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-
Avena sp.	Oats	+	-	-	-	-	+	-	-	+	-	-	-	-	-	+
cereal indet.		++	++	-	-	+	+	++	+	+	-	++	-	+++	+++	++
Total Cereal Grain		++	+++	+	+	++	++	++	+	+	+	+++	-	+++	+++	+++
OTHER CROP SEEDS																
Pisum sativum L.	Pea	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Vicia or *Pisum* sp.	fodder vetch, bean or pea	+	+	-	-	-	-	+	+	-	-	-	+	+	+	+
Total Cultivated Pulses		+	+	-	-	-	-	+	+	-	-	-	+	+	+	+
WEED SEEDS																
Vicia or *Lathyrus* sp.	vetch or tare	-	-	+	-	-	+	-	-	-	-	-	+	+	+	-
cf. *Medicago lupulina* L.	black medick	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
cf. *Trifolium* sp.	Clover	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Rumex sp.	Dock	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-
Galium aparine L.	Goosegrass	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-
Anthemis cotula L.	stinking mayweed	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Gramineae indet.	Grass	-	-	-	-	+	-	-	-	+	-	-	-	-	-	-
weed seeds indet.		-	+	-	-	-	-	-	-	-	-	-	-	+	+	-
Total Weed Seeds		+	+	+	-	+	+	-	+	+	-	-	+	++	+	-
Total seeds		++	+++	+	+	++	++	++	+	+	+	+++	+	+++	+++	+++

+ 1-5, ++ 6-20, +++ 21-45

Table 48: Carbonised plant remains

	Sample	16	17	2	20	10	11	12	13	9	14	18	19	17
	Feature	312			361	376	208	382		192	427	485	487	
	Context	313	322	340	349	375	379	381	415	418	428	486	488	511
	Sample Volume (litres)	30	40	40	10	40	40	40	40	40	20	40	40	40
	Feature Type													
	Phase													
Pomoideae indet.	hawthorn, apple etc	-	-	-	-	-	-	-	-	-	++	-	-	-
Corylus avellana L.	Hazel	-	-	-	-	-	+	-	-	-	-	-	-	+
Fagus sylvatica L.	Beech	+	++	-	-	-	+	+	+	+	-	++	++	+
Quercus sp.	Oak	-	+	+	+++	+	-	-	-	+	-	-	+	-

+ present, ++ some, +++ much

Table 49: Charcoal

7 DISCUSSION

Pre-Phase 1

Prehistoric

The field-walking in Great Bowling Field yielded a small assemblage of nondescript later prehistoric pottery which could as easily have been introduced through medieval manuring as be indicative of the presence of prehistoric activity. The valley of the river Thame has yielded extensive remains from the earliest periods of post-glacial prehistory.

At Dorchester-on-Thames where it joins the River Thames the Late Iron Age *oppidum* of Dyke Hills dominates the confluence, while earlier Neolithic remains, such as the cursus and later Bronze Age barrows are present along the west bank. At Princes Risborough there is the Neolithic barrow at Whiteleaf Hill (Hey *et a*. 2007). Further upstream in the vicinity of Thame recent interventions have yielded Neolithic pottery, Bronze Age barrows and Iron Age pit alignments (Taylor 2012). In common with all river valley tributaries of the Thames the Thame Valley was extensively exploited from the Mesolithic onwards and the presence of residual prehistoric pottery is unsurprising. Nevertheless, it is clear that further work is warranted to clarify the nature of the remains.

Roman

The Roman pottery assemblage was entirely residual, and in the case of some sherds evidenced abrasion indicating that they had been moved around prior to deposition. Other sherds, however, were in good condition, and included a rim-sherd of Central Gaulish samian ware and fine Oxford wares. A date after *c*. AD 250 is proposed for the fine Oxford ware assemblage.

While there is little evidence for Roman activity in the immediate vicinity of Newington, work carried out south and east of Newington along the line of the Chalgrove/East Ilsley pipeline has revealed later Roman field boundaries, pits and gullies (ie PRN 26114, SU 58870 94370; PRN 17488 SU 6549 9764; and PRN 17499, SU 61368 93801), and an excavation carried out to the north at Chiselhampton revealed early Roman field boundaries (Williams 2006), as did work at Copt Hay, Tetsworth (Robinson 1974) in advance of construction for the M40.

To the west, work has been undertaken evidencing Roman rural occupation at Berinsfield (Miles 1995, 26) while Dorchester-on-Thames was an urban focus and of importance since the Iron Age (Frere 1962, 1984, Booth & Henig 2000, 58-62; 187-196). A Roman road is argued to have run between Dorchester-on-Thames and Fleet Marston, Bucks., through Newington (Malpas 1987, 26-29), where Malpas suggests that a building on the Holcombe side of the village stood on Roman metalling.

Booth and Henig in *Roman Oxfordshire* (2000, 206) refer to the discovery of a burial urn at Newington, reported by Meric Casaubon. This undoubtedly does not refer to Newington, Oxfordshire, but rather to Newington, near Sittingbourne, Kent. Casaubon was a prebendary at Canterbury Cathedral, and reported on numerous archaeological excavations in Kent during the middle of the 17th century.

The Roman evidence is scant and, as remarked above, entirely residual. However, such an assemblage, albeit small, is indicative of some Roman activity in the vicinity. As so little archaeological fieldwork has been undertaken between Stadhampton to the north, Chalgrove to the east and Benson to the south it is unsurprising that the Roman period is so poorly represented, and only reinforces the dictum that absence of evidence is not evidence of absence. Late Iron Age and early Roman activity, consisting of field enclosures, was uncovered during excavations at Chiselhampton House, Chiselhampton near Stadhampton (Williams 2006). Nonetheless it is clear that any Roman site in the vicinity of Newington was exploiting a landscape in which farming played a key role.

Saxon

Despite the manor having been granted to Canterbury by Emma in the late 10th century, no evidence for Anglo-Saxon activity was identified during investigations at Park Field nor Great Bowling Field. This observation may be taken to infer that Newington was only exploited for agriculture, with occupation being very limited – perhaps no more than a single household and associated entourage. The manor's later role of providing for Canterbury students at Oxford not yet formulated.

Equally, the name Holcombe (see Historical and Archaeological Background above) undoubtedly indicates an earlier Anglo-Saxon origin to the hamlet forming part of the Benson multiple estate (Ditmas 2009, Fig. 2.8), predating Newington being granted to Canterbury. The name Newington meaning 'new settlement' may be indicative of the foundation of the village being closely associated with the separation of Newington from Benson, while Holcombe continued to be a holding of the royal estate.

The 1900 2nd Edition Ordnance Survey 1:10,560 shows a group of farm buildings identified as Little Holcombe, in contrast to Holcombe, which is marked Great Holcombe, indicating that there were two distinct settlements. Little Holcombe does not figure on the 1595 Hovendon map, which in itself is not surprising as such maps were legal documents, rather than dispassionate records of the countryside, illustrating solely what was pertinent to the transfer of land or dispute over property in question. Further work at both what was Great Holcombe and Little Holcombe would provide a more clear indication of the pre-Conquest activity.

Other Canterbury manors like Newington include Alsted (Ketteringham 1976), South Malling (Jones 1979) and Monks Risborough (Page 1908). All three manors were held by Christ Church, Canterbury; the latter two were also sub-manors of royal multiple estates gifted during the late Saxon period.

Phases 1 and 2 (11th-12th centuries) (Fig. 10)

A pair of gully stubs dating from before the 11th century were investigated, but yielded little significant data. By the late 11th or early 12th centuries enclosures were laid out, probably functioning for stock control. The palaeochannel may well have already been in existence, as indeed may the middening activity, although this is only dated from the late 11th century.

Early enclosures
The earliest phase comprises two enclosures. On the west side of the site the enclosure appears to be more of a small paddock on a west by northwest/east by southeast alignment, which was modified by the addition of a fence, represented by a line of postholes. The second enclosure, to the east, was defined by four sections of interrupted ditch, oriented northwest/southeast. There was at least one point of access between the two enclosures, in the northwest corner of Enclosure 2. A posthole suggests a permanent gate to the enclosure. The eastern part of the paddock comprises sections of an interrupted ditch, although there may well have been fencing, which is not visible now. At the extreme east end of the revealed enclosure a suite of postholes and small gullies indicate a possible fenceline and either associated drainage or enclosure boundaries. The pits 435 and 444, which contained metallurgical waste, are also associated with this phase; the pottery from the pits dates from the late 11th century onwards, although it is possible that they are later and are associated with Brian Gilmour's 'closure' or foundation pits in Phase 3.

Midden
The earliest pits associated with the midden area were excavated to the north of Enclosure 2 and were dug into the natural Gault Clay, as relatively shallow bowl cuts, in contrast to the later 12th and 13th century pits, which were much more straight-sided and flat-bottomed in profile. This middening, located southwest of the palaeochannel, was relatively undisturbed. Due to later activity much of the midden area was dated to the 13th century as a result of truncation or terracing and dumping associated with the newly opened-up areas. Evidence for smithing in the form of slag was recovered from the midden.

Palaeochannel
The possible line of a palaeochannel was recorded by SOAG in the 1980s when they surveyed the western part of Park Field, although was not extensively investigated during the phase of work by JMHS due to time constraints. The palaeochannel cut north by northwest across the northeast side of the site, in the direction of the drain, which lying between Newington House and Park Field, is fed by a source in Great Bowling Field to the east.

No dating was recovered from the palaeochannel, which makes it impossible to know whether it predates Phase 1 or whether it is a later feature. Within the report it is assumed that it was a natural feature which predated the Saxo-Norman use of the site, and which was modified over time.

Discussion
The layout of a pair of enclosures is clearly only a small part of a larger organisation of the manorial holding. The full extent is however impossible to ascertain. The earthwork survey undertaken by SOAG did not appear to extend to the east toward the A329, but it is clear that there are unrecorded but visible earthworks south of the site on the slope of the hill.

It is feasible that Newington was initially developed in opposition to Holcombe, which pre-Conquest was probably part of the royal manor of Benson, but which after the Conquest appears to have been part of Drayton, perhaps even part of an estate belonging to Dorchester-on-Thames (Lobel 1962, 16-17; 71). As the land was part of the Canterbury Cathedral manor at the Dissolution, it is very probable that it was already part of the lands given by Emma in the 10th century, which in the late 11th century Lanfranc acquired as Archbishop of Canterbury and Prior of Holy Trinity.

At this stage the estates of the priory and the cathedral were not separate. As there is no evidence for settlement pre-dating the enclosures, it is very probable that these ditches represent a post-Conquest development of the manor.

Phase 3 (early 12th-13th centuries)

The enclosures were replaced by plots, one of which – Plot 2 – is characterised by associated structural remains. Plots 1 and 3 did not evidence any structures at this point, although any may well be beyond the edges of excavation. Structure 1 in Plot 2 was a smithy, built in timber, preceding Structure 4. It was not recognised as a smithy during excavation as only half of the building was revealed; however metallurgical remains – including hearth smithing bottoms, fuel ash and hammer-scale – were recovered from both associated and contemporary features in the vicinity of the post-fast structure.

Plot 2: Structure 1

There was certainly one smithy at Newington, and possibly as many as three smithies represented by the remains at Newington. The earliest postulated smithy, adduced from archaeological remains, was the structure located beneath the island in the proposed lake, which comprised the gable-ends of a building and associated floor surface. Pits and gullies in the immediate area surrounding the proposed smithy building yielded smithing hearth bottoms (SHBs), or plano-convex blooms (PCBs), which are the result of blacksmithing or forging rather than heavier industrial activities such as smelting. The quantity of these indicates that the presence of a smithy here. The majority of the SHBs were recovered from pits in the vicinity of the structure. This in itself is not absolute evidence, and unfortunately, it was not recognised as such during excavation. Targeted sampling for hammerscale was not carried out on Structure 1. Nevertheless, hammerscale was recovered from environmental sampling of several features associated with Structure 1, which permitted its identification during post-excavation analysis as a smithy.

Structure 2 on the west side of the excavation was a post-fast structure with a beaten-earth floor. Much of it was under the island, limiting the interpretation of it. It measured 7m × 13.2m (*c.* 23’ × 43’8”) and comprised an eaves gully at both north and south short ends – the former was notable for the number of stakeholes for a stud wall (although none were present along the long sides) – postholes, which were only represented on the north side and northeast corner, and a beaten earth floor. The building was more than likely an industrial structure, despite the proximity of a number bone and pottery assemblages from around the building’s associated pits and gullies. The presence of a number of smithing blooms, and slag ash, in addition to jars such as that from 539, is strongly indicative of industrial activities rather than domestic.

It is perhaps also worth noting a further similarity with the late Saxon site at Yarnton (Hey 2004, Fig.8.5). There a rectangular structure comprising two beam-slots at right angles with associated postholes was found near to the smithy (Hey 2004, Fig. 8.1). The beam-slot structure seen at Newington had no obvious postholes, but these may have shallow or, equally possible, removed when the cobbled yard surface was machined off.

In comparison with the later Structure 4 very little of Structure 1 was seen. However, the associated rubbish is typical of a smithy. Moreover, as the western property boundary of Plot 2 was reused during Phases 3 and 3a, it is tempting to see the plot having been laid out for a smithy initially, and that Structure 4 replaced Structure 1 as part of a process of modernisation of the smithing activities.

Midden and enclosures

The area on the north side of the site was terraced back, and subsequently used for rubbish disposal, with the result that a midden accumulated on the south bank of the palaeochannel, although no direct relationship was established during the intervention between the early stream channel and terracing. The stream was probably not a significant watercourse, but provided a water-source for the smithy, closer than the Thame.

The evidence for an initial attempt to manage the rubbish disposal is clear in Test Pit 2 where terracing was subsequently sealed by dumps of refuse. The rubbish dumped appears to be largely devoid of slags, although a small amount is present. The midden also yielded roof-tile, indicating a date from the middle of the 12th century onwards. This activity appears to have gone hand-in-hand with the use of Plot 2 as a smithy.

The function of the other two plots – 1 and 3 – is not apparent, but if, as suggested above, these were laid out as part of a post-Conquest manorial exploitation policy, it is possible that these could equally have functioned as domestic enclosures as further industrial units. Indeed the relative absence of dense industrial residues or remains – such as worked bone or artefacts for carrying out other activities might indicate the higher probability of the adjacent enclosures being domestic, notwithstanding Paul Blinkhorn's comments on the prevalence of vessels of a more industrial character.

Discussion

This phase provides the first evidence, if slightly circumstantial, for smithing being carried out at Newington within the manorial complex. Smithing in this context must be seen as an economic activity not dissimilar from milling, potting, tile-production or any of the extractive industries – be it clay, stone and so forth. As such an industry, the erection of the building was possibly at the cost of the landlord, although there is no evidence for this.

Although increasing landlord control cannot be proved (Hinton 1990, 107), indications such as changing boundaries, as evidenced in Phase 2, might also account for the erection of the post-fast Structure 1 smithy. Drawing customers from surrounding farmers, both from Newington manor as well as other demesnes, a smithy was a source of revenue, which would be exploited in much the same way as any other technology.

The miller provides a good comparison, acting as a middleman between the producer and the final customer, the miller drew a toll from grain milled in order, in part, to pay his own fine to his overlord for the right to run a mill, which itself was frequently not his own property (Hinton 1990, 153). Such a model is the most likely to apply to a manorial smithy such as Newington. What is clear is that by the 13th century, a mill has been added to the resources (CCA-DCc-ChAnt/N/29; Selway-Richards 2005, 53), and that the wood at Bix was also being exploited for firewood, which may perhaps also be the source of the beech charcoal from some of the smithing-related features.

Arne Jouttijärvi (2009) discusses the extent to which smithing in Viking Age Denmark was organised. The smithy at Viborg Søndersø (Jouttijärvi n.d.) evidenced a structure in use between AD 1019 and 1023, in which a number of sandy floor levels were thrown down prior to periods of use. A relatively short use period is represented by five levels, each of which preceded a season's smithing. The final period prior to its destruction and the building of a whole new unrelated structure was characterised by maintenance in anticipation of the blacksmith's return, during which the sandy floors were re-laid.

We cannot say whether the smithy at Newington was operated by a semi-itinerant smith, which is the implication at Viborg Søndersø, but the maintenance of the workshop area may well be indicated by the relatively small amount of smithing debris. The 12th/13th century smithy contrasts with the later smithy by the lack of abandoned ironwork and other materials. This would seem to indicate that as Structure 2 approached the end of its use-life, it was cleaned out prior to being replaced.

What is perhaps of some interest at Newington is Brian Gilmour's observation that the slag recovered largely dates from the 12th-century Phase 3 smithy, and comes for the most part from one of five pits. He proposes the possibility that these pits may well represent some form of 'closure/foundation deposit' associated with the abandonment of the earlier smithy and erection of the new. Such approaches are more frequently seen in the archaeology of prehistoric metalworking (Bradley 1990), although Duncan Wright (2010) has recently written about the liminal position of smiths in Anglo-Saxon society, both in a social and physical context. Margaret Williams discussing early medieval Irish smiths asserts that slag may well have had a social role to play, given that it had undergone transformation from one material to another (Williams 2010, 39); one, which tied it to concepts such as fertility and health (Hingley 1997, 15; 2006, 216).

As a practice the burial of the slag might be seen as not dissimilar to the practices of bricklayers and builders of incorporating dead cats, shoes and coins into new structures, as evidenced by the Deliberately Concealed Garment Project (http://www.concealedgarments.org). The burial of smithing hearth bottoms might be seen as a means of tying the earlier smithy to the new, and – while not necessarily consciously making a propitiatory deposition – nevertheless ensuring the smithy was fruitful and enjoyed good fortune. Such an incidence of the continuity of folkloric behaviour does not require the actor to be carrying out the activity with the same intentions as an earlier individual doing the same actions.

At Baston, Lincolnshire, (Taylor 2003) the smithy lacked a superstructure, with only the bowl-shaped sunken hearths and the working surfaces subsisting. Taylor suggests that bowl-shaped sunken hearths may well be earlier, in which case it is possible that any hearth associated with the Structure 1 smithy was similar. Caution must, however, be exercised as sunken hearths were also recovered from London Road, Crawley, Sussex (Cooke 2001), Low Farm, Thornton, Cleveland (Vyner 2003) and Towton, North Yorkshire, (Fern 2006), while the late Saxon hearth at Yarnton (Hey 2004) was a positive feature, very similar in design to that at Newington.

If nothing else, this indicates a wide variety of practices in smithing technology. It ought to be noted that Chris Fern (2006) proposed the smithing activity at Towton was opportunistic and perhaps associated with the Battle of Towton in 1461. It is equally possible that the smithy was longer-lived, and although there is no direct evidence for this, such activity would explain the proximity of the hearth to a sandstone block in a stone-setting he proposes as a post-pad (Fern 2006, Fig. 3), but which could equally represent an anvil-setting. Such a bowl-shaped sunken hearth may well subsist beneath the island at Newington, although as it was not excavated it is not possible to be certain of this.

Phase 4 (13th-14th centuries)

Phase 3 is characterised by the continuity of the plots laid out during Phase 2, and by the remains of buildings associated with each plot. Structure 3, excavated by SOAG, lay within Plot 1; the well-preserved remains of a rural smithy, comprising what was probably a timber-framed building, Structure 4, on stone footings with an anvil setting and adjacent hearth and bosh within a Plot 2; and within Plot 3 a third building, Structure 5 with a possibly associated ore-roasting oven.

Structure 3

To the east of Structure 1 and north of Structure 2 was a metalled floor and associated postholes, postpads and external gully excavated by SOAG in 1983/4. A large single stone was present on the north side of the JMHS excavation, which despite looking like a post-support was not associated with any other feature. Following receipt of the SOAG archive and drawing together of the results from both excavations it became clear that the stone may well have functioned as a post-support associated with Structure 3 in SOAG's Trench II. Moreover, despite a limited excavation area, the presence of a number of SHBs, as well as a piece of tuyére, is conducive to the identification of this structure as either a smithy or some form of associated industrial structure. Unfortunately, it was not recognised as such a building and so was not sampled for hammerscale at the time.

Nonetheless, the overall context of the site, and the presence of the main smithy – Structure 4 – excavated by JMHS during 2006 and 2007 provides a strong case for this partly examined building also having been erected for industrial, possibly smithing-related, activities. The SOAG structure, which was located west of the midden area, evidenced postpads and postholes laid onto or cutting the metalled floor. It is best to consider this structure to have been industrial rather than a domestic structure.

Structure 4

It would appear that the postulated Phase 3 smithy was a success, as early in the 13th century, a new purpose-built smithy was erected. It is clear that we do not and cannot know the details for the building of the smithy, unless there lies in uncatalogued documents at Canterbury details for its construction. It was about the same time that the first smithy at Alsted, Surrey was built, which was also a holding of Canterbury, and which may be indicative of an attempt to develop the role of the monastic manors, providing other services, such as smithing. At present there is too little evidence to argue such a point conclusively, however, there are a number of monastic manors with smithies, and examination of the role of monastic orders in developing such manors might be rewarding, with a larger data-set, in the future.

There are five of the nine diagnostic traits relevant to ascribing smithy status to the site (Astill 1993, 272) present at Newington. These are the presence of hammerscale, smithing slag, fuel ash slag, scrap, associated stone artefacts (hones etc.), as well as the anvil setting, the hearth-bases and the bosh. Some of these have already been evidenced in the Phase 3 smithy.

The smithy at Newington was a square-sided building oriented to the northeast, measuring 8.1m by 5.4m (26'6" by 17'9") externally. The west, south and east sides comprised a stone cill, which was less well-preserved on the south side, that would have supported the cill-beam. The width of this cill varied between 0.25m and 0.8m. The building was more than likely only a single storey high. A break in the west wall indicates an access. The north side of the building was characterised by postholes, which suggests an open or partially open structure; indeed this would seem a prerequisite for the shoeing of horses, for example. On the east side of the smithy further stone footings indicate a small lean-to or similar ancillary structure. There were yard surfaces on the north and south sides of the smithy. On the north side, these sealed a few earlier pits, but on the south side there was a marked absence of earlier activity. Earlier pits lay beneath the east annexe, which may well have functioned as a woodshed or similar storage facility.

The Structure 4 smithy at Newington was clearly a timber super-structure on a stone cill. Smithies excavated elsewhere in the country frequently have evidenced similar, relatively light footprints. Although Alsted (Ketteringham 1976, 28) was built of low flint and clay walls with post-settings and both Burton Dassett (Gaimster *et al*, 1989 215-7) and Waltham Abbey (Huggins and Huggins 1973) had 'masonry' footings, these examples contrast markedly with the more ephemeral remains from Goltho (Beresford 1975, 46) where only a number of post-pads were present, or Godmanchester (Wesbster and Cherry 1975, 259-60) where the structures were in cob; the smithy at Baston (Taylor 2003) appeared to be a post-fast structure, as was probably the case at Lyveden (Steane and Bryant 1975), and even Crawley (Cooke 2001) where no structural remains were recovered, at all – also the case at Chingley (Crossley 1975).

The excavations at Alsted, Waltham Abbey, Yarnton, Lyveden and Meal Vennel, Perth (Cox 1996), also revealed hearths. The late 14th-century raised hearth at Alsted was particularly well preserved (Ketteringham 1976 Fig. 22). Similarly the hearth at Waltham Abbey was also raised (Huggins and Huggins 1973, Fig. 2). Although the hearth differed from Yarnton insofar as tile-built hearths are inevitably of a date after the 12th century, when tile is first introduced as a roofing material, the stone hearth at Yarnton was closer in overall form to that at Newington than the examples from Alsted and Waltham Abbey. Unlike the pit at Yarnton (Hey 2004, 167) no kerb was apparent. The hearth at the 14th/15th smithy at Goltho (Beresford 1975, 46) had a kerb on its east side, but which did not surround the entire hearth. The Goltho smithy also had a bosh (Bereford 1975, 46), which was also seen at Wharram (Hurst 1979, 48) and perhaps Waltham Abbey (Huggins and Huggins 1973, 136), as well as at the Newington smithy. Such clay-lined pits appear to have functioned to keep the smith's tools cool, rather than for quenching the worked iron (Tylecote 1981, 43).

The hearth then is a strong indicator for smithing activity, although far from the only. Excavations at Alsted, Waltham Abbey, Yarnton and Meal Vennel, Perth, have evidenced anvil settings similar to that at Newington. The similarity, however, between the Yarnton and Newington examples, goes some way to placing the smithy at Newington very much in a Saxo-Norman smithing tradition. The arrangement at Yarnton and Newington comprised a limestone surface with a roughly squared setting in the middle. At Newington this stone setting was placed on the underlying subsoil. It is clear that the stone setting would have held a piece of timber, to which the anvil would be affixed (Ketteringham 1976, Fig. 39; also Tylecote 1981, Fig 40; Cox 1996, Illus 10, 11 & 12). It is clear that the hearth and anvil need to be close to one another, and the arrangement at Newington conforms well with the observation an 'anvil would be positioned so that the smith could, by means of a part turn, move iron in his left hand from the fire to the hearth' (Huggins and Huggins 1973, 135). Hammerscale from around the anvil-setting confirms such an interpretation.

Smithing requires an anvil, but the apparent lack of an anvil-setting on sites such as Godmanchester (Webster and Cherry 1976, 259-260), Goltho (Beresford 1975) or Wharram Percy (Hurst 1979) does not exclude such sites. Sampling for hammerscale can indicate the location of the anvil – as Alison Mills & Gerry McDonnell (1992) demonstrated at Burton Dassett, and more recently Arne Jouttijärvi (2009) has shown for both Rødbøl, Vestfold, Norway and Viborg Søndersø, on Jutland. The excavation at Newington was methodically sampled – although in many of the examples investigated since PPG 16, there has been very limited methodological sampling for hammerscale. In any case, hammerscale is not easily visible to the naked eye during excavation, and is perhaps the only trace of smithing which is conclusive. Hammerscale was recovered at Newington from environmental samples associated with 12th-century features, but no sampling of the earlier smithy was undertaken. It is clear with hindsight that having identified the 13th-century smithy, all putative buildings should have been sampled for hammerscale.

Although the excavation at Newington failed to identify the earlier 12th-century smithy until post-excavation analysis, the succeeding smithy was sampled during the excavation. As a consequence it is possible to confirm that the feature proposed as an anvil-setting was indeed such. A greater quantity of hammerscale was present to the south of the anvil-setting – adjacent tot the south wall of the smithy – than to the north or east; similarly there was yet again less to the west, where the smith would have stood. This concurs with Jouttijärvi's observations at Rødbøl and at Viborg Søndersø (Jouttijärvi 2009, Figs 11 and 14). The relative absence of slag from the 13th-century smithy is – as has been already stated – perfectly in keeping with expectations. At other sites, such as Bordesley (Astill, 1996), and Somerby (Mynard 1969) slag was used as hardcore and frequently moved off-site – and it can be assumed that this was the case also at Newington.

At Braggington, Shropshire (Barker 1966), there was little evidence for any ironworking in the immediate vicinity of the postulated smithy, however, to the northeast of the structure, was a significant deposit of dumped slag and smithing waste within the croft (Barker 1966 Fig. 29), indicating that frequently there was waste-management of slag and other residues. Grenville Astill (1996, 186) points out that similar management of slag was observed at both Goltho and Bordesley Abbey. Furthermore, Astill reinforces this observation when he observes that a poverty of surviving material remains is common to all sites, with the single exception of Waltham Abbey. In such a case it is unsurprising that smithies are infrequently seen in the archaeological record. It is perhaps also due to the apparent *ad hoc* nature of some smithing that identification does not occur, in the absence of a sampling strategy, such as magnetic susceptibility which would indicate magnetic anomalies perhaps indicative of smithing activities (Brian Gilmour, *pers comm*).

Structure 5 & ore-roasting oven
In Plot 3, which during the course of the 13th century became part of Plot 2, by means of backfilling ditch 505 and cutting two ditches 369 and 468, a stone structure provisionally identified as an ore-roasting hearth was investigated. The feature, which comprised a stone-lined cut, far greater in width than the stone structure itself, had some capping stones at the south end, away from the postulated stoke-hole. It was cut into a natural rise in the gravel, just to the north of what appeared to be the post-pad of a building, which extended beyond the edges of excavation and therefore not investigated. The structure, which had no signs of use, such as scorching, had collapsed in the past, and during machining stones were removed from the vicinity of the structure, suggestive of plough damage, or partial dismantlement in the past. Although narrower and shorter than a possible parallel at Minepit Wood, Rotherfield, East Sussex (Money 1971, Fig. 33), the postulated ore-roasting hearth was within Plot 3, which was where sherds of Potterspury ware, made on the Northamptonshire ironstones, were found. In the absence of specific evidence of pieces of ore, and the uncertain nature of the building to the south, the ore-roasting hearth has been proposed in the absence of any more credible explanation for the structure.

Discussion
The tax returns indicate that during the 13th century the population increased, in line with the rest of England. Certainly the development of ‘filial’ vills (Postan 1972, 127) at Berwick Prior and Britwell Prior would explain why in the succeeding century and particularly by the late 16th century Newington assumes the air of an increasingly depopulated settlement. Although there is no mention of the smithy at Newington in documentary sources, the existence of the mill is confirmed in an agreement between the Bishop of Lincoln and John Fynch Prior of Canterbury. Slightly earlier than this, the early part of the 14th century, Andrew le Smith, presumed of Britwell Prior, is named in a manorial court roll. By the time of the dispute between the Bishop of Lincoln and John Fynch, visitations appear to be dropping off, as indeed the monks at Oxford are embroiled in legal problems with Balliol, which may well be not unrelated to the decline apparent by the late 16th century, suggested by the paucity of houses on the Hovendon map.

Phases 5 (M13th-L14th centuries) and 6 (15th century)
By Phase 5 – that is after the middle of the 13th century – rates of deposition were already reducing, with a marked drop-off in the amount of slag and metallurgical related material being deposited in features. Most of the later slag was recovered from the external surfaces. This is a consequence, in part, of there are only a few features dating from this period. It is clear that the smithy, if not already abandoned is

not in use to the same as extent and that while the previous cutting of the new boundary between Plots 2 and 3 reinforces the on-going use of the space, there are few new pits and no new structures associated with this phase of activity indicating that the site underwent a significant retrenchment and we must assume an initial shrinkage of the village was underway; indeed the change in climate from the early 14th century is associated with a reduction in the creation of new small-holdings (Dyer 2002, 160). By the 15th century, a large rubbish pit was dug into the metalling to the rear of the Structure 4 smithy, at this point now, it was probably no more than piles of unreclaimed timber, roof-tiles, and scatters of nails and bits of iron rubbish.

Discussion

What is clear is that the site was in use until after the middle of the 13th and into the early part of the 14th centuries, at the very least, and perhaps later. Abandonment appears to date to the earlier part of the 15th century, if it extends into the century, at all. There would, however, appear to have been a hiatus over the course of the 14th century during which time deposition is to all archaeological intents and purposes not visible. However, as noted for Bordesley Abbey, Braggington and Somerby, removal of slag off site was the usual practice. Nevertheless, there is no indication of an intention to return, following this late 14th/early 15th-century abandonment of the site, as has been evidenced in the ethno-archaeological record through caching or storing materials (Cameron 1993, 4). The later activities – pitting and rubbish deposition – need not indicate anything more than serendipitous reuse of waste-ground. This explains the reasonably high quantity of animal bone still deposited after the abandonment of the site.

By the time the smithy was abandoned, over the course of the late 14th early 15th centuries, the yard had in addition to scrap-metal, nails and building debris spread across it. The building materials found on the yard surface suggest a structure roofed with tile – rather than thatched – and both large and small nails evidenced suggest that the north face may well have been faced with wooden cladding, although given that much of the building debris was concentrated to the northeast of the former smithy, it is possible that some deliberate collection of materials had been undertaken on or just after abandonment, but not followed through. Ethnographic evidence (Joyce and Johannessen 1993, 147) indicates that provisional discard is an important aspect of site abandonment, distinct from primary or secondary rubbish disposal, and that ‘at sites which were rapidly abandoned, [such] *de facto* refuse, including items normally curated, was abundant and highly correlated with intended areas of use’ (Joyce and Johannessen 1993, 139). The presence of such items as the rowel, the chape, key, harness cheek-piece and so forth are strongly indicative of such an exit strategy. The spread of nails over the yard points to the possibility of the dismantlement of the wooden superstructure having been started, but not entirely completed. No burning was observed over the cobbled yard-surface indicative of a fire for rubbish disposal.

The abandonment of the smithy and associated enclosures was complete by the 15th century and the site was occasionally used for the discard of rubbish, as evidenced by the pit 494. The rubbish was being brought on site, as is clear from the presence of floor tile – some of which was reasonably new and unworn, such as the Penn tile fragments found in 494 and on (190) – and which may well be related to either the retiling of the church or perhaps the manor. By the late 14th century Penn tile had captured much of the market along the Thames. It was shipped from the wharf at

Hedsor up-river to Oxford (Green 2005 132) and downstream as far as the Tower of London, at least (Green 2005 127-9).

Abandonment is a normal part of the process of settlement (Cameron 1993, 3). There is a tendency to locate desertion or, as in the case of Newington, shrinkage of medieval villages within the timeframe of the Black Death and to use the plague as the explanation rather than as one of a myriad of complex factors. The population increase in the period between the 12th and early 13th centuries was largely that of the peasantry (Dyer 2002, 155), although given that our estimates for earlier population are based on the indirect source of Domesday, such estimates are imprecise and perhaps too low (Dyer 2002, 155). Land pressure entailed an increase in migration to urban centres, which had an effect on the rural landscape as land taken into cultivation rapidly fell out of use again giving an impression of greater abandonment than perhaps occured. Other factors include decreasing fertility due to over-exploitation of soils which in turn enabled pasture to replace arable and hastening the process of depopulation;

Clearly, by the later 16th century, when the estate map showing '*Mr Oglethorpes howse*' in the approximate location of the present Newington House was surveyed, the surface occupation does not correspond to that on, for example, the 1st Edition Ordnance Survey. It is, at present, perhaps equally presumptuous to assume that the 1595 estate map corresponds with the high medieval disposition of houses. There do not appear to be strong grounds for identifying tofts and associated crofts within the site, where Park Field is today. Indeed, the 16th century pottery from the site was recovered from within the topsoil, strongly suggestive of the site having been abandoned and turned over to the plough.

However, the houses giving onto the road leading from Newington to Warborough may be indicative of the eastern end of a strip of north/south aligned tofts and crofts running west to the River Thame from the road, tying into those plots excavated by JMHS in 2006. It was not possible to associate the earthwork survey carried out by SOAG with any features to the east of the site, although the present site excavated by JMHS did seem to correspond with the results obtained during the 1980s. The levelling of Park Field after the carrying out of the SOAG survey meant that the initial results could not be re-checked by JMHS.

Fieldwalking carried out and subsequently plotted by SOAG reveal the presence of discrete spreads of tile and pottery within Great Bowling Field. While manuring can be the cause of some of the finds distribution within the field, two distinct densities are apparent on both the pottery and tile plots. While the two plots do not directly correspond this might be explained by the relative greater weight of the tile fragments, with the result that they did not move around the field with ploughing perhaps to the same extent that pottery would.

The distributions can be associated with two or possibly three structures visible on the plan of 1595 drawn up by Thomas Langdon, on behalf of Robert Hovenden, rector of Newington, who surveyed those lands of the Oglethorpe estate, and which appears to have comprised the priory manor in part. Park Field is not shown on the map, but is clearly part of the Oglethorpe estate.

8 CONCLUSIONS

Introduction

Despite over twenty years of archaeological interventions since the introduction of PPG 16 and latterly PPS5, there have been surprisingly few medieval rural smithies revealed during development work. There is indeed an expectation 'common to archaeologists, historians and the general public – that every village had its smithy, from the industrialised Victorian period back through post-medieval and medieval England to the Saxons, and, no doubt, even before' (Williams 2012, 20).

Moreover, the frequency of development control work in English villages would lead one to anticipate that a higher proportion of smithing structures should have been recovered during watching briefs, evaluations and excavations. This would not seem to be the case. At present there appear to have been only six discovered (Table 41) in the past 25 years. This total excludes a number of sites which were clearly smelting sites, but do not appear to have been centres for blacksmithing. Some of the sites in Table 41 – Waltham and Bordesley Abbeys, Chingley, held of Boxley Abbey, Crawley as well as Braggington and possibly Lyveden – were both places where both ore and iron were worked.

Site name	Date (approximate)
Baston, Lincs	10^{th}-13^{th}
Lyveden, Northants	11^{th}/12^{th}
Newington, Oxon	12^{th}-14^{th} C
Waltham Abbey, Middlesex	12^{th}-14^{th} C
Bordesley Abbey , Worcs	12^{th}-15^{th} C
Godmanchester, Cambs	13^{th} C
Wharram Percy, N Yorks	L13^{th} to 14^{th} C
Alsted, Surrey	14^{th} C
Chingley, Kent	14^{th} C
Goltho, Lincs	14^{th}/15^{th} C
London Rd, Crawley, Sussex	14^{th}/15^{th}
Burton Dassett, Warks	14^{th}-15^{th} C
Towton, East Yorks	15^{th} C
Braggington, Salop	15^{th} C
Fountains Abbey	15^{th} C
Tintern Abbey	15^{th} C
Somerby, Lincs	15^{th} - 16^{th} C
Kirkstall Abbey	15^{th} - 16^{th} C
Furnells, Raunds, Northants	15^{th}-16^{th} C
Midland Rd., Raunds, Northants	16^{th} C
Thornton, Cleveland	16^{th} C

Table 41. Ironworking sites mentioned in the text (italicised sites found under PPG 16 conditions)

The smithies investigated are notable for the absence of easily diagnostic evidence, which is also a reason why many of the urban iron-works such as Whitechapel (Sygrave 2005), Yarm (Evans & Heslop 1985) or Norwich (Atkin 2002) have not been included. Too often there have been few if any structural remains and little or no sampling for hammerscale on such sites; the smithy at Whitechapel, which was confirmed through the presence of hammerscale, is a notable exception. Apart from the research project at Bordseley Abbey (Astill 1993), the greater part of our knowledge derives from excavations pre-dating archaeology as a factor in the planning process.

Documentary background
Certainly our historical knowledge of medieval smiths is not lacking. There is ample documentary evidence concerning them; the earliest evidence from the late 13th century details London smiths forming unlawful assembly (Bromley & Child 1960, 22), and being banned from night-work due to noise pollution – a situation which was still a complaint a century and a half-odd later (Geddes 1991, 174-5). Craft specialisation was a feature of smiths, with the result that a range of iron-working guilds, making knife-blades, armour, various bits of horse-gear and so forth, were formed and incorporated (Geddes, 1984, 17) ever before the incorporation of the Worshipful Company of Blacksmiths in 1571 (Bromley & Child 1960, 22).

Such a focus on the documentary sources, however, prejudices us strongly in favour of the urban and high status smith – such as James of Lewisham, who worked on St Stephen's Chapel, Westminster (Geddes 1991, 168), or Thomas of Leighton who wrought the grille for Queen Eleanor's tomb (Geddes 1984, 22) – to the detriment of the more widespread rural smith. For these the documentary sources are largely silent – an occasional mention of a individual such as that of Andrew le Smith at Newington in 1331 (Ault 1972, 94) in the context of the harvesting of his wheat, rather than as a smith. This tells us little. Jean Le Patourel (1968) discussed the whether there was the possibility of establishing a relationship between name and occupation in the pottery industry and concluded that after the 13th century potters increasingly bore surnames which were not necessarily indicative of their chosen profession.

Nevertheless, whether the break between name and occupation was fully applicable in the iron-working trades is less certain: Jane Geddes (1984, 17) details 'Thomas Lorymer [i.e. a maker of bits, spurs and harness-pieces], Robert Marshall (i.e. farrier), John Lorymer *over the smiths' row*, John Lorymer by the Cuckstoolpit and John Locksmith were responsible for producing their mystery play together in 1382' (my italics). The mystery play was, of course, a guild affair, and therefore strongly indicative of the name and occupation going hand in hand still at the end of the 14th century, where Jean Le Patourel suggested such a relationship already less strong by the 13th century. It is apparent that the picture is less than certain and clear-cut.

As was noted in the Historical Background, a significant problem for the manor is that much of its surviving documentary sources are held at Canterbury and certainly in the 1980s were not well archived. A small quantity of material has been examined from the online resource at the Public Record Office, but this was of limited use in the context of the present study.

Archaeology of smithing
Iron slag is found on nearly all medieval settlement sites. Contrary to expectation – derived in part from historical sources indicating increasingly widespread smithing (Crossley 1981, 29) – there are comparatively few excavated rural medieval smithies in England. Moreover, attention has tended to focus on the larger manufactories such as Bordesley Abbey (Astill 1993), in the absence of there being a large data-set of lower status sites. There are two sets of indices for identifying smithing: material and for structural remains.

The material indices which Grenville Astill (1993, 276) enumerates are smithing slag, hammerscale, ash layers, bar iron, scrap iron, blanks or 'moods', incomplete forgings, metalworking tools, associated stone artefacts. As Astill (1995, 186) points out there are frequently few of the material indices from a smithy, which one might expect to find, actually found during excavation. It should be noted that not even Bordesley Abbey had all nine: at Newington, four were identified– smithing slag, hammerscale, scrap iron, and associated stone artefacts (comprising a range of differing types of whetstone/hone), across three groups (Astill 1995, 187).

The Phase 4 smithy, Structure 4, was particularly interesting insofar as very little large smithing slag was actually associated with the building. The only slag present to any significant degree was the microslag hammerscale, a product of the working of hot iron, and, consequently, the more incontrovertible iron-working residue as it does not travel far from the place of production. Burton Dassett (Mills & McDonnell 1992) and Raunds (Audouy & Chapman 2009, 140) are notable for large quantities of hammerscale being recovered identifying the building as a working smithy.

Large smithing hearth blooms were usually moved off site to be reused as hardcore or for other consolidation purposes (cf Beresford 1975, 46). The sampling of hammerscale showed densities in and around the anvil, indicating potential working practice, tailing off at a distance from the anvil, with the exception of the smithy side entrance where the high density may well be associated with the smith exiting and cleaning himself off.

Nevertheless, both microslag and various smithing slags as well as hearth material were not only present in the Phase 4 remains, but the presence of such in features associated with the Phase 3 building, most of which lay beneath the proposed duck-island in the lake, enables a tentative but ultimately convincing identification of an earlier smithy.

The implications of this are significant as this indicates the strong possibility that the smithies at Newington were erected by the manor as an income raising mechanism hand in hand with the exploitation of the mill recorded in Domesday and again in 1384 (CCA-DCc-ChAnt/N/29A). A potential location for the mill might well be immediately to the west of the site where the land drops steeply away to the river Thame. This was not examined during the intervention as it lay outside the remit of the project.

Only a limited quantity of scrap iron was recovered. This is undoubtedly due to the apparent tidying up during dismantlement of the smithy. Nonetheless, a number of whetstones were recovered from the smithy, including one from the wall matrix of the Phase 4 Structure 4 smithy. This use of this hone may well date from the Phase 3 smithy.

In addition to the four indices the Newington smithy yielded there were also the structural indices. The excavation revealed two hearths and an immediately adjacent setting for an anvil; a postulated bosh was also located adjacent to the smithing area; there was no evidence for a chimney-hood.

The size of the smithy at Newington – at 8.1m × 5.7m – was somewhat larger than many of the other examples previously investigated – Goltho measured 7.3m × 4.2m, Raunds 7.5m × 4.6.2m and Godmanchester 5.8m × 4.5m – and so is comparable with Bordesley Abbey. Like the smithies at Goltho, Godmanchester, Burton Dassett and Alsted the smithy at Newington was purpose-built, with a timber super-structure having been placed on the stone-footings. Alsted was also a holding of Canterbury, but despite the contemporaneity of the two smithies, there do not appear to be any particular similarities in formal attributes between the two buildings.

A number of the other medieval smithies – such as at Tintern Abbey (Courtney 1989) and Fountains Abbey (Coppack 1986) or Sandal Castle (Mayes &Butler 1983) – would appear to have been *ad hoc* affairs reacting to use of already extant space. In this analysis these do not always make for useful comparanda. Jane Grenville has commented quite rightly that 'Workshops have not been a central focus of archaeological inquiry' (2004, 29), indicating that much of what has been written has been incidental to other concerns such as social and economic conditions for historians; artefact production and distribution for industrial and historical archaeologists; site formation processes for field archaeologists.

The use of tile to roof the Phase 4 structure is unsurprising and the presence of a tile-kiln at Alsted was probably directly related to the need for such roofing materials for the smithy there (Kettringham 1976, 29-31). Due to the limited publication of sites such as Burton Dassett and Godmanchester it is not always clear what the roofing materials of the other rural smithies were.

Indeed, the pitched tile hearth observed at Newington was also in use at Bordesley Abbey (Astill 1993, 279), whereas at Alsted, the hearth was of sandstone (Kettringham 1976, 25); stone appears to have been the preferred material for most other hearths. The hearths at Goltho and Towton were negative-features; at Towton, a bowl-hearth excavated into the natural (Fern 2006, 8; Fig 5). Nevertheless, the frequent presence of two contemporary hearths on smithy-sites has already been picked up by Grenville Astill (1993, 279).

Unlike the smithies at Goltho and Waltham, which both evidenced pad stones in the vicinity of the hearths interpreted as supports for a chimney hood, Newington did not appear to have been so equipped.

Newington was however equipped with an unambiguous anvil-setting which was corroborated by the distribution of hammerscale around it. Other anvil-settings, such as Burton Dassett and Viborg Søndersø have also revealed good positive evidence for the presence of an anvil-setting. Chris Fern (pers. comm.) has indicated the possibility that the 'postpad' at Towton may well be such a setting; on consideration, the building, measuring *c* 4m × 3m, in Area 4 at Seacourt (Biddle 1961/2, Fig. 6) with its central hearth in stone and adjacent difficultly explained posthole (*ibid*. 94) may indeed well represent a similar hearth and anvil-setting layout.

Workshops and work-space

The smithies at Newington can be located along the continuum of informal smithing carried out in *ad hoc* or only semi-permanent structures of the Anglo-Saxon period to the more formalised structures of the late medieval and early post-medieval. A transition, which, if the ceramic industry is any guide (Le Patourel 1968), be paralleled by a shift from a workforce which was denominated by their craft specialisation to one in which nomenclature is only a distant echo of one's forebears' occupation. Jane Geddes does, however, suggest that such a picture, for the ironworking industry is not necessarily so clear-cut (Geddes 1984, 17).

The change from informal smithing activities to a more professional occupation is expressed archaeologically by increasingly well-built and structured buildings for carrying out smithing in which anvil-setting, hearth and bosh are all located within reach of one another and located within a building built for the job in permanent materials. The medieval workshop is as poorly understood as the late medieval and post-medieval workshop (see Grenville 2004), as similarly, attention has tended to focus on produced goods and artefact composition over the layout of the building and the potential work-space. In the context of the medieval iron-industry, the metallurgical evidence has tended to be favoured over the archaeological investigation of space.

In her paper 'Workshops – a review and proposal for a research agenda' (Grenville 2004) which admittedly focuses on the late medieval and post-medieval periods, in the case of iron-working the emphasis is on the larger-scale industrial productions of sites such as Chingley (Crossley 1975) and other later equivalents to Bordesley Abbey. The role of the smaller-scale is not considered. Nevertheless in the context of manorial exploitation, these smaller-scale operations were potentially as important. The manor of Merstham, of which Alsted was a sub-manorial holding, was responsible for providing sufficient income for clothing for the monks at Canterbury (Malden 1911).

The smithy at Newington – like those at Viborg Søndersø (Jouttijärvi 2009), Midland Rd, Raunds (Audouy & Chapman 2009) and Burton Dassett (Mills & McDonnell 1992) – was sampled for hammerscale. The results for Midland Rd does not appeared to have been analysed spatially, and although those from Burton Dassett have yet to be fully analysed, Mills and McDonnell (1992, 8) proposed a similar process of spatial use to that which Jouttijärvi identified at Viborg Søndersø where the smith's operating area was defined by the relative absence of hammerscale.

Areas where there was an increasing density of hammerscale formed a 'fall-zone' where the struck droplets landed at a distance from the working area. At Viborg Søndersø, Jouttijärvi showed how movement in the work-space could be identified as the smith used different parts of the smithy for charcoal storage (2009, Fig 13), as well as for working the bellows and subsequent fine-work on objects (2009, Fig 14). These observations were deduced from the location, as well as the spatial arrangement of the droplets forming the hammerscale distribution.

As noted above, insufficient sampling was carried out at Newington for such a fine-grained and chronologically discrete analysis of the smithing activities at Newington. Nevertheless, a certain degree of analysis was possible for the use of space within the smithy. The location of the anvil was confirmed, as was the existence of a south wall, both through analysis of the density of hammerscale. The presence of the smith himself is attested to by the high density of hammerscale at the west door to the smithy: here, on exiting the relative darkness of the smithy it would appear that the smith wiped his front down of hammerscale.

Analysis carried out on the spatial arrangement of hearth, anvil and potentially bosh shows that the structural elements are within close proximity to one another, usually in the order of 1-2m, with stocking areas – whether for fuel or for materials – at a greater distance. In this context, identifying anvil-settings immediately adjacent to hearths, such as at Towton and Seacourt is unsurprising.

Economics of manors and manorial workshops

The role of the manorial lord in developing the industrial capability was key. This process can, for example, be seen to operate in the tile industry from the 13th century onwards, as David Hare (1991) has shown for both ecclesiastical manors such as Highclere and Odiham as much as for royal manors such as Clarendon (Hare 1991, 89-90). Jenny Stopford has also proposed such a role was undertaken by monasteries (Stopford 1993, 105). Documentary reference is made to the need for workshops and materials to carry out the work for which a tiler was contracted and for which the patron was responsible for supplying (Stopford 1992, 348-50). This is most likely to have been the same form of contract for blacksmiths.

This is most clearly illustrated in the case of monastic smithing, and particularly smelting, operations such as Waltham Abbey, Chingley and Bordeley Abbey. Nevertheless, smithies at Alsted, Wharram Percy, Burton Dassett, Goltho, Braggington, and Somerby, which also span the 13th to 15th centuries, were undoubtedly farmed as rentals by the land-owners. These smithies comprise a mix of secular and religious holdings and have also yielded a range of Astill's material and structural indices.

Unlike the larger monastic operations, which involved significant machinery – such as Bordesley or Chingley – the morphological traits of the smaller smithies are wider in variety. Not all the sites evidence either bosh or anvil setting; some seem to indicate that the smithy was within or part of the smith's house, while others evince a stand-alone structure. It is clear that there is not a strict morphology to the smithies excavated so far. The smithies revealed in excavation are very much structures adapted to need. There is no typical smithy for the medieval period all the while sharing a range of traits.

As noted above the smithy and mill at Newington formed important assets which would be farmed for rents by the priory; larger-scale forges were leased at very attractive rents: that at Blubberhouses was £25 for the year in 1258-9; Henkstank, which only ran for 20 weeks, was leased for £10; and a third, unnamed was let at £17.18s.0d (Bolton 1980, 168). These bloomeries were capable of generating up to 20 tonnes of iron a year.

A London master smith was earning approximately £18 per year and employing a journeyman at 40s. per year in 1434 (Geddes 1991, 184); although it is not clear whether the master's 16d. per day also included employees' costs. A century earlier the king's smith was paid 8d per day (Geddes 1991, 186). The rent from a smithy such as Newington or Alsted would undoubtedly have been much less; it is hard to estimate such costs, but as a comparison the brick-yard at Hull was leased from the

Crown for 13s. 4d. in 1303-4 (Brooks 1939, 156). At Cowick (Yorks) potters paid 20s. clay rent between 1375 and 1400 (Cherry 1991 204). The frequent lack of sufficient detailed records makes comparison difficult between different scales of industry.

Documentary sources indicate that contact between Canterbury and the manor was regular until the end of the 14th century. The foundation of Canterbury College in 1362, which proceeded to draw on rents from the manor, presumably enabled greater monitoring of the manor's accounts by monks at Oxford rather than there being a need to make annual visitation to the manor. Nevertheless, as with the pottery and tile industries (Cotter 1997; Stopford 1992, 1993) it would seem most likely that patronage on the part of the lord of the manor or tenant-in-chief is the most likely mechanism for the organisation of the smithy. Insufficient work on the progression from journeyman to master smith has been undertaken; moreover, as noted above, journeymen were frequently no more than employees, rather than masters in waiting.

With respect to mills, of which Newington manor was in possession, over the course of the late 12th to 13th centuries, those which were in secular hands, and indeed owned outright by millers, increasingly passed into the hands of the lord of the manor (Hinton 1990, 153); this assertion of control over industrial resources for textile production also occurred in the northwest (*ibid*.).

While the urban smith was a freeman and of some consequence, it seems more than likely that the economic situation and status of a rural blacksmith would have been quite different; the carrying out of his occupation would have been subject to the lord of the manor, or his representative. In return for rent, and perhaps even payment in kind, the smithy would be held on lease for a period of time by the smith, dependent on the overall financial well-being of the mass of the peasantry, to make a living in specialised labour, in much the same way that it has been suggested for carpenters during the 14th century and possibly earlier (Dyer 1986).

Jenny Stopford addressing the structure of the tile industry has suggested that one possible mode of production might involve monastic establishments, which – until the explosion of production at Penn, Bucks in the 14th century – dominated floor-tile production, employing teams of tillers to make, market and ship tile onto the market (Stopford 1993, 105). Such a mode indicates that in some cases monasteries were potentially deeply embedded in local economic networks; the example of the fulling mill, and by inference the smithy at the Cistercian abbey at Fountains, has been used by David Hinton (1990, 154) to argue for actively working against the development of a local market.

As Claire Ingrem (see above) has shown, horse bone is well-represented at Newington, which may well be due to the use of horse for transporting materials, such as pig-iron derived from the carbonate ores of Northampton or potentially elsewhere in Oxfordshire (Geddes 1991, 167). The excavations at Dean Court Farm also revealed significant quantities of horse bone, where it was also adduced that they come from pack-animals (Allen 1994, 441).

Mark Robinson commented on the presence of beech charcoal in the environmental assemblages. Indeed the transport of wood or charcoal from the manorial holding of woodland at Bix, in the Chilterns, would be sufficient to explain the presence of horse as pack-animals and, as a consequence, evidence of intra-manorial trade. Incidentally, Nettlebed, the source of South-East Oxfordshire ware, lies on the road between Bix and Wallingford, close to Newington.

The presence of the costrel as well as the relatively large assemblage of Potterspury ware, from Northamptonshire, could well evidence manorial trade, despite the limited state of our knowledge of potential routes. In contrast with Chalgrove, Tetsworth, Dean Court Farm and Seacourt, Brill/Boarstall ware is an important component of the pottery assemblage at Newington, to the extent that the tuyère found in the SOAG campaign was in a typically Brill/Boarstall fabric, as was the costrel.

The transport of goods could have involved some degree of inter-manorial trade. Pottery at Sandal Castle (Moorhouse 1983 61) has demonstrated the connections which the Warenne family maintained with their holdings in Sussex, Cambridgeshire and Buckinghamshire. As retainers and family-members moved round the various estates, so too were goods. The trade route which the Potterspury ware and Brill/Boarstall ware costrel intimates need not have been between various manors of a single estate. Christ Church, Canterbury had no significant holdings in Northamptonshire. Nevertheless, the potential trade in iron with Newington indicates the pre-eminent role of manors and the patronage of the lord of the manor in the local economy.

Manorial demise and abandonment of the smithy

The reasons for the abandonment of the smithy are not readily apparent. Court Rolls and Feet of Fines indicate that Holcombe manor was occupied through the 14th, 15th and 16th centuries. The same names – eg John (le) King, Hugh of Berwick – occur in both documentary sources at the same time, indicating continued occupation of the hamlet. Indeed the need to settle cases in court indicates that claims on land needed legal sanction in the years after the Black Death, whereas were the parish deserted such legal processes would be less necessary.

Why the smithy, and indeed the mill also, were abandoned remains, however, unclear. Whether the population collapse after the Black Death meant that such manorial industries – requiring semi-skilled tenants to run them at a profit – were unsustainable or whether the change relates to the management of the manor by Canterbury cannot be realised in the absence of further documentary research on Canterbury's estates.

The smithy's demise predates the Reformation sufficiently for there to have been no correlation between the seizing of church land and the economic collapse of the manor. It is interesting to note that Owen Oglethorpe, grandson of the former rector, bishop Owen Oglethorpe, and who was married to Jane, daughter of former rector Clement Parratt, held the manor in the 1590s. At this time, the rector of Newington, who was also the Warden of All Souls, Robert Hovenden had an estate map drawn up to ensure the legality of an exchange of land between Oglethorpe and himself. This is the origin of the Hovenden map in All Souls Warden's manuscripts.

The map shows a number of houses fronting onto the road between Stadhampton and Warborough, which is now part of the east end of Park Field, as well as a number of houses extending east along the north side of Great Bowling Field, which appear to have been recovered during field-walking by SOAG. Clearly, there has been much early post-medieval desertion of the hamlet, although how this corresponds to any potential late medieval desertion or shrinkage due to the Black Death is uncertain.

The band of Gault Clay, stretching the east side of the Thame Valley to the chalk of the Chilterns, is a part of Oxfordshire notable for the density of shrunken and deserted medieval villages (Mileson 2010, 57) which went hand-in-hand with disruption to the old open-field system through the consolidation of holdings and enclosure exacerbated by a change from cereal production to animal husbandry over the course of the latter years of the 1300s into the 15th century (*ibid*.).

The extent to which this process can be ascribed to the Christ Church holding of Newington is unclear. Ault (1972: 40) indicates that swine were kept at Newington, and that sheep were being grazed (*ibid*: 45) on open-fields, when manorial bye-laws state that sheep may not go into those pasture fields until they had already been grazed by cattle, and presumably horses, who needed longer grass, due to the physiognomy of their teeth.

Shrinkage and desertion can be seen at villages such as Seacourt (Biddle 1961/2), Thomley (Holden 1985), and Tetsworth (Robinson 1974), as well as on manorial holdings such as Barentine's Manor, Chalgrove (Page *et al*. 2005), Dean Court Farm (Allen 1994) and the presumably, relatively isolated farmstead at Sadler's Wood (Chambers 1974). As noted above desertion was a complex issue with rarely a single cause.

Nevertheless, it appears that from the 14th century onwards the core of the manor of Newington may well have shrank all the while the satellite or daughter settlements of Berrick Prior and Britwell Prior grew. It is not clear whether this is despite or due to the financial stress under which Christ Church, Canterbury found itself through over-extending itself in taking on both the construction of new church buildings and a number of secular developments (Hinton 1990, 191).

Nonetheless, the development of the satellite settlements seems to be evidenced particularly by documentary references to named individuals as being 'of Berwick' or 'of Britwell' (see Ault 1972; Canterbury Cathedral archives), in the current absence of archaeological evidence for growth in the settlements.

Concluding remarks

As noted at the beginning of the report in the Aims and Objectives section, it was perhaps overly ambitious to attempt to draw too much inference from the data concerning the origin of nucleated villages and their morphology. Too little of the site was excavated; although, the field-walking did enable sufficient confirmation of elements of the Hovenden plan of 1595, that one must accept the historical reality of other buildings represented on the map.

Moreover, it is also tempting to accept that the earthworks, since disappeared, observed by SOAG were actually part of an extended settlement area within Park Field overlooking the east/west drain, separating Newington House from Park Field.

It is unfortunate that the earthworks were insufficiently recorded, although it may well prove that further details remain to be found.

It would appear that the two hamlets, Great Holcombe and Newington, which faced one another either side of the tributary stream of the Thame, the former a sub-manor of Dorchester-on-Thames, the latter of Christ Church, Canterbury, formed a largish settlement drawn from two different manors. The 19th-century OS mapping shows Newington comprising the rectory and Newington House, while Great Holcombe was a large hamlet, with a daughter hamlet, Little Holcombe; it has now disappeared entirely.

More generalised processes of shrinkage as well as the different manorial origins contributed to the morphological development of both manors and associated hamlets. The different manorial control exercised over the two manors clearly lead to significant differences in their late medieval and post-medieval development.

The interventions at Newington have provided a valuable data-set which can be used for comparison with similar smithy sites. Although our understanding of the building located by SOAG is still less than well-understood, the post-excavation assessment identified an earlier smithy under the duck-island within the area of the lake.

The buildings did not make an enormous contribution in themselves to our understanding of class and status, so much as allow a deeper refining of the manorial complex over a chronologically greater period. Moreover, the excavation provides an important reminder of the limited means available for easily identifying medieval smithies.

The work carried out will continue to inform our understanding of medieval smithing and indeed the nature of medieval rural industry at the level of the manor and within its region. Furthermore it augments the data for the ecclesiastic and monastic model for demesnal exploitation, in which longer-term investment can be realised, as evidenced in some ceramic building material production sites at the same time.

The role of industry has been investigated at various sites where activities as diverse as milling, pottery production, sheep-raising, tile-production and mineral extraction, to name but a few have been carried out. The manor at Newington was clearly sufficiently successful in its first stages that the priory invested in the construction of the stone founded smithy in the 13th century; such rural industry is in need of more study.

Moreover, the presence of a mill at Newington in Domesday, which was potentially located immediately adjacent to the smithing site on the river Thame, indicates the role of rural industry in such ecclesiastical manors where the requirement for an instant profit was less important than perhaps than a long-term income. Certainly it is known that the manor was farmed for the provision of Canterbury students at Oxford.

Finally, the excavations provided a valuable opportunity to bring a legacy excavation and interventions to publication. The work carried out by SAOG during the early 1980s was an ambitious undertaking, and the results are a testament to both the volunteers who worked on the interventions and to the enthusiasm and commitment of

R.A. Chambers' who, it is clear from the archival material loaned by SAOG to JMHS, aided and supported SOAG in developing their recording and interpretation of the site.

The retrieval and assimilation of this archive with the recent excavation has proved to be beneficial to SOAG and to JMHS for a fuller understanding of the site. For the county, the work has been of benefit, as finally details on the Historic Environment Record have been resolved, and the exact nature of the entries can be clarified for future research and development control.

9 ACKNOWLEDGEMENTS

I should like to thank everyone – Andrew Dyne, Eoin Fitzsimons, Dave Gilbert, Daniel Heale, Magali Levray, John Moore, Helen Noakes, Mick Parsons, Daniel Saussins and John Winterbourne – who worked on the site under what were largely very difficult conditions. Torrential rain was an abiding memory of the excavation. I should also like to mention Geoff Ward, who as groundsman for John Nettleton, carried out the machining, expertly and with great diligence.

Thanks are also due to Hayley McParland, who provided a contribution on the phytholiths recovered from a sample; to Jenny Winnett who undertook the small finds reports; to Andrej Čelovský, Eoin Fitzsimons, Paul Hughes and Jenny Winnett for their various contributions to the illustrations. All site photographs were taken by the author.

I would like to extend my thanks to all the external specialists who provided reports – Paul Blinkhorn, Paul Booth, Brian Gilmour, Claire Ingrem and Mark Robinson – as well as others who were consulted during the preparation of this report. Special thanks are due to The Warden and Fellows of All Souls College, Oxford for permission to reproduce the Hovenden Map (All Souls College Warden's MS 3) of 1595. I would like to add my own thanks to Dr Norma Aubertin-Potter, Librarian in Charge for her patience and enthusiastic assistance in locating the original map from the Warden's Manuscripts.

Paul Smith, former County Archaeologist, and formerly of Oxfordshire County Archaeology Services monitored the work and provided invaluable support and succour for the bringing of the project to this stage; so too must thanks go to Chris Welch, Inspector of Ancient Monuments at English Heritage, and Paddy O'Hara, also at English Heritage who managed the project from the funding end. I would like to extend my thanks to John Moore who managed the project at JMHS.

Thanks are due to John Nettleton for commissioning John Moore Heritage Services to undertake the initial watching brief and for funding the publication of the final report.

Finally I would like to thank my wife and family for their support during the excavation and various phases of report preparation. All errors remain my own.

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8.2 Books

Abbreviations used
CUP: Cambridge University Press
OUP: Oxford University Press
SMA: South Midlands Archaeology

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Appendix 1. Newington House JMHS; pottery by context and by weight and by sherd count

Fabric	100		200		202		300		301		329		330		352		356		361		403		405		425		1001		1002		Context total		Date
Cntxt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	
100			1	25	9	181	13	124							14	365			1	120											38	815	U/S
101					4	52	35	401																							39	453	U/S
102							6	59							2	43															8	102	M 16th C
105			3	43	2	25	9	115							5	70											1	14			20	267	13th C
107			5	26	11	94	14	135							1	10															31	265	13th C
109			1	12	1	13	1	27																							3	52	L 11th C
110					10	120	5	49							1	2															16	171	13th C
113					1	2																									1	2	L 11th C
115					3	14	6	246							1	26															10	286	13th C
117					7	55	3	11																							10	66	L 11th C
119			1	1	2	26																									3	27	L 11th C
125			1	12			1	6																							2	18	13th C
126					1	47																									1	47	13th C
127					1	10	5	42							2	19															8	71	13th C
129					3	30	11	126																							14	156	L 11th C
131							3	9							1	14															4	23	13th C
135			1	21	3	32	14	147																							18	200	L 11th C
136			1	2	2	11	5	51																							8	64	L 11th C
137					10	65	45	514																			1	10			56	589	L 11th C
139							2	49							1	2															3	51	13th C
143					1	15	1	12							1	9	2	15													5	51	M 13th C
145					1	4									3	49															4	53	13th C
147							1	21																							1	21	L 11th C
149			1	7																											1	7	11th C
151	1	21	1	4	7	83	21	218																							30	326	13th C
155					1	10																									1	10	13th C
157															1	4															1	4	M 13th C
158			1	11	5	103																									6	114	L 11th C
Fabric	100		200		202		300		301		329		330		352		356		361		403		405		425		1001		1002		Context total		Date

Cntxt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	
161							3	11																							3	11	13th C
163					4	56	30	384																							34	440	13th C
165			4	43	2	21																									6	64	L 11th C
167			1	26	10	128	4	16																							15	170	L 11th C
173					1	15	3	15					1	3																	5	33	12th C
176			1	8																											1	8	11th C
185			1	27	1	12	5	29							7	140															14	208	13th C
188							2	8							1	5															3	13	13th C
190					2	12	8	41							5	27															15	80	15th C
191					3	55	4	28																							7	83	L 11th C
193															1	3															1	3	13th C
194					1	6	1	5							1	67															3	78	15th C
203							2	13																			9	153			11	166	L 11th C
205							1	6																							1	6	L 11th C
207					2	30	1	4																							3	34	L 11th C
209					1	33																									1	33	L 11th C
215					1	6	1	2																							2	8	L 11th C
217							1	14																							1	14	L 11th C
221							1	5																							1	5	13th C
223							2	25							1	4															3	29	13th C
225					2	61	5	65																							7	126	12th C
226			1	48	1	2																									2	50	12th C
227					1	33	2	16																							3	49	12th C
228					2	27	26	575																							28	602	M 16th C
229					1	19	2		17										2	16											22	35	L 11th C
233					7	63	10	110							2	18			2	24											21	215	13th C
234							2	13							2	44															4	57	13th C
245									1	53																					1	53	13th C
247			2	11																											2	11	11th C
249			1	21	8	69	3	32											1	5											13	127	L 11th C
Fabric	100		200		202		300		301		329		330		352		356		361		403		405		425		1001		1002		Context total		Date
Cntxt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	

252			1	5																											1	5	11th C
264					37	598	1	26							17	132															55	756	13th C
265							1	19																							1	19	L 11th C
266			2	18																											2	18	L 11th C
267					1	12	2	51																							3	63	13th C
269			1	21			33	234																							34	255	13th C
271			3	17	2	6	5	34																							10	57	13th C
272							1	66																							1	66	12th C
275			1	6			1	80																							2	86	L 11th C
277							1	28																							1	28	12th C
279					6	21																									6	21	12th C
280					5	38	5	44																							10	82	L 11th C
281					9	98	10	169																							19	267	13th C
282					4	32	4	22																							8	54	L 11th C
283							2	34																							2	34	13th C
284					3	11	2	14							1	1															6	26	13th C
285			1	14			27	713																							28	727	13th C
287					1	56																									1	56	L 11th C
289							1	2																							1	2	L 11th C
291																											1	25			1	25	RB
293			2	7			39	542																							41	549	13th C
295							4	64																							4	64	L 11th C
297					1	10	9	134																							10	144	L 11th C
301							2	11																							2	11	L 11th C
303							5	59							1	10															6	69	13th C
313							12	71																							12	71	L 11th C
316					1	5	2	22																							3	27	13th C
317					10	91	10	59							34	432			2	4											56	586	M 13th C
318			1	9			10	122							10	335															21	466	13th C
319			1	4			4	49							4	43															9	96	13th C
Fabric	100		200		202		300		301		329		330		352		356		361		403		405		425		1001		1002		Context total		Date
Cntxt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	
320			1	3	1	1	3	56							10	159															15	219	15th C

321					1	6	2	4																			1	40			4	50	15th C
322					9	40	4	16							9	49															22	105	13th C
323					1	6	2	9							6	352			2	16											11	383	15th C
324					3	59	4	48											2	27											9	134	15th C
325							1	9							1	10			1	9											3	28	13th C
326					6	136	7	47											1	11											14	194	12th C
331					1	11	2	61							9	69											1	10			13	151	13th C
332							5	12							6	27															11	39	13th C
335							2	3							5	43															7	46	15th C
336					14	109	5	43							11	163															30	315	15th C
337					14	158	4	36																							18	194	13th C
340					2	7	2	2							12	37							1	9							17	55	15th C
345					1	8	3	24							2	12			2	8											8	52	13th C
346			1	1	6	34	21	227																							28	262	L 11th C
347					4	39	2	25							14	153											1	20			21	237	15th C
348					2	42	60	787																							62	829	L 11th C
352			3	5	10	45	19	123																							32	173	L 11th C
353					7	59	20	198																							27	257	L 11th C
354					1	10	7	33																							8	43	L 11th C
355							2	12							1	15															3	27	13th C
356					1	10																									1	10	15th C
357					2	19	2	7																							4	26	13th C
358							1	1							3	48															4	49	13th C
359			1	4			4	61																							5	65	15th C
366					2	23	4	13																							6	36	12th C
367					2	14	5	30																							7	44	L 11th C
368			5	41	4	50	12	75							4	60	1	4	1	2							1	6	1	12	29	250	M 13th C
370			1	14	9	50	21	147																							31	211	12th C
373					11	218	5	112											2	41											18	371	L 11th C
Fabric	100		200		202		300		301		329		330		352		356		361		403		405		425		1001		1002		Context total		Date
Cntxt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	
374					1	11	1	14																							2	25	L 11th C
375							5	15					1	14	6	98	4	104			1	1									17	232	15th C

381															3	11															3	11	13th C
385							1	11																							1	11	L 11th C
386							1	5																							1	5	15th C
391					1	5	1	5																							2	10	12th C
393					2	5	5	32							5	35															12	72	13th C
397	1	5					1	4																							2	9	L 11th C
399							5	15							7	22															12	37	M 13th C
401					2	90																									2	90	L 11th C
403			2	33	1	2	10	61					1	12																	14	108	12th C
405			1	3			1	8																							2	11	L 11th C
413					1	1	8	37																							9	38	L 11th C
415					1	6	4	63							2	18															7	87	13th C
418			1	2	3	9	19	89											2	13											25	113	L 11th C
419							2	59																							2	59	15th C
422					3	15	2	19																							5	34	L 11th C
423							1	2							1	5															2	7	13th C
424					2	11	2	16							7	155	1	38							1	3					13	223	M 16th C
425							1	6											1	11											2	17	L 11th C
426															4	51															4	51	15th C
428															4	51															4	51	13th C
429					7	74	7	104							1	47															15	225	13th C
430					7	55	8	46							9	114															24	215	13th C
431															1	6															1	6	M 13th C
434					1	2									5	33															6	35	L 11th C
436							4	99																							4	99	L 11th C
443			2	9			11	198																							13	207	13th C
445					3	24	1	22	1	4																					5	50	13th C
448					21	233	1	8																			1	48			23	289	13th C
Fabric	100		200		202		300		301		329		330		352		356		361		403		405		425		1001		1002		Context total		Date
Cntxt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	
449					10	82																									10	82	L 11th C
450					2	6																									2	6	13th C
455					7	69	5	24					1	1																	13	94	13th C

456															4	628															4	628	13th C
457							16	140							15	120															31	260	M 13th C
458					1	11	12	114					1	7	13	82			1	10											28	224	13th C
461					4	18	4	21																							8	39	13th C
462					1	11	3	28							2	98															6	137	L 11th C
463					4	20	5	48											1	12											10	80	L 11th C
465							1	2																							1	2	M 13th C
467							1	5							2	7															3	12	L 11th C
470					3	13	5	27																							8	40	L 11th C
471					1	5	4	38																			1	6			6	49	M 13th C
474											1	4			1	13															2	17	M 13th C
475					3	21	10	98							1	49															14	168	13th C
478															2	19															2	19	L 11th C
479							11	349																							11	349	13th C
481					1	2																									1	2	M 13th C
486			5	9	2	6	19	55			3	7			6	20			4	10											39	107	13th C
488					4	147	25	171							5	36			1	9											35	363	13th C
491					2	12	2	9							2	33															6	54	15th C
493			2	22	3	37	4	126							20	1376	1	141													30	1702	13th C
497															1	5															1	5	13th C
499					4	38	3	23																			1	14			8	75	L 11th C
503					1	28																									1	28	13th C
504					6	68	2	7					1	34	20	188															29	297	15th C
506							1	10	29	230																					30	240	13th C
507							4	172																							4	172	13th C
508					1	17	1	11							1	5															3	33	13th C
511					11	253	40	213							1	2															52	468	13th C
Fabric	100		200		202		300		301		329		330		352		356		361		403		405		425		1001		1002		Context total		Date
Cntxt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	
515							2	16							1	8															3	24	M 13th C
521							4	19							6	149	1	7	2	20											13	195	M 13th C
522					5	42	5	63							3	43															13	148	13th C
524					2	79	10	95							11	132			1	25											24	331	L 11th C

525							2	32																							2	32	M 13th C
526							2	22							1	5															3	27	13th C
528							4	14							1	1															5	15	M 13th C
530							1	13							1	29															2	42	L 11th C
533					2	197																									2	197	L 11th C
538			4	17	20	230	245	6307																							269	6554	L 11th C
540					2	45																									2	45	13th C
542			2	13											219																221	13	13th C
545															1	3															1	3	13th C
546															2	108															2	108	13th C
548															1	86															1	86	L 11th C
555					1	31																									1	31	15th C
566															10	183															10	183	13th C
Total	**2**	**26**	**72**	**625**	**488**	**5803**	**1299**	**17879**	**48**	**287**	**4**	**11**	**6**	**71**	**621**	**7145**	**10**	**309**	**32**	**393**	**1**	**1**	**1**	**9**	**1**	**3**	**19**	**346**	**1**	**12**	**2605**	**32920**	

Appendix 2. Park Field SOAG Trench II; selected pottery by context and by weight and by sherd count

Fabric	200		202		300		326		330		352		356		361		425		1000		1001/1002		Context total		Date
Cntxt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	
1			9	33	22	84	1	2			56	225	10	33									98	377	M 13th C
2	1	22									7	77											8	99	13th C
3	2	6	4	26	17	63					14	58					1	12	1	1			37	153	19th C
4			4	17	4	10																	8	27	12th C
5					1	6																	1	6	L 11th C
6					3	10																	3	10	L 11th C
7			3	5	22	117																	25	122	12th C
13	1	15																					1	15	11th C
0091			2	7	2	6					4	18											8	31	12th C
0092											2	4	1	4									3	8	14th C
0093	1	10	1	3	1	3					14	120	2	6									19	142	M 13th C
0094			1	4	5	9					7	26	1	4	1	3							15	46	M 13th C
0095			1	6	7	22			1	2			3	16									12	46	M 13th C
0096					5	30			2	5			2	4									9	39	M 13th C
0097	3	23			23	125			1	6	10	68											37	222	M 13th C
0098	1	3	3	17	18	111					8	20	1	5									31	156	M 13th C
0191			1	1	2	6																	3	7	M 13th C
0192			2	3	5	10					15	171	7	16									29	200	M 13th C
0193	1	4			4	8			1	2	22	115	1	3									29	132	M 13th C
0194					8	39			1	7	10	22	4	17									23	85	M 13th C
0195			2	5	2	8					7	56	2	8									13	77	M 13th C
0196											6	26	3	18									9	44	M 13th C
0197			4	15	9	39					7	27	2	8							1	14	22	89	M 13th C
0198	1	10	1	4	16	46					10	27	2	5									30	92	M 13th C
0291					3	19					4	6	3	16									10	41	M 13th C
0292					3	35					18	52	1	3									22	90	M 13th C
0294			3	7	5	8					1	1			2	13					1	1	9	16	M 13th C
0295											2	24	2	12									4	36	M 13th C
Fabric	200		202		300		329		330		352		356		361		425		1000		1001/1002		Context total		Date

Cntxt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	No	Wt	
0296	1	6			1	1					4	10	1	4									7	21	M 13th C
0297			1	1	7	23					5	23											13	47	13th C
0298			1	5	6	17					7	12											14	34	13th C
0394											1	9											1	9	13th C
0395					1	3					2	28	1	2									4	33	14th C
0396											2	2											2	2	13th C
0397					2	9																	2	9	L 11th C
0494					1	3																	1	3	13th C
0495					1	7					3	84											4	91	13th C
0496			1	5	3	9					1	2											5	16	13th C
0497					1	8																	1	8	L 11th C
29					2	6																	2	6	L 11th C
Totals	12	99	44	164	212	900	1	2	6	22	249	1313	49	184	3	16	1	12	1	1	2	15	574	2687	

Appendix 3. Iron working residues

Context	Feature	Type	Phase	Size (cm) (max)	Optical microscopy	Wt (g)	Type of residue/ magnetic	Description / comments
?+	u/s	u/s	u/s	42		30	?crucible or slag/magnetic	Mixed, mainly dark grey, some porosity & stones, uneven base, hollow top
102		Layer	u/s	58		62	Dense smithing slag/non magnetic	Small, nearly complete PCB, dark grey + rusty patches
149	150	Gully fill	1	50		16	Dense, thin 'slab' slag/upper part highly magnetic	upper part dark grey, part vitrified plus a few white speckles, lower part lumpy and a bright rusty colour
205		?	1	95		637	Mostly dense smithing slag, & frag of thin 'slab' slag/upper part highly magnetic	3 PCBs + 2 irregular lumps (599 gm), dark grey-brown & rusty patches + mixed griity dirt with slag bits, some hammerscale etc (38 gm) plus # one piece of thin (0.5 cm) frag (3 cm long) of highly vitrified slaggy material with smooth fused upper surface, but lumpy and iron-rich underneath
269	263	Ditch fill	?1	77		111	Dense smithing slag/partly magnetic	Single, part formed PCB, mainly dark grey with rusty patches, and also has impression of hearth base on the underneath, this part being much more magnetic
293	263	Ditch fill	1	122		289	Med density smithing slag, lightly magnetic lower part	~Oval PCB, dark brown with rusty patches
443	444	?feature	?1	100		1190	Med density smithing slag, lightly magnetic in part	10 pieces: 4 part formed, unevenly shaped PCB's with a similar dark brown/rusty porous structure, and 5 smaller irregular lumps with similar structure, one thinner, denser part formed PCB with a shiny but lumpy & more magnetic upper surface, mainly v dark grey in section, rusty patches
479	480	?feature	?1	68		604	Variable density smithing slag/ partly but unevenly magnetic	10 main pieces + gritty bits, 2 part formed PCBs, the rest amorphous lumps. 2 of these are denser, mainly dark grey and more magnetic, one of these having a lumps of totally corroded iron (frags) adhering to it. 2 of remainder are flattish and dense

Context	Feature	Type	Phase	Size (cm) (max)	Optical microscopy	Wt (g)	Type of residue/ magnetic	Description / comments
538	435	?	?1	85		928	Mostly variable density, partly magnetic smithing slag	15 lumps or fragments: 1 concave dense PCB very dark brown to nearly black with some rusty patches mainly underneath, 1 PCB and 9 other irregular dark grey brown lumps or frags with small rusty patches, + 3 flatter smaller pieces almost black but with small gritty pieces of white calcined stone
538	435	?hearth related	1	65		150	Mixed, variable density, partly magnetic smithing slag	5 fragments of 4 different forms ?all of smithing slag: 2 ?lightweight pieces of fused hearth lining, 1 piece of thin flattish dark grey/black slag, 1 piece of grey/black dense material v similar to tapslag, 1 piece grey or grey/orange dense material, possibly vitrified hearth wall?
117	118	Pit fill	2	100		265	Dense, lightly magnetic smithing slag	One irregular lump, mainly dark grey-brown + small frag
125	130	Gully fill	2	54		97	Dense, lightly magnetic smithing slag	2 irregular lumps, both dark grey with small rusty patches
129	104	Ditch fill	2					?Slag
135	136	Square pit fill	2	25		3	Dense, thin 'slab' slag/highly magnetic	upper part dark grey, part vitrified plus a few white speckles, lower part lumpy and a bright rusty colour
167	168	Ditch fill	2	21		10	Dense, lightly magnetic	Small fragment, dark grey [?+ nails]
271	270	Ditch fill	3	36		15	Med density part magnetic smithing slag	Small dark grey brown lump with impression of base of hearth underneath, this par being more magnetic? accumulation of small iron pieces here.
324		?layer	?2	60		204	Med density smithing slag/ part magnetic lower side	3 irregular mainly dark grey-black lumps with some small rusty patches
326	327	Pit fill	3	130	HM694F	2840	"	100 very similar small to med size lumps and frags but including one or two pieces of flat thin 'slab' slag
326	327	Pit fill	3	82		895	Variable density smithing slag, partly magnetic	16 lumps of v similar smithing slag of variable shape and colour - mostly dark grey brown with rusty patches, 3 part formed PCBs, rest smaller irregular lumps
326	327	Pit fill	3	85	HM694E	6240	Variable density smithing slag/ magnetic lower side	~110 lumps, some partformed as PCBs but nearly all are irregular, mostly small to med sized pieces (not frags), magnet indicates metal present in some

Context	Feature	Type	Phase	Size (cm) (max)	Optical microscopy	Wt (g)	Type of residue/ magnetic	Description / comments
346		Layer	3	42		46	Variable density smithing slag, partly weakly magnetic	6 small lumps/pieces, mostly dark grey-brown
348	435	Pit fill	3	102		1180	Medium density smithing slag, partly but unevenly magnetic	3 irregular PCBs, one part formed PCB, and 11 smaller irregular lumps or fragments of same, variable dark grey, with some rusty brown patches + granular fragments & dirt - part hammer scale
366	?	?layer	?2	50		224	Medium density smithing slag, partly magnetic	Assorted pieces: one quarter of a well formed PCB with impression of hearth base, 5 smaller irregular pieces, one with hearth base impression - all dark grey brown with rusty patches - and 2 flattish pieces with very dark, part vitrified (shiny) surface
367	?	?layer	?2	72		176	Dense smithing slag/magnetic	Single piece, approx one quarter of a PCB, dark grey brown, with a very dense crust (approx 6mm thick)
370	?	?hearth related		95		615	Medium density smithing slag, partly but unevenly magnetic	A single (5.5 cm) thick, but irregular (415 gm) PCB with impressions of both side and base of hearth, plus 12 smaller very irregular lumps - mostly v dark grey or brown, but with rusty patches and white speckles or bits, and a single (10mm thick) flattish gritty piece of slag with hammerscale, plus a piece of iron (?nail shank)
370		?hearth related	3	58	HM694A	258	Medium density smithing slag, unevenly magnetic	22 pieces of thin 'flat'[tish], smooth and shiny on top, mostly,almost black, but rougher and partially reddish under
374	?	?hearth related	3	52	HM694B	42	Medium density smithing slag, partly lightly magnetic	2 irregular lumps, dark rusty brown
374	?	hearth related	3	37		8	Medium density, lightly magnetic smithing slag	Single fragment of 'thin' slag, dark grey, but paler surface
418	192	Gulley fill	3	46		135	part magnetic smithing slag, non magnetic fuel ash slag	7 med to small lumps, 3 of med grey brown friable low density fuel ash slag, 4 of med density, harder, dark grey brown smithing slag + grit with some hammerscale
418	192	Gulley fill	3	36		12	Medium density smithing slag, variably magnetic	2 fragments of 'flat', dark grey material with white speckles; ?hearth related

Context	Feature	Type	Phase	Size (cm) (max)	Optical microscopy	Wt (g)	Type of residue/ magnetic	Description / comments
470	?	?	3	65		112	Probable smithing slag, lightly magnetic	5 lumps (frags) of v dark brown to black, fairly dense slaggy material, but no rusty patches to speak of.
471	?	?	3	55		86	Dense magnetic smithing slag	a single irregular, nearly complete, dense dark grey lump (recovered in 2 pieces)
*115	116	Ditch fill	3	65		99	Dense lightly magnetic smithing slag	Irregular lump, dark grey + rusty patches
127	128	Post hole fill	3	82		70	Iron tip for wooden spade	Broken, more survives of one side/ metal core survives ok
*185		wall	3	94		255		Finds in smithy wall base: 3 irregular lumps, smaller with impression of hearth base, dark grey-brown
190		Yard metalling	5	29		14	Med density smithing slag,	Irregular dark variable dark grey-brown frag embedded in
264		Layer	3	36		25	Dense smithing slag, partly magnetic	Irregular dark grey lump with impression of base of hearth on underside, this lower part being much more magnetic
284		Layer	3	78		234	Dense smithing slag, partly magnetic	One complete, irregular med density dk grey lump with rusty patches; and one, incomplete lump, thicker (4 cm) and denser than usual for smithing slag, v dark grey, with a very dense, vitrified, partly magnetic upper crust
317		Wall matrix	4	55		21	Dense thin 'slab' slag/highly magnetic upper part	upper part very dark grey with some white speckles, lower part lumpy and a rusty colour
318		Layer	4	108		770	Med density smithing slag/ partly magnetic lower part	One complete, irregular, dk grey (PCB) lump with rusty patches, plus 15 smaller lumps of very similar material
318		Layer	4	61		53	Dense thin 'slab' slag/highly magnetic upper part	upper part very dark grey with some white speckles, lower part lumpy and a rusty colour
318		Layer	4	40		12	Medium density smithing slag/ slightly magnetic	Irregular lump, dark grey, similar appearance to thin 'slab' slag but lumpier upper surface, no rusty patches under, and less magnetic
319		Midden	4	66		258	Assorted waste pieces:	4 smallish lumps of medium density smithing slag (66 gm) dark grey/brown with rusty patches, one thin dark grey flattish, dense & magnetic piece with white speckles 30gm and one larger lump (162 gm) of med density, dark rusty material, magnetic in places - at break looks like a mostly corroded mass of smaller pieces of iron, now a lump

Context	Feature	Type	Phase	Size (cm) (max)	Optical microscopy	Wt (g)	Type of residue/ magnetic	Description / comments
320		?Layer	4	58		108	Med density smithing slag/ partly magnetic	A single irregular lump of dark grey brown smithing slag with the impression of the base of the heath underneath
323		?Layer	4	55		466	Variable density-dense or med dense smithing slag/ partly magnetic	10 irregular lumps of diff sizes, mainly dark grey with some rusty patches; & one, small elongated lump of metal (7gm)
325		?Layer	4	34		22	Med density smithing slag/ strongly magnetic	Single small irregular lump, ?part magnetite and corroded metal
331		Layer	4	27		8	Med density smithing slag/ partly magnetic	Single small irregular v dark grey lump + white speckles
331		Layer	4	47		39	Dense smithing slag/magnetic	Flattish piece (~1.4 cm thick) with very dark grey magnetic upper layer with white speckles (most of thickness) with uneven smoothish top piece, lower part with impression of hearth base
332		Cobble layer	4	38		65	Med density smithing slag/some nearly non-magnetic, one partly lower side lightly magnetic	3 smallish iregular lumps of typical dark rusty brown smithing slag single frag (2cm/4gm) of flat dark grey non-magnetic slag with white speckles, flat both sides (~7 cm thick) with rust staining under gravel surface south of smithy
333		Wall base	4	85		320	Variable density smithing slag/ partly magnetic	8 lumps, one an elongated PCB, rest are smaller irregular lumps, part formed on base of hearth, mostly dark grey brown
336	505	Ditch fill	4	73		193	Variable density-dense or med dense smithing slag/ partly magnetic	4 lumps, one a part formed irregular PCB, the rest smaller
355	?356	Fill of ?feature	4	66		99	Med density smithing slag/partly magnetic	2 irregular very inhomogeneous lumps made up of smaller dark grey-brown or rusty brown bits
458	?	?	4	120		1300	med to dense smithing slag, partly magnetic	2 large lumps, one of PCB form and one irregular, and a smaller irregular lump, plus 3 (of ?5) fragments of a small iron (now corroded away) 'pill box' with corroded (rusty) remains of contents

Context	Feature	Type	Phase	Size (cm) (max)	Optical microscopy	Wt (g)	Type of residue/ magnetic	Description / comments
481	482	?feature	?	100		641	Med to dense smithing slag/variably magnetic	10 lumps/frags of very variable size and shape; 2 main frags of concave PCB, very dark greyish brown & some rusty patches, 4 small fragments of similar material, 3 frags or small lumps of less dense, slightlt less dark material, and one (3 cm) fragment of flat smithing slag, nearly black upper half with shiny surface, but lower half reddish-brown
486	?	?	5	45		31	compact clayey material, non-magnetic: prob not slag	2 smallish lumps, medium grey colour- not fired (?),no bubbles unlike nearly all smithing slag,
499	?	?	4	113		827	Fairly dense smithing slag/mostly moderately magnetic	2 lumps - 1 complete PCB (773gm), variable material, dark grey on one side with raised edge (?against edge of hearth) to dark grey brown with more rusty patches on other side, and a single half lump of dark grey brown material, more rusty at surface
507	?	?	4	50		26	Med density smithing slag/partly magnetic	Single complete lump, black, with many small bubbles, amorphous with shiny surface, no rusty patches visible on outside
514	515	?	4	19		2	Low density smithing slag/slightly magnetic	Mainly dark rusty brown and more irregular, dark grey-brown with rusty patches
337		?Cobbled layer	5	36	HM694C	12	Smithing slag, medium density/slightly magnetic	Single irregular smallish, very dark, greyish/black lump
347								
347					HM694D		Hearth re-lining	
375	376	Fill of feature	6	40		33	Smithing slag/partly magnetic plus fuel ash slag/non-magnetic	3 small lumps, 2 are medium density, dark brown, partly magnetic smithing slag, the other is low density, non-magnetic fuel ash slag with a high proportion of stony material

Key to abreviations:
PCB = plano-convex smithing hearth base

Key to phases:
Phase 1 = 11^{th} century
Phase 2 = L11^{th} century
Phase 3 = E12^{th}–13^{th} century
Phase 4 =13^{th}–14^{th} century (?first half)
Phase 5 = M13^{th}–L14^{th} century (v late med)
Phase 6 = 15^{th} century and later (post-med)

Appendix 4. Estimated age according to epiphyseal fusion (NISP)

a) Phase 3

i) cattle

		Fused	Unfused
7-10 months	Scapula	1	
7-10 months	Pelvis	1	
15-20 months	Humerus,d	1	
24-30 months	Tibia,d	1	
24-30 months	Metacarpal	2	
24-30 months	Metatarsal		1
36 months	Calcaneus		1
36-42 months	Femur,p		1

ii) sheep/goat

		Fused	Unfused
5 months	Scapula	2	
15-20 months	Tibia,d	1	
7-10 months	Phalanx I	1	
42 months	Femur,d		1

iii) pig

		Fused	Unfused
12 months	Scapula	1	
24 months	Metapodial		1

b) Phase 4

i) cattle

		Fused	Unfused
7-10 months	Scapula	3	
"	Pelvis	3	
12-15 months	Radius,p	3	
15-18 months	Phalanx II	2	
15-20 months	Humerus,d	2	
20-24 months	Phalanx I	3	
24-30 months	Tibia,d	3	
"	Metacarpal	1	
"	Metatarsal	1	
36-42 months	Femur,p		1
42-48 months	Radius,d		1
42-48 months	Femur,d		2

ii) sheep/goat

		Fused	Unfused
3-4 months	Humerus, d	1	
3-4 months	Radius,p	1	
15-20 months	Tibia,d	6	3
36 months	Calcaneus		1
42 months	Tibia,p		1

iii) pig

		Fused	Unfused
12 months	Humerus,d		1
12 months	Radius,p	3	
24 months	Metapodial		1

c) Phase 6

i) cattle

		Fused	Unfused
20-24 months	Phalanx I	1	
24-30 months	Tibia,d	2	1
24-30 months	Metapodial	1	
36-42 months	Femur,p	1	1

ii) sheep/goat

		Fused	Unfused
15-20 months	Tibia,d	1	1
42 months	Femur,d		1

iii) pig

		Fused	Unfused
12 months	Humerus,d	2	
12 months	Phalanx I		1
42 months	Radius,d		1

Appendix 5. Metrical data

Phase	*Taxa*	*Element*	*Measurement*						
			GL1/GH	*GLm/GB*	*BFD*	*LmT*			
4 (E13th – E 14th)	Horse	Astragalus	50	49.1	43.2	51.5			
4 (E13th – E 14th)	Cattle	Astragalus	60.3	54.2					
4 (E13th – E 14th)	Cattle	Astragalus	61.7	54.5					
4 (E13th – E 14th)	Cattle	Astragalus		57.2					
4 (E13th – E 14th)	Sheep	Astragalus	28	27					
4 (E13th – E 14th)	Pig	Astragalus	42.8	41					
			SD	*DC*	*Bd*				
3	Horse	Femur		516					
4 (E13th – E 14th)	Horse	Femur			89				
5	Horse	Femur	39						
5	Cattle	Femur		39.9					
			GL	*Bp*	*Dp*	*SD*	*Bd*	*Dd*	
4 (E13th – E 14th)	Galliform	Femur	74.1	15	10.8	6.1	13.8	12.6	
			41	*42*	*43*				
3	Sheep	Horn core	8		23.6				
4 (E13th – E 14th)	Sheep	Horn core		34.1	20.2				
			Bd	*BT*	*HT*	*HTC*			
3	Horse	Humerus			30.8				
3	Cattle	Humerus	76.9	71.1	41.5	32.2			
4 (E13th – E 14th)	Cattle	Humerus	68.9		38.7	30.4			
4 (E13th – E 14th)	Cattle	Humerus	69.3	40.5	30				
3	Sheep/goat	Humerus	26.8	25.9	15.5	12.4			
5	Pig	Humerus	14.4						
			GL						
4 (E13th – E 14th)	Pig	Lower molar	32.9						
			GL	*Bp*	*Dp*	*SD*	*Bd*	*B@f*	
3	Cattle	Metacarpal	196		57.3	34.3	29.7	60.8	52.2
4 (E13th – E 14th)	Cattle	Metacarpal	173.5	44.3	27.7	2347.5	42.5		
4 (E13th – E 14th)	Cattle	Metacarpal			66.7	41.3			
5	Cattle	Metacarpal			60.9	38.3			
5	Cattle	Metatarsal			42.2	42.8			
5	Cattle	Metatarsal			43.1	44.6	25.1		
5	Cattle	Metatarsal			49	48.6	27.3		
4 (E13th – E 14th)	Sheep/goat	Metatarsal			18.5	18.9			
			LA						
5	Horse	Pelvis	57.6						
4 (E13th – E 14th)	Cattle	Pelvis	62.5						
			GL	*Bp*	*BFp*	*SD*	*Bd*	*BFd*	
3	Horse	Radius		80.6	74				
3	Horse	Radius					74.2	62	
4 (E13th – E 14th)	Horse	Radius		73.6	67.9	32.7			
5	Horse	Radius	e325	76.9	71.3	35.2			
4 (E13th – E 14th)	Cattle	Radius		76.3	71.2				
4 (E13th – E 14th)	Cattle	Radius		82.5	75.1	42.5			

Date	*Taxa*	*Element*	*Measurement*						
			GL1/GH	*GLm/GB*	*BFD*	*LmT*			
4 (E13th – E 14th)	Sheep	Radius		30.4	26.2				
4 (E13th – E 14th)	Pig	Radius		22.7		16.6			
4 (E13th – E 14th)	Pig	Radius		25.6					
4 (E13th – E 14th)	Pig	Radius		30.2					
			GLP	*BG*	*LG*	*SLC*			
3	Horse	Scapula	86.3	46.2	52.5	68			
3	Cattle	Scapula	52.9	37.5	46.3				
4 (E13th – E 14th)	Cattle	Scapula	61.4	43.2	52.8				
4 (E13th – E 14th)	Cattle	Scapula	66.7		55.4	49			
3	Sheep/goat	Scapula		16.6					
3	Pig	Scapula	34.6	23.5	30.8	22.2			
			SD	*Bd*	*Dd*				
3	Cattle	Tibia		39.4					
4 (E13th – E 14th)	Cattle	Tibia		56.2	42.3				
5	Cattle	Tibia		62.8					
4 (E13th – E 14th)	Sheep	Tibia		22.9	17.9				
4 (E13th – E 14th)	Sheep	Tibia		23					
4 (E13th – E 14th)	Sheep	Tibia		23.4	16.7				
4 (E13th – E 14th)	Sheep	Tibia	12	25.4	18.8				
5	Sheep	Tibia		23	17.9				

Abbreviation	**Measurement**
B@f	Breadth at the point of fusion
Bd	(Greatest) breadth of the distal end
BFd	(Greatest) breadth of the facies articularis distalis
BFp	(Greatest) breadth of the facies articularis proximalis
BG	Breadth of the glenoid cavity
Bp	(Greatest) breadth of proximal end
BT	(Greatest) breadth of the trochlea
DC	Depth of the Caput femoris
Dd	(Greatest) depth of the distal end
Dp	(Greatest) depth of proximal end
GB	Greatest breadth
GH	Greatest height
GL	Greatest length
GL1	Greatest length of the lateral half
GLm	Greatest length of the medial half
GLP	Greatest length of the processus articularis (glenoid process)
HT	Height of the trochlea
HTC	Height of trochlea centre
LA	Length of the acetabulum
LG	Length of the glenoid cavity
LmT	Length of the medial part of the Trochlea tali
SD	Smallest breadth of diaphysis
SLC	Smallest length of the collum scapulae (neck)