Tables and captions

Artefact #	Dimensions (mm)	Description	Cross-section Shape	End Condition
95	72x5x5	Bar	Square	Hot Cut both ends
115	51x1x0.9	Bar	Square	One tapered end
120	28x6x1	Bar	Rectangular	One tapered end
260	49x5x3	Strip	Rectangular	One tapered end, cut
299	89x6x3	Strip	Rectangular	Tapered both ends, hot cut one end
320	158x2x1	Bar	Rectangular	One end drawn to a point
364	94x6x4	Curved Bar	Rectangular	One tapered end
369	80x4x4	Bar	Round	One end thinned to a rod
547	62x9x3	Bar	Rectangular	One tapered end

Table 7.3.1. Summary description of the iron bars recovered from the smithy.

Artefact #	Phosphoric Iron Hv	Ferritic Iron Hv	Steel Hv	Predominant Alloy	Average Grain Size	Clean/Dirty
95	166	n/a	n/a	phosphoric iron	3	clean
115	136	151	157	phosphoric iron	4	dirty
120	174	166	226	composite	6	dirty
260	140	127	108	composite	7	dirty
299	n/a	116	207	ferrite	5	dirty
320	205	n/a	n/a	phosphoric iron	7	clean
364	n/a	90	130	low carbon steel	7	clean
369	n/a	n/a	239	steel	n/a	clean
547	138	125	143	composite	6	clean

Table 7.3.2. Summary details of the metallurgy of the iron bars. (Artefacts – Finds Number; Phosphoric iron Hv – average micro-hardness of the phosphoric iron; Ferritic iron Hv - average micro-hardness of the feritic iron; Steel Hv - average micro-hardness of the steel; Predominant Alloy – dominating microstructure; Average Grain Size – ASTM Grain Size; Clean/Dirty – clean implies low slag inclusion content. Dirty implies high slag inclusion content.

Site	Hearth Bottom (kg)	% of assemblage	Smithing Slag Lumps (kg)	% of assemblage	Hearth Lining (kg)	% of assemblage	Total
Wharram Percy Smithy	12.9	12	78.8	74	14.2	13	105.9
Hamwih (Site 31)	84.8	13	540.7	85	13.3	2	638.8
Mucking	69	33	115.4	56	22.3	11	206.7
West Heslerton	43.2	40	62.9	58	2.9	3	109
Yarnton	6.7	60	2.6	23	1.8	16	11.1
Flixborough	11.3	84	0	0	2.2	16	13.5
Burton Dassett	34.5	10	310.3	90	1.1	<1	345.9

Table 7.3.3. Comparison of smithing slag debris from a range of sites. Mucking (McDonnell 1993), West Heslerton (Cowgill, J. and McDonnell G. forthcoming), Yarnton (Hey 2004), Flixborough (Starley 1999) and Burton Dassett (McDonnell 1992a). Note Burton Dassett is Medieval in date rather than Saxon.

Sites	Year of Excavation	Number of Hones Found
44, 59 and 76*	*1977/78 and 1981-90*	*32*
*81**	*1981-90*	*14*
*84, 85, 90 and 93**	*1981-90*	*26*
*Churchyard***	*1962-73*	*6*

Table 7.3.4. Distribution of hones at other sites excavated at Wharram Percy. Source: Wharram VIII and Wharram XI

Site	Smithing Slag Lumps	Hearth Bottoms	Hearth Lining	Smelting Slag	Other
Churchyard	*3.3*	*1.4*	*0.1*	*-*	*0.1 (cinder)*

Table 7.3.5. Distribution of slag at other sites excavated at Wharram Percy. Source: Anne Clarke

	Class 1			Class 2		
	Smithing Slag Average	**Hearth Bottom Average**	**Average**	**Smithing Slag Average**	**Hearth Bottom Average**	**Average**
MgO	0.9	0.6	0.8	0.4	0.3	0.3
Al_2O_3	5.4	4.5	4.9	2.6	3.3	2.9
SiO_2	58.3	52.9	55.6	37.4	29.7	33.6
P_2O_5	0.7	0.5	0.6	0.7	0.8	0.7
SO_3	0.1	0.1	0.1	0.1	0.2	0.1
K_2O	3.7	3.7	3.7	1.6	1.3	1.4
CaO	6.3	5.0	5.6	3.0	2.4	2.7
MnO	0.1	0.1	0.1	0.1	0.1	0.1
FeO	24.6	32.6	28.6	54.1	62.1	58.1
FeO /SiO_2	0.4	0.7	0.5	1.4	2.3	1.9

Table7.3. 6. The archaeometallurgical analysis of the slag showed that both the hearth bottoms and the smithing slag lumps have similar compositions with two broad compositional groups emerging (after Daoust 2007)

Finds From the Smithy, other than iron	
Domestic finds	
stone and glass beads	2
loom weight	1
spindle whorl	2
glass jar	1
palm cup	1
Copper alloy hair pin	1
Copper alloy ring	1
antler combs	12
bone pins	8
bone whistle	1
bone buzzer	1

Table 7.3.7. Domestic finds from the smithy (Sites 44, 59 and 76**)**.

Smithy associated finds	
Copper alloy strips	4
lead lump	1
mould fragments	2

Table 7.3.8. Non-ferrous finds from the smith (Sites 44, 59 and 76**)**.

Ferrous Finds From the Smithy	
Wood working	
wood working tools	2
wire	4
Specialty tools	
knives	12
Building ironwork	
staples	1
hinges	4
lock	1
key	1
ring	1
strips	3
handle	1
nails	376
Dress fittings	
dress pins	5
strap ends	2
belt pins	1
hilt guard	1
Smithy finds	
bars	9
Hone Stones	32
slag plates	23
slag	91.7kg

Table 7.3.9. Iron working related finds from the Smithy(Sites 44, 59 and 76**)**.

Site	Date	A	B	C	D	U/C	Total	Reference
Settlements								
West Stow, Suffolk	5th-7th	14	18	-	6	12	50	(West 1985)
Poundbury, Dorset	5th-7th	3	4	-	1	1	9	(Green *et al.* 1987, 101)
Wharram Percy	7th-8th	6	3	-	-	3	12	(Stamper & Croft 2000, 133-135)
Six Dials, Hamwic	8th-9th	42	66	-	-	24	132	(McDonnell *et al.* 1991)
Fishergate, York	8th-9th	1	15	-	-	13	29	(Rogers 1993, 1273-1276)
Coppergate, York	9th	11	20	-	-	10	41	(Ottaway 1992, 584)
Cemeteries								
Cannington, Somerset	4th-7th	-	18	-	10	5	33	(Rahtz *et al.* 2000, 326)
Beringfield, Oxfordshire	5th-6th	-	20	-	24	8	52	(Boyle 1995, 73-74)
Mucking, Essex	5th-7th	17	91	-	29	21	158	(Starley 1996)
Empingham II, Rutland	5th-7th	8	13	-	18	30	69	(Timby & Bartlett 1996, 65-66)
Buckland, Dover	5th-8th	34	47	5	5	42	133	(Evison 1987, 113-117)
Alton, Hampshire	5th-8th	6	18	-	4	3	31	(Evison 1988)
Norton, Cleveland	6th	11	8	11	15	13	58	(Sherlock & Welch 1992, 51)
Edix Hill, Cambridgeshire	6th-7th	3	44	-	6	2	55	(Malim *et al.* 1998, 217)
Didcot, Oxfordshire	7th	-	8	-	-	3	11	(Boyle 1995, 222)

Table 7.3.10. Table summarising the knife back shapes at both cemetery and settlement sites over time. U/C indicates were a knife fragment was unclassifiable. The knives from Wharram Percy have been shaded to allow easier comparison.

Knife	Knife Form		Manufacture Typology	Cutting Edge		Heat Treated	Back		Notes
	Shape	Tang interface		Microstructure	Hv		Microstructure	Hv	
134	B	Distinct both sides	0	-	-	Unknown	Ferrite Ferrite with pearlite Phosphoric iron	193 218 187	Heterogeneous iron
159	A	-	2	Tempered martensite	524	Yes	Ferrite Phosphoric iron	170 197	Piled iron back Multiple white weld lines
176	B	Distinct both sides	2	Ferrite with pearlite	121	Unknown	Phosphoric iron	197	One piece of iron
237	A	Distinct both sides	2	Pearlite	172	No	Ferrite	99-120	Piled iron back
278*	B	-	2	Ferrite cutting edge Fine pearlite	155 391	No	Ferrite with pearlite	138-187	Piled iron back Repair?
307	-	Distinct both sides	0	-	-	Unknown	Ferrite Phosphoric iron	186 156	Heterogeneous iron
308	A	-	2	Pearlite	216	No	Ferrite	125-199	Piled iron back
442	-	Distinct both sides	3	Pearlite	314	No	Pearlite with ferrite Phosphoric iron	203 146	Piled iron back
472	A	-	2	Pearlite	296	No	Phosphoric iron	179-202	Two pieces of iron in back
502	A	Distinct one side	2	Pearlite	235	No	Pearlite with ferrite Ferrite	245 120	Heterogeneous iron White weld line

Table 7.3.11. Summary of the ten knives analysed. This includes the archaeological typologies assigned to the ten knives. It also shows the manufacturing typology, cutting edge and back microstructures along with their average hardness values (or in some cases ranges).

Sites		Manufacturing Typology and Cutting Edge Data						
		0	**1**	**2**	**3**	**4**	**5**	**Overall**
Poundbury, Dorset[1]	Number	1	1	4	1			**7**
5th-7th	Avg HV	210	245	505	214			**384**
	Range HV	210	245	330-615	214			**210-615**
Wharram Percy	Number	2		7	1			**10**
7th-8th	Avg HV	185		279	314			**264**
	Range HV	171-199		121-524	314			**121-524**
Flixborough[2]	Number	2		11		1		**14**
7th -10th	Avg HV	204		556		479		**500**
	Range HV	139-268		379-650		479		**139-650**
Six Dials, Hamwic[3]	Number			12			1	**13**
8th-9th	Avg HV			430			607	**444**
	Range HV			153-813			572-642	**153-813**
Fishergate, York[4]	Number			5				**5**
8th-9th	Avg HV			445				**445**
	Range HV			314-630				**314-630**
Coppergate, York[5]	Number		1	5		1		**7**
9th	Avg HV		407	708		309		**608**
	Range HV		407	244-927		309		**244-927**
	Number	**5**	**2**	**44**	**2**	**2**	**1**	**56**
Settlement Total	**Avg HV**	**198**	**215**	**477**	**264**	**394**	**607**	**439**
	Range HV	**139-268**	**245-407**	**121-927**	**214-314**	**309-479**	**572-642**	**121-927**
	Number	**7**	**12**	**7**	**3**	**6**	**8**	**43**
Cemetery Total[6]	**Avg HV**	**159**	**304**	**686**	**189**	**551**	**255**	**363**
	Range HV	**144-208**	**125-724**	**258-1000**	**181-196**	**433-775**	**116-650**	**125-1000**

Table 7.3.12. Table showing the number of each knife manufacturing types at each of the different settlement sites including the 10 Wharram Percy knives (shaded). It also shows the average hardness value and the range of hardness values (HV) for the cutting edges for each manufacturing type at the settlement sites. [1](Tylecote 1987), [2](Starley 1999), [3] (McDonnell 1987c, 1987d), [4] (Rogers 1993), [5] (Ottaway 1992) and [6](Blakelock & McDonnell 2007).

Artefact #	Length (mm)	Complete?	Used?	Typology
160	35	without point	used	unknown
218	27	yes	used	oval head
219	63	yes	unused	spike
394	36	yes	unused	offset head
398	33	yes	used	fiddle key
550	29	yes	used	horseshoe
556	20	without point	used	unknown

Table 7.3.13.Classification of analysed nails (Source Watt this volum)

Artefact #	Phosphoric Iron Hv	Ferritic Iron Hv	Steel Hv	Predominant Alloy	Average Grain Size	Clean/dirty
160	202	n/a	n/a	phosphoric iron	3	clean
218	224	n/a	n/a	phosphoric iron	5	clean
219	168	86	n/a	phosphoric iron	2	dirty
394	162	120	141	combination	3	clean
398	n/a	130	168	ferrite	7	clean
550	177	n/a	164	combination	6	dirty
556	177	n/a	208	phosphoric iron	4	dirty

Table 7.3.14. Metallography summary of the nails. (Artefacts – Finds Number; Phosphoric iron Hv – average micro-hardness of the phosphoric iron; Ferritic iron Hv - average micro-hardness of the feritic iron; Steel Hv - average micro-hardness of the steel; Predominant Alloy – dominating microstructure; Average Grain Size – ASTM Grain Size; Clean/Dirty – clean implies low slag inclusion content. Dirty implies high slag inclusion content.

	Wharram Slag Compsoition Type 1 (average)	Wharram Slag Compsoition Type 1 (average	Flixborough	West Heslerton	Bestwall	Average
MgO	0.8	0.3				
Al_2O_3	4.9	2.9				
SiO_2	55.6	33.6				
P_2O_5	0.6	0.7				
SO_3	0.1	0.1				
K_2O	3.7	1.4				
CaO	5.6	2.7				
MnO	0.1	0.1				
FeO	28.6	58.1				
FeO/SiO_2	0.5	1.9				

Table 7.3.15. Wharram analyses compared to data from other Saxon sites

Site	Knives Analysed	Average Hardness	Number of Butt-welded knives	Number of Heat Treatments	Number of White Weldlines
Wharram Percy 7^{th}-8^{th}	10	246	7	1	3
Flixborough 7^{th} -9^{th} [1]	6	473	4	5	4
Six Dials, Hamwic 8^{th}-9^{th} [2]	14	517	11	10	5

Table 7.3.16. Table showing the knife quality based on the average hardness of the cutting edge, the presence of heat treated steel and white weldlines for the Wharram Percy knives compared to other knives from Middle Saxon sites. [1](Starley 1999) and [2](McDonnell 1987c, 1987d).