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CHESTER, CHESHIRE
ASSESSMENT OF EVIDENCE FOR METAL WORKING FROM CHESTER AMPHITHEATRE

TECHNOLOGY REPORT

Carlotta Gardner

ARCHAEOLOGICAL SCIENCE

ENGLISH HERITAGE

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Assessment of Evidence for Metal Working from Chester Amphitheatre

Carlotta Gardner

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SUMMARY

A total of 108kg of material that was thought to provide evidence for metal working from Chester amphitheatre was submitted for assessment. Iron smithing is the main process evident from the diagnostic material and it is likely that the majority of the undiagnostic material is associated with this process. It is suggested that a large proportion of the material is residual as very little comes from primary contexts; however there are two Roman phases which may show small scale iron smithing industries. Both of these phases are construction periods for the amphitheatre and so it is possible that a small amount of iron smithing was carried out during these periods of construction. The evidence for non-ferrous metalworking is crucibles and litharge fragments.

ARCHIVE LOCATION

Grosvenor Museum, Chester

DATE OF Research

November 2008 - March 2009

CONTACT DETAILS

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INTRODUCTION

The site of the Roman amphitheatre at Chester (SJ 4082 6616) was excavated in 2004 by English Heritage and Chester City Council to increase knowledge about the site and to allow for re-interpretation of the results from the excavations by F.H. Thompson in the 1960s (Garner & Wilmott 2008). Three areas of the amphitheatre were excavated in 2004: areas A, B and C (Figure 1), each of these areas was phased independently, there are however some phases which can be seen in more than one area. The excavations of these areas revealed evidence of human activity spanning from the middle Iron Age (pre-amphitheatre) to the 20th century (service trenches and excavations). The following assessment of the evidence for metal working identified the type(s) of metal working that took place.

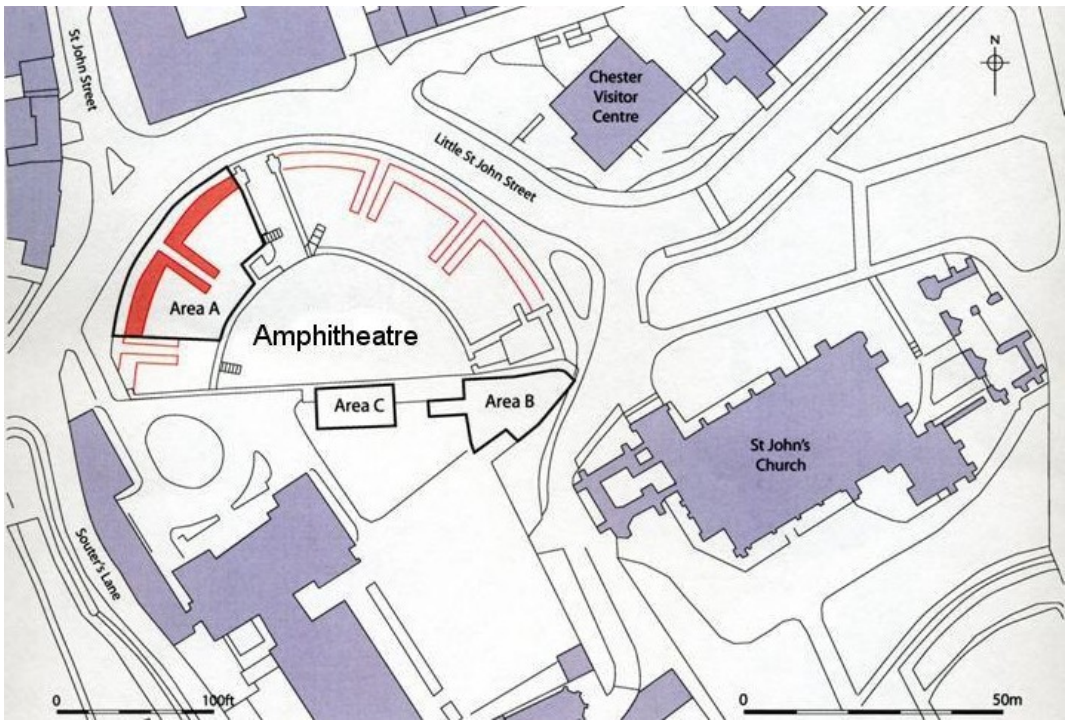

Figure 1: A plan of the current layout of Chester in the area of the amphitheatre. The locations of areas A, B and C are also shown (Eddie Lyons).

Roman amphitheatres were often built on the edges of towns, due to their size, and they were the principal place of entertainment. The entertainment on offer at the amphitheatres in Britain is thought to consist of bear baiting and criminals being condemned to death, there is evidence (a graffito on a sherd of pottery) at Leicester suggesting gladiators also formed part of the entertainment (Wacher 1974, 54). Amphitheatres were built in a variety of ways ranging from simple earth banks to stone-built structures (Wacher 1974, 51). Chester was originally built with earth banks and timber this was later replaced with stone. It is unlikely that any metal working took place within the amphitheatres and that the material found is in-situ, this is because of the nature and the later re-use and excavation of the site. It is possible however, that there

were small industries in the vicinity of the amphitheatre supporting the construction and other functions of the surrounding town.

METHOD

A total of 108kg of material that was thought to provide evidence for metal working from Chester amphitheatre was submitted for assessment. After visual examination, and when necessary qualitative X-ray fluorescence (XRF) analysis for quick identification, it was possible to divide the material into three categories: diagnostic metal working debris (Appendix Tables 1, 2 and 3), undiagnostic metal working material (Appendix Tables 4, 5 and 6) and other material (Appendix Tables 7, 8 and 9). Table 10 lists the different materials found, which category they fall into and the code that is used in other tables throughout the text. The categories of diagnostic and undiagnostic metal working debris and processes that they represent are explained below and most are described in more detail by Bayley *et al* (2001). Once the debris had been identified, it was grouped by phase so the metal working processes identified could be dated. The material listed under Other (Table 10) is not included in the discussion of the phases. Table 11 summarises, by weight, the amount of diagnostic metal working debris, undiagnostic metal working debris and other material that was found in each area.

Table 10: Categories of material and their codes.

Diagnostic debris		Undiagnostic debris		Other	
Material	Code	Material	Code	Material	Code
Smithing hearth bottom	SHB	Burnt brick	BB	Calcite	Cal
Smithing slag	SS	Coal	Co	Ceramic	Ce
Spherical hammer scale	SHS	Coal ash	CoA	Chalk	Ch
Flake hammer scale	HS	Fuel ash slag	FAS	Fired clay	FC
Iron slag	Fe slag	Hearth/furnace lining	H/FL	Jet	J
Iron ore	Fe ore	Iron metal	Fe	Lime	L
Litharge	Li	Undiagnostic slag	US	Limestone	LS
Copper slag	Cu slag			Mineral	Min
Crucible	C			Natural	Nat
				Ochre	O
				Pumice	P
				Quartz	Q
				Shale	Sh
				Stone	St

Table 11: A summary of the amount (in kg) of material found from each area

Area	Diagnostic debris	Undiagnostic debris	Other material	Total
A	11.58	24.94	2.75	39.27
B	19.13	25.77	14.90	59.80
C	0.25	8.04	0.45	8.74
Total	30.96	58.75	18.10	107.81

MATERIALS AND PROCESSES

The iron smithing process is most commonly identified by **smithing hearth bottoms**. These hearth bottoms are easily recognised by their characteristic plano-convex form; normally they have a rough convex base and a slightly concaved or flat upper surface that is normally vitrified as a result of being close to the tuyère, the hottest part of the hearth. These hearth bottoms occasionally have hearth lining attached to them. Another diagnostic material associated with smithing is **hammer scale**, millimetre-sized iron oxide flakes or spheres produced when iron is smithed or welded. It is less often recovered from archaeological sites due to its very small sizes and when it is found in large quantities it is likely that it is in-situ. **Smithing slag** is identified by inclusions of coal as this fuel was not used in the smelting process (Tylecote 1986, 225) and is therefore diagnostic of the smithing process. Other iron working slags, described here as '**iron slag**' and '**undiagnostic slag**', were also found. They have been classified as undiagnostic debris as they cannot be positively identified as the product of a particular iron working process. However, as no smelting slag was identified, it is likely that they are further evidence for iron smithing.

Litharge is a waste product produced by either the extraction or large-scale refining of silver. If the litharge contains only lead then it represents the primary extraction of silver, but if it also contains copper then it represents the refining of debased silver.

Crucibles are clay vessels used to melt non-ferrous metals prior to casting. The outer surface, sometimes covered with an extra layer of clay, is normally vitrified and the inner surface reduce fired (black or dark-grey in colour). Occasionally metallic droplets are trapped in the inner surface, these can be analysed to determine the alloy being melted; metal can also be trapped in slag layers in or outside the crucible. Crucibles can often be dated by their typology which is based on their fabric and their form.

Slag that is rich in certain metals can be diagnostic of the type of metal being worked. Iron-rich slag (**iron slag**) often has iron metal trapped this makes the slag appear magnetic it also has a rusty orange colour due to the oxidation of the iron. Copper-rich slag (**copper slag**) is identified by its dark brown, grey or black colour with small areas of copper corrosion (green-blue in colour); if the copper has dissolved in the slag then normally it is a bright red colour. Copper working can also be evident from areas of copper corrosion on vitrified clay/hearth lining. These slags are not diagnostic of a process but only of the metal being worked, although it is likely that the iron-rich slag is associated with smithing (which appears to be the most common process represented by the Chester material). **Ores** can also be diagnostic of the metal being worked on site but do not provide definite evidence that smelting was taking place.

Vitrified hearth lining is produced by a high temperature reaction between the clay lining of a hearth or furnace and the ash from the fuel. Often there is a gradient of vitrification with the inner surface being highly vitrified and the outer parts un-modified. This material

is diagnostic of a high temperature process but no more information can be drawn from it.

There a number of different materials produced by high temperatures that are not diagnostic of a particular process, for example; fuel ash slag and burnt bricks. The majority of the undiagnostic high temperature material could have been produced as a result of numerous processes including metal and glass working; it could also be a result of a structure burning. Other materials that have not been exposed to high temperatures, such as coal, may also be associated with the metal working, however, they are not diagnostic of a particular process.

METAL WORKING IN AREA A

Evidence for metal working in area A forms almost half (42%) of the total material assessed. The majority of metal working debris found in area A is not from primary contexts but from pits and the backfill from robbing and archaeological investigation. The material is therefore likely to be either residual or debris that has been moved from its primary context and dumped in area A. Table 12 lists the phases that the material is from. Only five of these phases (4, 7, 11b, 12, and 15) have more than 1kg of diagnostic material and are therefore discussed in more detail.

Table 12: The phases identified in area A and their descriptions

Phase	Description
1	Pre-Roman: Middle Iron Age
2	Pre-Roman: Late Iron Age
3	Roman pre-Amphitheatre
4	Amphitheatre 1a construction
6	Amphitheatre 1b construction (grillage/stair)
7	Amphitheatre 1b use (especially exterior sand/shrine)
8	Amphitheatre 2 construction
9	Amphitheatre 2 use (exterior/ arena block)
10	Early medieval (entrance blocking/ arena occupation)
11a	Robbing of internal structures
11b	Robbing of outer wall from exterior
12	Medieval pits
13	Post-medieval pits
14	19th/20th century structures
15	Archaeological interventions

Phase 4

Phase 4 represents the construction of the period 1a amphitheatre. 1.33kg of diagnostic material (Appendix Table 1) was found from this phase and 2.49kg of undiagnostic material (Appendix Table 4) from high temperature processes. The majority of the diagnostic material, 87%, found has been identified as iron smithing slag and it is likely that most of the undiagnostic slag also derived from iron smithing. Two crucible fragments were also found in this phase.

Phase 7

Phase 7 represents the use of the period 1b amphitheatre. In this phase the majority, 82%, of the diagnostic material (Appendix Table 1) has been identified as litharge. Three crucible fragments have also been identified (0.009kg). A further 6.99kg of undiagnostic material (Appendix Table 4) has been identified in this phase, almost all of this is undiagnostic iron working slag.

Phase 11b

Phase 11b represents the robbing of the exterior wall prior to the medieval period. 2.20kg (Appendix Table 1) of diagnostic metal working debris was excavated from this phase. The majority of the material (89%) is iron smithing debris; the rest of the diagnostic material is made up of iron slag, likely to be from the smithing process, and a single crucible fragment (Appendix Table 3). As well as the diagnostic debris 0.75kg of undiagnostic material (Appendix Table 4) has been identified from 11b.

Phase 12

Phase 12 represents the medieval pits, as spot-dated in 2004. In area A this phase is the most abundant in diagnostic metal working debris (Appendix Table 1). 70% of this is smithing debris. Crucible fragments and 3.96kg of undiagnostic material has also been identified.

Phase 15

Phase 15 represents previous archaeological interventions.1.95kg of diagnostic metal working debris was found, and like phases 11b and 12 the majority (97%) of the material is smithing debris. A further 0.98kg of undiagnostic material and one fragment of crucible were also found in this phase.

METAL WORKING IN AREA B

A total of 59kg of material was examined from area B of the Chester Amphitheatre excavations. The material from area B comes from 12 different phases (Table 13) and there is some un-stratified material. The majority of the phases are post-medieval and are either cultivation deposits or construction phases and therefore it unlikely that the material is in-situ. There are six phases (6, 10, 11, 14, 15, and 18) that have more than 1kg of diagnostic material, discussed in detail below.

Table 13: The phases identified in area B and their descriptions

Phase	Description
6	Construction of period 1b amphitheatre (grillage/ stair)
10	Early medieval (entrance blocking/ arena occupation)
11	Robbing
13	14th/15th century cultivation soils & stone founded buildings.
14	16th century formal garden and demolition layers.
15	17th century deposits and Civil War debris.
16	Late 17th/early 18th century cultivation soils and cultivation lazy/beds (for liquorice/asparagus?) & pits.
17	Mid/late 18th century construction and use of the cellared building with associated pits and cultivation soils.
18	Demolition and robbing of cellared building
19	19th century alterations to the boundary wall with St. Johns and associated garden features.
20	19th/20th service trenches.
21	Archaeological interventions

Phase 6

Phase 6 is the construction of the period 1b amphitheatre. 6.24kg of diagnostic material (Appendix Table 2) was found and 5.68kg of un-diagnostic debris (Appendix Table 5). This phase has a much higher amount of debris found than from any other phase in this area. 5.7kg (91%) of the diagnostic material is evidence of iron smithing. The majority, 65%, of the undiagnostic material has been identified as undiagnostic iron working slag, and 24% has been identified as hearth/furnace lining; this material is likely to be associated with smithing, evident from the diagnostic material. A total of ten crucible fragments have been identified from this phase.

Phase 10

Phase 10 represents the early medieval occupation of the arena and the blocking of the entrance. 1.36kg of diagnostic material (Appendix Table 2) was found and a further 2.38kg of undiagnostic material (Appendix Table 5). A large proportion, 87%, of the diagnostic material was identified as iron smithing debris.

Phase 11

Phase 11 represents a period of robbing. In this phase 1.13kg of diagnostic material (Appendix Table 2) was found, all of which was identified as iron smithing debris. 2.92kg of undiagnostic material (Appendix Table 5) was also identified, the majority was undiagnostic iron working slag.

Phase 14

Phase 14 represents the 16th century formal gardens and demolition layers. In total 3.45kg of diagnostic material (Appendix Table 2) was identified, all of which is iron smithing debris, and 6.13kg of undiagnostic material, mainly undiagnostic iron working slag (Appendix Table 5).

Phase 15

Phase 15 represents the 17th century deposits and Civil War debris from this area. A total of 1.49kg of diagnostic material (Appendix Table 2) has been identified and 1.81kg of undiagnostic material (Appendix Table 5). Like in the previous phases discussed; iron smithing debris forms the majority of the diagnostic material from this phase. One crucible fragment has also been identified.

Phase 18

Phase 18 represents the demolition and robbing of the cellared building which was constructed and used in the 18th century (phase 17). 2.09kg of diagnostic material (Appendix Table 2) was identified from this phase and a further 1.18kg of undiagnostic material was also identified. Iron smithing slag forms the majority (95%) of the diagnostic material.

METAL WORKING IN AREA C

The evidence for metal working in area C is very limited (a total of 8.74kg of material was examined). The material analysed from area C comes from 7 different phases and there is no significant quantity of diagnostic material in any of these. Table 14 shows the different phases and their descriptions. The majority of the phases are cultivation soils and so you would not expect to find metal working debris unless it was residual. There are only two phases, 10 and 14, that have any considerable amount of material.

Table 14: The phases identified in area C and their descriptions.

Phase	Description
10	Early med (entrance blocking/ arena occupation)
12	12th/13th century cultivation soils & pits?
13	14th/15th century cultivation soils
14	16th century feasting pit and demolition layers
15	17th century deposits and Civil War debris.
16	Late 17th/early 18th century cultivation soils lazy/beds (for liquorice/asparagus?) & pits
20	19th/20th century cultivation soils and demolition deposit & service trenches

Phase 10

Phase 10 represents the early medieval occupation of the site and the blocking of the entrance; this phase is also evident in area B. There is a very small amount of metal working debris from this phase with a total of 0.12kg of diagnostic material (hammer scale) and 1.89kg of undiagnostic slag.

Phase 14

Phase 14 represents a 16th century feasting pit and demolition layers. This phase is also present in area B, both areas in this phase show little evidence for metal working. A total of 0.13kg of diagnostic material (Appendix Table 3) was identified, iron slag forms the majority of the diagnostic material and a single crucible fragment has also been identified. A further 3.04kg of undiagnostic material (Appendix Table 6) has been identified, the majority of this being undiagnostic iron working slag.

CONCLUSION

There is little evidence for metal working taking place at the amphitheatre as the majority of the material does not come from primary contexts, as discussed in the introduction. The majority of the debris appears to be either residual or material that has been dumped in pits or trenches (created by robbing or archaeological investigations) from other areas of the fort and town. The majority of the diagnostic material that was found in the 2004 excavations from area A and B is evidence of iron smithing (mid blue in Figures 2 and 3). It is more than likely that most of the undiagnostic material identified from areas A, B and C (maroon in Figures 2-4) is also associated with the smithing process. There are two phases that may show very small scale iron smithing industries, phase 4 (area A) and phase 6 (area B). Both of these phases are construction periods for the amphitheatre (1a and 1b) and so it is possible that a small amount of iron smithing was carried out during these periods of construction.

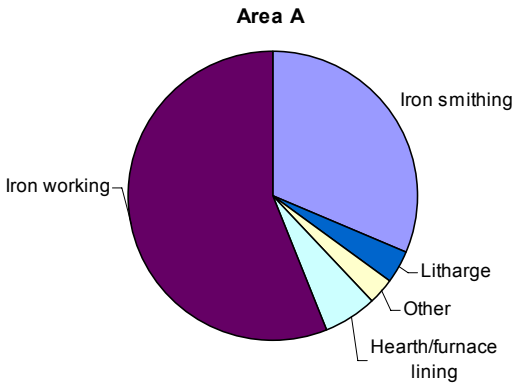

Figure 2: A pie chart illustrating that, by weight, iron smithing is the most common process identified in area A.

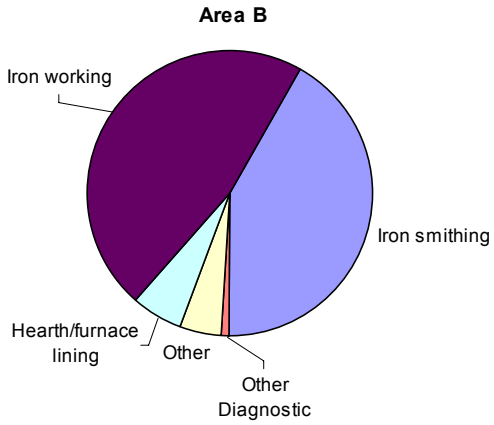

Figure 3: A pie chart illustrating that, by weight, iron smithing is the most common process identified in area B.

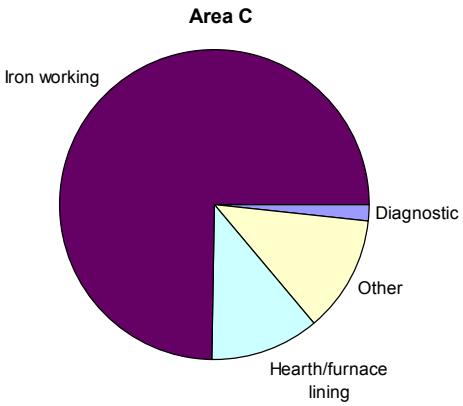

Figure 4: A pie chart illustrating that, by weight, there is very little diagnostic material in area C but that the majority of the identified material is evidence of iron working.

POTENTIAL FOR FURTHER WORK

More detailed information on contexts and phases, for example the volume of the medieval pits (phase 12 area A) would provide valuable information that could be used for more accurate interpretations. An area that may warrant further work is the examination of the crucible fragments using XRF and scanning electron microscopy with energy dispersive spectrometry (SEM-EDS) analysis. XRF may provide a rough idea of the composition of the alloys being melted in the crucibles. However, the exact composition can not be determined (Dungworth 2000) unless there are metallic droplets trapped within the crucible fabric. The collection of crucible fragments (Table 15) is not large and may not derive from industrial activity within the amphitheatre. Nevertheless, some of this material is stratified in primary construction deposits (c. AD60-80). Detailed examination of this material (SEM-EDS) will contribute to an improved understanding of Roman copper-based metallurgy in first-century Britain. None of the crucible fragments in post-Roman contexts are definitely from post-Roman types so they are probably all re-deposited Roman material.

Table 15: The number of identified crucible fragments found in each period and area of Chester amphitheatre excavations in 2004.

Period	A	B	C
Roman	5	10	-
Early medieval	-	-	-
Medieval	5	-	-
Post-medieval	1	2	1
Unphased	2	-	-
Total	13	12	1

Another area that will provide further information about the types of processes taking place on or in the vicinity of the site is the analysis of the litharge. Using XRF it would be possible to determine whether the litharge is a result of silver extraction or the refining of silver.

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Appendix:

Table 1: Diagnostic material from area A (kg).

	Phase										
Material	4	6	7	11a	11b	12	14	15	Un-stratified	Unphased	Total
SS	0.07		0.13		0.98	1.47	0.03	0.87			3.55
SHB					0.97	0.80		1.03			2.80
HS	0.09		0.09		0.02	0.16	0.09				0.45
SHS			0.01								0.01
Fe slag	1.16	0.12	0.11	0.10	0.22	0.90	0.30	0.03		0.04	2.98
Cu slag						0.02					0.02
Li			1.59								1.59
C	0.01		0.01		0.01	0.11		0.02	0.01	0.01	0.18
Total	1.33	0.12	1.94	0.10	2.20	3.46	0.42	1.95	0.01	0.05	11.58

Table 2: Diagnostic material from area B (kg)

	Phase										
Material	6	10	11	14	15	16	17	18	19	20	Total
SS	2.80	0.70	0.46	3.44	1.08	0.71		2.07	0.05	0.73	12.04
SHB	2.87	0.49	0.67		0.27		0.48				4.78
HS	0.03			0.01	0.05	0.13	0.39	0.02	0.84		1.47
Fe slag	0.25	0.17			0.07				0.03		0.52
Cu slag					0.02				0.00		0.02
Li	0.16										0.16
C	0.12				0.01		0.01				0.14
Total	6.24	1.36	1.13	3.45	1.50	0.84	0.88	2.09	0.92	0.73	19.14

Table 3: Diagnostic material from area C (kg)

Material	Phase		Total
	10	14	
HS	0.12	0.00	0.12
Fe slag		0.12	0.12
C		0.01	0.01
Total	0.12	0.13	0.25

Table 4: Undiagnostic material from area A (kg).

Material	Phase																Total
	1~3	4	6	7	8	9	10	11a	11b	12	13	14	15	Void	Un-stratified	Unphased	
CoA									0.04	0.76		0.02	0.23				1.05
Co										0.02							0.02
FAS		0.05		0.03		0.01			0.02	0.08		0.07				0.01	0.27
H/FL		0.08	0.19	0.05					0.49	0.40		0.01	0.04			1.18	2.44
US	2.98	2.36	0.11	6.91	0.01	0.07	0.01	0.13	0.20	2.70	0.02	0.63	0.71	0.02	0.23	4.07	21.16
Total	2.98	2.49	0.30	6.99	0.01	0.08	0.01	0.13	0.75	3.96	0.02	0.73	0.98	0.02	0.23	5.26	24.94

Table 5: Undiagnostic material from area B (kg)

	Phase													
Material	6	10	11	13	14	15	16	17	18	19	20	21	U/S	Total
BB									0.33					0.33
CoA				0.07	0.09	0.17	0.26	0.03	0.29	0.32	0.46			1.69
Co					0.02									0.02
FAS	0.60						0.19			0.23				1.02
Fe										0.04				0.04
Fe ore	0.01										0.01			0.02
H/FL	1.37	0.24	0.64			0.06	0.02			0.03	0.19			2.55
US	3.71	2.14	2.28	0.20	6.02	1.58	1.37	0.07	0.45	1.47	0.40	0.29	0.03	20.12
Total	5.68	2.38	2.92	0.27	6.13	1.81	1.84	0.10	1.18	2.09	1.05	0.29	0.03	25.77

Table 6: Undiagnostic material from area C (kg)

	Phase							
Material	10	12	13	14	15	16	20	Total
CoA				0.77	0.02	0.07		0.86
Co				0.01		0.03		0.04
FAS				0.12				0.12
Fe	0.01							0.01
H/FL	0.44		0.46	0.01		0.02		0.93
US	1.90	0.47	0.81	2.12	0.12	0.62	0.04	6.07
Total	2.35	0.47	1.27	3.03	0.14	0.74	0.04	8.04

Table 7: Other material from area A (kg).

	Phase											
Material	4	6	7	9	11a	11b	12	14	15	Void	Un-stratified	Unphased	Total
Cal							0.01						0.01
Ch								0.01	0.20				0.21
FC			0.01										0.01
Fe			0.04				0.01						0.05
L	0.01		0.02				0.01					0.59	0.63
LS	0.08	0.01	0.14		0.03		0.07	0.58	0.04		0.01		0.96
Min			0.01										0.01
Nat										0.30			0.30
O			0.01	0.07	0.04				0.03			0.04	0.19
P												0.03	0.03
Q			0.02									0.01	0.03
Sh						0.05							0.05
St	0.07		0.01		0.00	0.01	0.15	0.03					0.27
Total	0.16	0.01	0.26	0.07	0.07	0.06	0.25	0.62	0.27	0.30	0.01	0.67	2.75

Table 8: Other material from area B (kg)

Material	Phase												Total
	6	10	11	13	14	15	16	17	18	19	20	U/S	
Cal	0.65										0.13	0.78	1.56
Ce										0.02		0.02	0.04
Ch											0.04		0.04
FC	0.01						0.08	0.06		0.11	0.00	0.26	0.52
J		0.01								0.02		0.03	0.06
L	0.01											0.01	0.02
LS	1.31	0.50	0.71	0.18	0.00	0.11			0.27	0.14	0.01	3.24	6.47
Nat	0.02			0.00	0.10	2.11						2.24	4.47
Q	0.02						0.00					0.03	0.05
St	0.01		0.14				0.03	0.09	0.01	0.19	0.02	0.47	0.96
Total	2.03	0.51	0.85	0.18	0.10	2.22	0.11	0.15	0.28	0.48	0.20	7.08	14.19

Table 9: Other material from area C (kg)

Material	Phase				Total
	13	14	15	16	
FC					0.00
L		0.01			0.01
LS	0.02	0.19	0.03	0.02	0.26
Nat		0.14			0.14
St			0.04		0.04
Total	0.02	0.34	0.07	0.02	0.45






ENGLISH HERITAGE RESEARCH DEPARTMENT

English Heritage undertakes and commissions research into the historic environment, and the issues that affect its condition and survival, in order to provide the understanding necessary for informed policy and decision making, for sustainable management, and to promote the widest access, appreciation and enjoyment of our heritage.

The Research Department provides English Heritage with this capacity in the fields of buildings history, archaeology, and landscape history. It brings together seven teams with complementary investigative and analytical skills to provide integrated research expertise across the range of the historic environment. These are:

* *Aerial Survey and Investigation*
* *Archaeological Projects (excavation)*
* *Archaeological Science*
* *Archaeological Survey and Investigation (landscape analysis)*
* *Architectural Investigation*
* *Imaging, Graphics and Survey (including measured and metric survey, and photography)*
* *Survey of London*

The Research Department undertakes a wide range of investigative and analytical projects, and provides quality assurance and management support for externally-commissioned research. We aim for innovative work of the highest quality which will set agendas and standards for the historic environment sector. In support of this, and to build capacity and promote best practice in the sector, we also publish guidance and provide advice and training. We support outreach and education activities and build these in to our projects and programmes wherever possible.

We make the results of our work available through the Research Department Report Series, and through journal publications and monographs. Our publication Research News, which appears three times a year, aims to keep our partners within and outside English Heritage up-to-date with our projects and activities. A full list of Research Department Reports, with abstracts and information on how to obtain copies, may be found on www.english-heritage.org.uk/researchreports

For further information visit www.english-heritage.org.uk

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