Pre-roman iron age metalworking tools from England and Wales: their use, technology, and archaeological context

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APPENDIX A

CATALOGUE OF FERROUS TOOLS

Introduction

Each entry is accorded a sequential catalogue number; this is followed by the figure number (A1 - A24), type of tool, and site. The location which is given at the end of the first entry line refers to the present (1990) whereabouts of the artifact, whether this is a temporary or permanent location, followed by a museum accession number if relevant. If this is a temporary (loan) number, this is indicated in square brackets.

'Description' gives present dimensions; if measurements are from X-radiographs, this is noted. Although dimensions of archaeological ironwork are seldom representative of original the artifacts (cf. Chapter 2.3.3), for comparative purposes it is necessary to indicate values. Interpretation is assisted by reference to 'Condition', which gives an assessment of the condition at the time of examination for the present study. The attributes included are principally those relevant to 'utilitarian' use. Completeness and damage is noted (which may have a bearing on both utilitarian and ritual use), and other information is included if pertinent to the general description. For brevity, unless otherwise unclear, dimensions such as some cross-sections are given in the sequence length (L) x width (W). The dimensions of hammer faces are given according to the orientation of the face in use, that is, L x W for a cross pein, W x L for a straight pein. The orientation of hammer faces, cross-sections, and other details are shown in the drawings.

'Examination' includes reference to an Ancient Monuments Laboratory (AML) accession number if this is relevant to the acquisition of records, and to X-radiographs if available and the year(s) in which these were taken. The original X-radiographs of the artifacts which were accessioned at the Ancient Monuments Laboratory are, in general, held there at present. For the others, the X-radiographs are avail-

able either at the museum housing the collection or at the laboratory responsible for the conservation of the collection. X-radiographs (or copies) taken during the course of this study by the writer have been deposited at the museum housing the objects, or with the excavator. 'Analysis' and 'Metallography' cite the reference to any published report, and in the latter case, the sample number (S) in the catalogue of metallography (Appendix B) if examined in the present study.

Examination procedures, and lists of finds which were examined by X-radiography and/or selective removal of accretions are given in Chapter 2.5. Where descriptions or dimensions are taken from the original publication this is stated in the catalogue entry. If the tool is redrawn from the published illustration, this is indicated by an asterisk after the figure number. The other tools are drawn with the aid of X-radiographs if available; shading is restricted to essential detail.

The entry 'Context/date' summarises context, date and metalworking associations, followed by an assessment of the security of the Iron Age attribution according to the following scheme:

[A] Definite Iron Age context

[B] Probable Iron Age context

[C] Not from a definite Iron Age context, but from form or associations, probably Iron Age in date

[D] From mid-first century AD horizon; type not known from earlier contexts, but potentially an Iron Age type

[E] From mid-first century AD or later horizon, or unstratified; type not distinctive of period, possibly post-Iron Age in date.

Abbreviations used in the catalogue

Dimensions

D	depth	MB	mid-blade
Diam	diameter	MP	mid-point
est.	estimated	OD	outside diameter
frag	fragment	R	radius
Ht	height	T	thickness
inc	incomplete	W	width
L	length	Wt	weight
max	maximum	X-ray	X-radiograph
min	minimum		

Site details

F	feature	SF	small find number
Tr	trench	N S E W	north, south, east, west

Location and accession

AMIA	Andover, Museum of the Iron Age
AML	Ancient Monuments Laboratory, HBMC, London
BMAG	Birmingham Museums and Art Gallery
BMP	British Museum, Dept. Prehistoric and Romano-British Antiquities
CAA	Cambridge, University Museum of Archaeology and Anthropology
CEM	Colchester and Essex Museum
CM	Chelmsford and Essex Museum
CMC	Corinium Museum, Cirencester
DCM	Dorset County Museum, Dorchester
DM	Devizes Museum
EFDM	Epping Forest District Museum, Waltham Abbey
GWG	Grimsby, Welholme Galleries
HM	Hertford Museum
HCM	Hereford City Museums
HW	Hereford and Worcester C.C., Archaeological Section, Worcester
KuH	Kingston upon Hull, Transport and Archaeology Museum
MM	Maidstone Museum and Art Gallery
McM	The Manchester Museum
MSA	Museum of Sussex Archaeology, Lewes
NAU	Norfolk Archaeological Unit, Gressenhall
NCM	Northampton, Central Museum and Art Gallery
NMW	National Museum of Wales, Cardiff
OAM	Oxford, Ashmolean Museum
OIA	Oxford, Institute of Archaeology
RM	Reading Museum and Art Gallery
SBM	Scunthorpe Borough Museum and Art Gallery
SCM	Somerset County Museum, Taunton
SM	Swindon Museum and Art Gallery
WCM	Winchester City Museum, Hyde House
XX	with excavator
Coll.	Collection

No. 1. (Fig. A1) **'POKER'** **Garton Slack, N. Humberside** KuH

Description Complete poker with a long narrow blade and a decorated handle. The blade is rectangular in section, tapering in width and slightly in thickness to the rounded tip. Square-sectioned handle, the end bent round to form a ring, which is round in section and lies in the same plane as the blade. The decoration comprises 3 twisted length separated by 2 plain regions. L 776mm. **Blade:** L 461mm; W x T (max) 18.5 x 5mm; T (min) 4mm. **Handle:** L 315mm, twisted = 270mm; W x T (bar) 8 x 8mm, (twisted = 9 x 9mm). **Ring:** OD 35mm. **Decoration:** from blade to ring: 5 quarter turns anticlockwise over c. 60mm, plain for c. 50mm, 4 quarter-turns clockwise over c. 55mm, plain for c. 45mm, 4 quarter-turns anticlockwise over c. 60mm.

Condition Surface corroded. Mineralisations adhere, including macro plant remains.

Examination X-ray (1973).

Context/date Grain silo Pit 1, resting on tongs No. 38 and below poker No. 5. Charcoal from pit, possibly from pit lining or covering, dated 180 ± 70 b.c. [Har-1228]. [A]

Reference Brewster 1980, 365, fig. 219, pl. 68.

No. 2. (Fig. A1) **'POKER'** **Witham Bury, Essex** CM: N22208:1

Description Blade and almost complete handle. Tapering flat blade with rounded end, broadest at the blade/handle junction; rectangular section. The shoulders are concave and there is a discrete thickening in width at the neck. The handle is oval in section near the neck and round-sectioned thereafter. At about mid-length there is a thickening (L 25mm, W 17mm) which retains traces of a fragment of iron binding, possibly a ferrule (surviving W 9mm). At the distal end of the handle is another thickening (L 23mm, W 14mm) which is more square in section and this also retains traces of iron binding (surviving W 10mm). The tip of the handle is fractured to a point and slightly bent. L 1024mm (inc). **Blade:** L 197mm; W x T (max) 45 x 7mm, (min) 15 x 4.5mm. **Handle:** L 827mm (inc); L between thickenings 415mm; Diam (stem) 14mm.

Condition Incomplete at handle tip. Much fissured and spalled; accretions obscure detail.

Context/date Discovered during railway construction through the centre of the hillfort, with pokers Nos 3 and 4, and three skeletons (possibly therefore from 1 or more of 3 burials). MIA pottery at the hillfort; ? c. C3rd BC - mid C1st BC. [C]

Reference Rodwell 1976, 43-5, no. 1, fig. 2.

No. 3. (Fig. A1) **'POKER'** **Witham Bury, Essex** CM: N22208:3

Description Blade and the greater part of the handle. Flat blade, rectangular section, tapering from the broadest point near the neck to the rounded end. The shoulders are concave and there is an expansion in width at the neck, the section rectangular. Round-sectioned handle. The orientation of the handle fragment is not known. L 1030mm

inc. **Blade:** L 150mm; W x T (max) 42 x 6mm, (min) c. 20 x 5mm. **Handle:** L 880mm (inc); Diam 12mm; L detached frag 729mm.

Condition — In 2 pieces. Incomplete at both ends of the handle fragment (corrosion damage). Much fissured and fractured; corroded layers and surface coatings obscure detail.

Context/date — Discovered during railway construction through the centre of the hillfort; with pokers Nos 2 and 4, and three skeletons (possibly therefore from 1 or more of 3 burials). MIA pottery at the hillfort; ? c. C3rd BC - mid C1st BC. [C]

Reference — Rodwell 1976, 45, no. 3, fig. 2.

No. 4. (Fig. A1) **'POKER'** **Witham Bury, Essex** CM: N22208:2

Description — A small fragment of the blade, the neck, and the greater part of the handle. The blade is barely traceable. There is a thickening in width to form a rectangular-sectioned neck. The handle is round-sectioned, and close to the distal end there is an oval hole (L c. 14mm, W c. 12mm) at right angles to the plane of the blade. The hole is partly blocked with corrosion products; these may be the remains of a rod (c. 7mm Diam). L 858mm (inc). **Handle:** L 824mm ?complete.

Condition — Incomplete; fractured across the blade close to the handle (corrosion damage), ?complete at the handle tip. Much fissured and spalled; accretions obscure detail.

Context/date — Discovered during railway construction through the centre of the hillfort; with pokers Nos 2 and 3, and three skeletons (possibly therefore from 1 or more of 3 burials). MIA pottery at the hillfort; ? c. C3rd BC - mid C1st BC. [C]

Reference — Rodwell 1976, 45, no. 2, fig. 2.

No. 5. (Fig. A1) **'POKER'** **Garton Slack, N. Humberside** KuH

Description — Almost complete poker. The blade is oval with a flat end, broadest at about mid-blade, flat, rectangular in section. The handle is round-sectioned; the end is bent round to form a small ring of rectangular-section which supports a larger round-sectioned ring (which lies in the same plane as the blade). L 885mm (almost complete). **Blade:** L 135mm; W x T (max) 39 x 5.2mm; W x T (at tip) c. 32 x 5.0. **Handle:** L 750mm, less ring 724mm; Diam 12mm. **Ring:** OD 35-40mm.

Condition — Surface corroded. Slight losses from the blade edge and tip and surfaces.

Examination — X-ray (1973).

Context/date — Grain silo Pit 1, handle resting on tongs No. 38 and poker No. 1. Charcoal from pit, possibly from pit lining or covering, dated 180 ± 70 b.c. [Har-1228]. [A]

Reference — Brewster 1980, 365, fig. 219, pl. 68.

No. 6. (Fig. A1) **'POKER'** **Southcote, Berks** RM

Description — Complete poker. Flat elongated blade, broadest near the handle, tapering in width to

the ?flat tip; rectangular section. The handle is round-sectioned, the distal end bent over and welded to form a ring which lies in the same plane as the blade. L 754mm (≈ complete). L blade frag 195mm, centre handle frag 270mm, ring frag 293mm. **Blade:** L 153mm (≈ complete); W x T (max) 44 x 4mm. **Handle:** L 601mm complete; Diam c. 9mm. **Ring:** OD 41mm.

Condition — Now in 3 pieces; recent fractures. Slight corrosion losses from blade end.

Context/date — Pit 3. Occupation date range ?C4th BC - C1st BC/AD. [C]

Reference — Piggott and Seaby 1937, 54, no. 4, fig. 8.

No. 7. (Fig. A1) **'POKER'** **Conderton Camp, Here & Worc** BMAG

Description — The blade is flat and almost oval, broader towards the handle and tapering in width to the flat end; rectangular section. The neck has a marked thickening in width and the section here is rectangular. The handle is round in section, the distal end bent round to form a ring which lies in the same plane as the blade, and through it is a small second ring. L 820mm; L (to end of 1st ring) 794mm. **Blade:** L 122mm; W x T (max) 35.5 x 2.0mm; W (min) 19mm. **Handle:** L (to end of 1st ring) 672mm; Diam 9mm. **First ring:** OD 45mm. **Second ring:** OD 25-29mm.

Condition — Complete. Surface corroded; coated.

Context/date — Found during magnetometer survey 1958-9, at base of modern top soil. [C]

Reference — Unpublished. Context given in personal communication (letter 25.3.1985, N. Thomas).

No. 8. (Fig. A1) **'POKER'** **Madmarston, Oxon** OAM: 1959.182

Description — Flat oval blade, broadest at mid-blade, rectangular section, ?flat end. Thickened in width at the neck. The handle is rectangular in section near the blade, tapering and oval-sectioned along the stem. The distal end is thickened as if there had once been a terminal. Slightly bent at mid-length. L 761mm ?complete. **Blade:** L 105mm; W x T (max) 37.5 x 4.5mm. **Handle:** L 656mm; W x T (MP) 10.5 x 7.5mm.

Condition — In 3 pieces. ?Incomplete at handle tip. Two recent fractures across the handle. Accretions obscure surface detail.

Context/date — Part of a hoard of ironwork including 12 currency bars and an axe-head; sealed under stone floor, inner rampart in cutting 8H. Late C2nd BC. [A]

Reference — Fowler 1960, 43, no. 16, fig. 18, no. 4.

No. 9. (Fig. A2) **'POKER'** **Waltham Abbey, Essex** EFDM

Description — Blade and tang. Oval dished blade, broadest at mid-blade, almost flat at the end. The tang is rectangular in section near the blade, tapering to square section and pointed. L (bent) 360mm; L (if straight) 475mm. **Blade:** L 165mm; W (max) 73mm; T 3-4mm (6mm from tip); dish 5.5mm. **Handle:** L (if straight) 310mm; W x T (mean) 10mm.

Condition Complete. Surface corroded.

Context/date From a probable ritual deposit of ironwork which includes 12 other metalworking tools (Nos 29, 30, 33-37, 45, 49, 50, 58, 141), woodworking tools, a sword and a linch-pin. The latter 2 items are typologically late C1st BC or early C1st AD. [D]

Reference Manning 1985, 12, no. A41, pl. 6.

No. 10. (Fig. A2) **'POKER'** **Sheepen, Essex** CEM

Description Incomplete blade and part of the decorated handle. Flat elongated blade, rectangular in section thickened longitudinally along the central axis; broadest near the handle junction. The handle is rectangular-sectioned near the blade junction, tapering to 5mm square section at the extant end. Three anticlockwise quarter twists of the decoration survive. L 269mm (inc). **Blade:** L 156mm (inc); W x T (max) 27 x 4.5mm, (min) 16 x 4mm. **Handle:** L 113mm (inc).

Condition Incomplete; fractured across at both ends. Surface corroded and spalled.

Context/date Region 6 Pit K14; cut into a Period I (AD 10-43) layer W of Site K1, with much 'native' material and some Claudian pottery. [C]

Reference Hawkes and Hull 1947, 343, pl. CIV, no. 8.

No. 11. (Fig. A2) **'POKER'** **Sheepen, Essex** CEM

Description Blade and tang. Flat elongated blade, tapering to the rounded point; rectangular section. Square-sectioned tapering tang, the shoulders concave. L 208mm. **Tang:** L c. 30mm (?complete). **Blade:** L 178mm (complete); W x T (max extant) 22 x 3.5mm.

Condition Complete (or almost) at both ends. Metal core but severely corroded; many losses from the surface and the edges of the blade. Bent along the length.

Context/date Region 3: unstratified in Site A4, Period IV (AD 49-61). [C]

Reference Hawkes and Hull 1947, 343, pl. CIV, no. 9.

No. 12. (Fig. A2; Plate Ib) **'POKER'** **Hunsbury, Northants** NCM: D133 1957-8

Description Blade and part of the handle. Long parallel-sided flat blade, rounded at the tip. The cross-section is rectangular, thickened longitudinally along the central axis on both sides. Concave shoulders. Rectangular-sectioned handle. L 220mm (inc). **Blade:** L 113mm (essentially complete); W x T (max) 34 x 5mm. **Handle:** L 107mm (inc); W x T (at fracture) 8 x 4mm.

Condition Fractured across the handle, some losses from the blade edges and tip. Stripped; coatings obscure surface detail.

Examination Analysis: Ehrenreich 1985, 214, HNY65b. Metallography: **Appendix B**, S1.

Context/date Discovered during quarrying. C5th/4th BC - C1st BC/early C1st AD. [C]

Reference Fell 1936, 67, no. 25.

No. 13. (Fig. A2; Plate Ib) **'POKER'** **Hunsbury, Northants** NCM: D391 1956-7

Description Part of the blade and part of the handle. Rectangular section; long tapering blade. L 180mm (inc). **Blade:** L 110mm (inc); W x T (max) 40.5 x 3.0mm. **Handle:** L 70mm (inc); W x T (at fracture) 11 x 3.5mm.

Condition Fractured across the handle and the blade end. Stripped; losses from the blade; accretions obscure surface detail. Slightly turned at up the tip of the blade.

Examination Analysis: Ehrenreich 1985, 213, HNY61a. Metallography: **Appendix B,** S5.

Context/date Discovered during quarrying. C5th/4th BC - C1st BC/early C1st AD. [C]

Reference Fell 1936, 67, no. 25.

No. 14. (Fig. A2) **'POKER'** **Hunsbury, Northants** BMP: 1896 4-11 89

Description Part of the blade and part of the handle. Rectangular in section; slightly thickened along the centre of the blade (on both sides). L 223mm (inc); L (blade frag) 98mm; L (handle frag) 125mm. **Blade:** L (extant) 84mm; W x T (max) 53 x 4.5mm. **Handle:** L 139mm (inc); W x T 13 x 7mm.

Condition Incomplete; recent fractures (in 2 pieces, no join). Accretions obscure detail.

Examination X-ray.

Context/date Discovered during quarrying. C5th/4th BC - C1st BC/early C1st AD. [C]

Reference Fell 1936, 74, no. 11, pl. XIII, no. 11.

No. 15. (Fig. A2*) **'POKER'** **Sheepen, Essex** CEM

Description Blade and part of the handle. The blade is rectangular, tapering slightly to the broad flat end. Rectangular-sectioned handle. Concave shoulders. L 152mm (inc). **Blade:** L 82mm (complete); W (max) 48mm, (min) 43mm. (After Niblett 1985).

Condition Fractured across the handle.

Context/date Site iia, F214, large rubbish/gravel pit dated by coarse pottery to early in period IV (AD 49-61). [E]

Reference Niblett 1985, fig. 77, no. 7, Mf. 8.3:D7.

No. 16. (Fig. A2; Plate Ib) **'POKER'** **Hunsbury, Northants** NCM: D389 1956-7

Description Blade and part of the handle. Flat oval blade, broader near the thickened neck. The handle is rectangular-sectioned near the neck, square thereafter; bent 70mm from the neck. L (bent, inc) 380mm, L (if straight) 397mm. **Blade:** L 130mm (?complete); W x T (max) 41 x 5mm. **Handle:** L (if straight, inc) 267mm, c. 7.5mm square.

Condition Incomplete; fractured across the handle, spalled at the tip and along the handle. Metal core; stripped; coatings obscure surface detail.

Examination Analysis: Ehrenreich 1985, 213, HNY61b. Metallography: **Appendix B,** S3.

Context/date Discovered during quarrying. C5th/4th BC - C1st BC/early C1st AD. [C]

Reference Fell 1936, 67, no. 25.

No. 17. (Fig. A2; Plate Ib) **'POKER'** **Hunsbury, Northants** NCM: D390 1956-7

Description Blade and part of the handle. Flat oval blade, broadest at mid-blade, thicker near the handle; rectangular in section. Thickened in width at the neck. Rectangular-sectioned handle which appears to taper. L 413mm (inc). **Blade:** L 118mm (complete); W x T (max) 38 x 4.5mm. **Handle:** L 295mm (inc); W x T (extant tip) 8.5 x 5.0mm.

Condition Fractured or spalled at the handle tip and along the length. Metal core; stripped; coatings obscure surface detail.

Examination Analysis: Ehrenreich 1985, 212, HNY18b. Metallography: **Appendix B,** S4.

Context/date Discovered during quarrying. C5th/4th BC - C1st BC/early C1st AD. [C]

Reference Fell 1936, 67, no. 25.

No. 18. (Fig. A2) **'POKER'** **Meare Village West, Somerset** SCM

Description Blade and handle junction. Flat oval blade, broadest at mid-blade; rectangular section. The blade end was probably rounded (but there are corrosion losses from the edges). Rectangular in section at the handle junction. L (extant) 111mm. **Blade:** L 90mm; W x T (max) 54 x 2.5mm.

Condition Recent fracture across the handle. No metal core.

Context Mound 22, NW of the central picket. Mound also yielded file No. 159, crucible sherds and ferrous slag. C3rd BC - mid C1st AD. [B]

Reference Gray and Bulleid 1953, 240, no. I129, pl. L.

No. 19. (Fig. A2) **'POKER'** **Hunsbury, Northants** NCM: D393 1956-7

Description Blade and part of the handle. Flat oval blade, broadest at mid-blade. Rectangular-sectioned handle, bent at about mid-length. L 266mm (inc). **Blade:** L 77mm (complete); W x T (max) 44 x 3mm. **Handle:** L 189mm (inc); W x T c. 10 x c. 5mm.

Condition Fractured across the handle. Metal core; stripped; coatings obscure surface detail.

Examination Analysis: Ehrenreich 1985, 214, HNY65a. Metallography: **Appendix B,** S6.

Context/date Discovered during quarrying. C5th/4th BC - C1st BC/early C1st AD. [C]

Reference Fell 1936, 67, no. 25, pl. IV:B, no. 3.

No. 20. (Fig. A2) **'POKER'** **Castle Yard, Northants** NCM: D111 1957-8

Description Flat oval blade, broadest at mid-blade, flat end. Rectangular-sectioned handle; slightly bent. L 298mm (?complete). **Blade:** L 69mm; W x T (at max width) 41 x 3.5mm. **Handle:** L 229mm; W x T 9.5 x 4mm.

Condition Fissured and flaking; partial metal core.

Context/date Discovered during levelling of the western defences during the C19th. From the core

of stone-faced rampart constructed C5th BC. Found with iron slag ('several hundreds-weight of scoria of iron') of which some at least was smelting slag. [A]

Reference Knight 1988, 36, fig. 5, 1.

No. 21. (Fig. A2; Plate Ib) **'POKER'** **Hunsbury, Northants** NCM: D392 1956-7

Description Blade and greater part of the handle. Flat, almost round blade, rectangular section. Rectangular-sectioned handle. L 417mm (inc). **Blade:** L 80mm; W x T (at max W) 59 x 3mm. **Handle:** L 337mm (inc); W x T 10 x 5mm.

Condition Incomplete at handle tip, slight losses from the blade edges. Metal core; stripped; coatings obscure surface detail.

Context/date Discovered during quarrying. C5th/4th BC - C1st BC/early C1st AD. [C]

Reference Fell 1936, 67, no. 25.

No. 22. (Fig. A2*) **'POKER'** **Tre'r Ceiri, Gwynedd** NMW?

Description Blade and part of the handle. Round flat blade with flat end. Rectangular-sectioned handle. L 311mm (inc). **Blade:** L c. 82mm; W (max) c. 80mm. **Handle:** L 229mm (inc). (After Hughes 1907, fig. 12.)

Condition Fractured across the handle and bent near the break.

Context/date Hut 69. Occupation at site: ?C2nd/1st BC - C1st AD. [B]

Reference Hughes 1907, 48, fig. 12.

No. 23. (Fig. A2) **'POKER'** **Beckford, Here & Worc** HW

Description Handle and part of the blade. Spatulate blade but insufficient survives to indicate the precise form or width. Concave shoulders. ?Complete handle, rectangular section and untapered. L 300mm (inc). **Blade:** L (surviving) 40mm; W x T (max, surviving) 43 x 3mm. **Handle:** L 260mm (?complete); W x T 9 x 7mm.

Condition Fractured across the blade and slightly spalled from the handle tip. Much fissured. Coatings obscure detail.

Examination X-ray.

Context/date (BO277701). From pit in rectangular enclosure on the west of the site. Pit assigned on basis of pottery to MIA. Foundry debris was recovered from the enclosure. [A]

Reference Publication forthcoming.

No. 24. (Fig. A2) **'POKER'** **Meare Village West, Somerset** SCM

Description Blade and handle, in 2 pieces. The blade is rounded (edge losses), broadest near the blunt, rounded end. The handle appears to join by overlapping the blade though the published illustration and overall length suggest otherwise. The stem is rectangular-sectioned near the blade and 'square in section thickness 10mm'

thereafter. L (as excavated) 630mm ?complete; L (present, with overlapped join) 590mm; L (blade frag, present) 69mm; L (handle frag, present) 554mm. **Blade:** L 69mm; W x T (max) 41 x c. 5mm. **Handle:** L (overlapped) 521mm; W x T c. 8 x c. 8mm.

Condition In 2 pieces with a poor join between the two; ?incomplete at the handle tip and fractured at the blade/handle junction; possibly complete as buried. Corrosion losses do not allow accurate assessment.

Context/date Mound 21, on 1st floor, 10ft [3.05m] SW of the central picket. Mound yielded ferrous slag, other metalworking debris (ferrous and non-ferrous), and metal-working tools were found in the adjacent mounds. C3rd BC - mid C1st AD. [A]

Reference Gray and Bulleid 1953, 240, no. 161, pl. L.

No. 25. (Fig. A2; Plate Ib) **'POKER'** **Hunsbury, Northants** NCM: D138 1957-8

Description Blade and part of handle. ?Oval blade with ?flat end; rectangular section. The handle is rectangular in section near the blade but it expands towards the extant tip and becomes more rounded in section (though these may be the effects of corrosion losses). The handle is bent (?ancient damage). L 212mm (inc). **Blade:** L 58mm ; W x T (max) 34 x 2.5mm. **Handle:** L 154mm; W x T c. 8.5 x c. 7.5mm.

Condition Fractured across the handle, surface losses from blade and handle. Metal core; stripped; coatings obscure surface detail.

Examination Analysis: Ehrenreich 1985, 213, HNY60a. Metallography: **Appendix B**, S2.

Context/date Discovered during quarrying. C5th/4th BC - C1st BC/early C1st AD. [C]

Reference Fell 1936, 67, no. 25.

No. 26. (Fig. A2) **'POKER'?** **Meare Village East, Somerset** SCM

Description ?Part of the blade of a poker. Oval, lenticular-sectioned blade, broadest near the handle junction. **Blade:** L (extant) 77mm; W x T (max) 43 x 9.5mm, (at tip) 34 x 2mm.

Condition Ancient fractures at both ends; fissured and repaired. Detail obscured by accretions.

Context/date Mound 14. C2nd BC - mid C1st AD. [B]

Reference Coles 1987, 127, no. I102, fig. 3.55.

No. 27. (Fig. A2) **'POKER'** **Meare Village East, Somerset** SCM

Description Part of the blade and part of the handle. The blade was probably round or oval but it is now fractured across the end; the section rectangular and dished. Rectangular -sectioned handle. L 98mm (inc). **Blade:** L 46mm (inc); W (max) 43mm; W (tip) 30mm; T (max) 3.5mm; T (min) 2.0mm. **Handle:** L 52mm; W x T (extant end) 6.5 x 4.0mm.

Condition In 2 pieces; incomplete at both ends; ancient break at blade tip, recent fracture across the handle, ?ancient break at blade/handle junction (corrosion products *in situ* but some recent losses at the join). Surface detail obscured by corrosion.

Context/date Mound 17, 7ft [2.13m] NE of central picket, in black earth under the clay, Floor 1. Within 10m was hot chisel No. 99, ferrous slag, and a crucible sherd. C2nd BC - mid C1st AD. [A]

Reference Coles 1987, 123, no. I40, fig. 3.50.

No. 28. **'POKER'** **Billingborough, Lincs** XX

Description Complete spatulate-ended poker, broken across the handle before deposition. Rectangular head. Round-sectioned handle, with one (possibly two) expansions. Ringed handle. Lengths: tip + handle frag, c. 515mm; handle tip, c. 362mm.

Context/date The two pieces were placed alongside each other (N-S) at the bottom of a recut of an E-W Bronze Age ditch. Brackish conditions in the recut ditch. Provisionally assigned late C2nd or earlier C1st BC. [A]

Reference Chowne 1979, 247, pl. p. 248; and pers. comm.

No. 29. (Fig. A3) **POKER** **Waltham Abbey, Essex** BMP

Description Complete poker, bent into a U-shape. Round-sectioned rod, tapering to a blunt point at one end and looped over to form a suspension ring at the other end. L (bent) 275mm, (if straight) c. 580mm. **Stem:** Diam (max) 10mm, (min) 2.7mm. **Ring:** OD 30mm.

Condition Surface corroded. Bent before deposition.

Context/date From a probable ritual deposit of ironwork which includes 12 other metalworking tools (Nos 9, 30, 33-37, 45, 49, 50, 58 and 141), woodworking tools, a sword and a linch-pin. The latter 2 items are typologically late C1st BC or early C1st AD. [D]

Reference Manning 1980, 91, fig. 3b; Manning 1985, 12, A40, pl. 6.

No. 30. (Fig. A3) **POKER ?** **Waltham Abbey, Essex** EFDM

Description Pointed tip of a ?poker, bent into a U-shape. Round in cross-section and tapering over the distal c. 80mm to a point, the final 2mm of which is bent over. L (bent) 165mm, (if straight) c. 275mm. Diam 7mm. (Not part of any tongs from the group).

Condition Surface corroded at the tip but heavily concreted with gravel at the other end, where the core is substantially voided. Traces of corroded fibrous core suggest that the diameter here was also 7mm. Corrosion fracture. Bent before deposition.

Context/date From a probable ritual deposit of ironwork which includes 12 other metalworking tools (Nos 9, 29, 33-37, 45, 49, 50, 58 and 141), woodworking tools, a sword and a linch-pin. The latter 2 items are typologically late C1st BC or early C1st AD. [D]

Reference Manning 1985, 104, P30, pl. 49.

No. 31. (Fig. A3) **?POKER HANDLE** **Fiskerton, Lincs** XX

Description Two rods of similar cross-section, found within 0.15m of each other, which together

may be a poker. **SF288/B:** inc rod with an off-set ?suspension loop. The section is square on the bend, round along the slightly tapering stem. L 170mm; Diam (max, MP) 11mm. **SF312/B:** inc at both ends, round section. L 101mm; Diam 9.5mm.

Condition — Both fragments are severely corroded and substantially voided.

Examination — X-ray (1981-3).

Context/date — From possible ritual deposit(s) found near C5th/4th BC causeway. The group includes 9 other metalworking tools (Nos 54, 55, 62, 71, 128, 135, 142, 145 and 172), woodworking tools, and a float whose handle dates stylistically to C4th BC. [A]

Reference — V. Fell forthcoming.

No. 32. (Fig. A3) **POKER** **Sutton Walls, Here & Worc** HCM: 6747

Description — Part of a ?poker handle. Round-sectioned rod bent over to form a ring at one end. L 274mm (inc). **Stem:** Diam 9mm. **Ring:** OD 45mm.

Condition — Ancient fracture across stem, losses from the end of the ring. Stripped.

Context/date — Area 1 Pit 1, from packing of a post-hole. Associated pottery mid C1st AD. [E]

Reference — Kenyon 1953, 61, no. 6, fig. 24.

No. 33. (Fig. A3) **TONGS** **Waltham Abbey, Essex** EFDM

Description — Complete tongs (in 3 pieces), curved jaws. The intact jaw and rein is bent 3 times along the rein; the other rein is in 2 pieces. The jaws are rectangular-sectioned with short flat extensions and flat tips. The intact rein is rectangular-sectioned and tapering, the distal 25mm is round-sectioned and tapering to a point. The fractured rein is rounded-rectangular in section throughout its length and retains the rivet head in situ. L (if straight) c. 550mm; (jaw frag 345mm, rein tip 206mm) **Jaws:** L (to rivet) 140mm; L x W (inside jaw, est.) c. 95 x 30mm; L extensions c. 15mm. **Reins:** L (to rivet, if straight) c. 405mm (intact) and c. 411mm (broken).

Condition — Complete; in 3 pieces; damaged in antiquity. Superficially corroded (+ ?haematite).

Context/date — From a probable ritual deposit of ironwork which includes 12 other metalworking tools (Nos 9, 29, 30, 34-37, 45, 49, 50, 58, 141), woodworking tools, a sword and a linch-pin. The latter 2 items are typologically late C1st BC or early C1st AD. [D]

References — Manning 1980, 89, fig. 1, c-d; Manning 1985, 8, A13, pl. 3.

No. 34. (Fig. A4) **TONGS** **Waltham Abbey, Essex** BMP

Description — Incomplete tongs with open bowed jaws and short gripping extension. Rectangular-sectioned jaws with flat tips. One rein is fractured close to the rivet, the other is bent twice along the length. The reins are square-sectioned near the jaws; the extant rein is round in section away from the jaws, tapering along the length. Rivet in situ. L (if straight) c. 600mm. **Jaws:** L (to rivet) c. 122mm; L x W

(inside jaw, if closed) c. 80 x c. 45mm; L (flat extension) 20mm & 24mm. **Reins:** L (to rivet, if straight) 478mm (complete), 50mm (inc).

Condition — Damaged in antiquity; nearly severed through the metal at one bend. One complete rein. Superficially corroded. Some ?haematite present.

Context/date — From probable ritual deposit of ironwork which includes 12 other metalworking tools (Nos 9, 29, 30, 33, 35-37, 45, 49, 50, 58, 141), woodworking tools, a sword and a linch-pin. The latter 2 items are typologically late C1st BC or early C1st AD. [D]

References — Manning 1980, 89, fig. 2a; Manning 1985, 8, A14, pl. 4.

No. 35. (Fig. A4) **TONGS** **Waltham Abbey, Essex** BMP

Description — Incomplete tongs with closed bowed jaws and short gripping extension. Rectangular-sectioned jaws with flat tips which are now off-set. One rein has an ancient fracture close to the rivet, the other is bent through a right angle close to the rivet and bent again in a different plane near to the end. The reins are rectangular-sectioned close to the rivet, round-sectioned thereafter, the extant rein slightly tapering. Rivet in situ. L (if straight) c. 560mm. **Jaws:** L (to rivet) 100mm; L x W (inside jaw) 68 x 38mm; L 17 mm (flat extension). **Reins:** L (to rivet, if straight) c. 460mm (complete) & 105mm (inc).

Condition — Damaged in antiquity; the metal is partly severed at one bend. One complete rein. Superficially corroded. Some ?haematite near the rivet and on the grips.

Context/date — From a probable ritual deposit of ironwork which includes 12 other metalworking tools (Nos 9, 29, 30, 33, 34, 36, 37, 45, 49, 50, 58 and 141), woodworking tools, a sword and a linch-pin. The latter 2 items are typologically late C1st BC or early C1st AD. [D]

References — Manning 1980, 89, fig. 2b; Manning 1985, 8, A12, pl. 2.

No. 36. (Fig. A4) **TONGS** **Waltham Abbey, Essex** EFDM

Description — Incomplete tongs; one jaw and part of the rein. The jaw is bowed with a flat gripping extension and flat tip. Rectangular-sectioned at the jaw and the rein junction, thereafter the rein is round in section. L 281mm (inc). **Jaw:** L (to rivet) 173mm; L x W (inside jaw, if complete, est.) c. 130 x c. 50mm; L (flat extension) 30mm.

Condition — Incomplete; bent and fractured in antiquity. Superficially corroded.

Context/date — From probable ritual deposit of ironwork which includes 12 other metalworking tools (Nos 9, 29, 30, 33-35, 37, 45, 49, 50, 58, 141), woodworking tools, a sword and a linch-pin. The latter 2 items are typologically late C1st BC or early C1st AD. [D]

References — Manning 1980, 89, fig. 2c; Manning 1985, 8, A15, pl. 4.

No. 37. (Fig. A4) **TONGS** **Waltham Abbey, Essex** EFDM

Description Incomplete tongs; part of one jaw, rein and rivet, and one complete rein. The complete rein is fractured across the rivet hole, and bent through 90° at mid-length. The other rein retains part of the bowed jaw and the rivet head and stem, and it is bent mid-way along the extant length. The reins are rectangular-sectioned near the jaws, square-sectioned and tapering along their lengths; the complete rein is pointed at its end. L (if straight) c. 400mm (inc); L (jaw + rein frag) 203mm. **Reins:** L (to rivet, if straight) c. 372mm (complete) and c. 178mm (inc).

Condition Incomplete; in 2 pieces; bent and fractured in antiquity. Superficially corroded.

Context/date From probable ritual deposit of ironwork which includes 12 other metalworking tools (Nos 9, 29, 30, 33-36, 45, 49, 50, 58, 141), woodworking tools, a sword and a linch-pin. The latter 2 items are typologically late C1st BC or early C1st AD. [D]

References Manning 1980, 89, fig. 2d; Manning 1985, 8, A11, pl. 2.

No. 38. (Fig. A5) **TONGS** **Garton Slack, N. Humberside** KuH

Description Complete tongs, curved jaws with closed, flat gripping faces, the tips rounded and almost meeting. Rectangular-sectioned at the jaws and the reins near the jaws, round in section over the final 80mm of one rein, 30mm of the other (longer) rein. Rivet in situ. L 545mm (complete). **Jaws:** L (to rivet) 153mm; L x W (inside jaw) 92 x 20mm; L (flat gripping faces) c. 38mm. **Reins:** L (to rivet) 392mm and 375mm.

Condition Substantial metal core. Mineralised plant remains + corrosion products in situ.

Examination X-ray (1973).

Context/date Grain silo Pit 1, found under pokers Nos 1 and 5. Charcoal from pit, possibly from pit lining or covering, dated 180 ± 70 b.c. [Har-1228]. [A]

References Brewster 1975, 115, fig. p.112; Brewster 1980, 364-5, fig. 218, pl. 69.

No. 39. (Fig. A5) **TONGS** **Llyn Cerrig Bach, Gwynedd** NMW: 44.294.32

Description Complete tongs, bowed jaws with flat closed gripping extension, the tips flat. The reins are rectangular-sectioned near the jaws, rounded-rectangular at the ends. Large rivet in situ. L 542mm. **Jaws:** L (to rivet) 102mm; L x W (inside jaw) 62 x 42mm; L (flat extension) c. 23mm. **Reins:** L (to rivet) 440mm and 427mm.

Condition Substantial metal core; very slight corrosion losses.

Context/date From probable ritual deposit(s) of metalwork, including individual items which date stylistically to C2nd BC - early C1st AD. See also tongs No. 43. [C]

References Fox 1946, 41, 96, no. 131, pls VI and XIX; Savory 1976a, 59, 18:32, fig. 16, 3.

No. 40. (Fig. A5) **TONGS WITH COUPLER** **Rudston, N. Humberside** BMP

Description Complete tongs, bowed jaws with long flat gripping faces. Rectangular-sectioned

slender jaws, closed (to within 4mm) at the flat tips. The reins are rectangular in section near the rivet, round-sectioned thereafter and they are inclined towards each other, the tips almost meeting. Rivet in situ. There are traces of mineralised textile on the upper side (as excavated) of the reins, and there is a lump of iron slag near the rivet on the reverse side. L 513mm. **Jaws:** L (to rivet) 110mm; L x W (inside jaw) 47 x 21mm; L (flat gripping faces) c. 50mm. Dimensions from X-ray. **Reins:** L (to rivet) 403mm; Diam at tips c. 8mm. **COUPLER:** Plate with 3 equally spaced, circular or rounded-rectangular holes, c. 9mm across. Mineralised textile survives on one side. L 90mm; W 20mm; T c. 4-6mm. Dimensions from X-ray.

Condition — TONGS: Much fissured; now fractured (in 5 frags). Accretions in situ.
COUPLER: Complete as excavated but now fissured.

Examination — X-ray (1980, 1987).

Context/date — Cemetery, Burial R154, young ?male inhumation, E/W, extended. Other grave finds: iron sword, two spearheads, hammerhead No. 78, possible wooden shield. Tongs placed over the sword, to right of centre body; the coupler adjacent to the inside of one of the reins, close to the jaws. Burial dates to C1st BC. [A]

References — Stead 1976; Stead 1979, 11-15; Fell in Stead forthcoming (FD/BY + FD/CD, fig. 109).

No. 41. (Fig. A5) **TONGS** **Santon, Norfolk** CAA

Description — Incomplete tongs, bowed jaws with flat gripping extension. Rectangular-sectioned, closed jaws. The reins are rectangular-sectioned throughout, slightly inclined towards each other. L 336mm (extant). **Jaws:** L (extant, to rivet) 70mm; L x W (inside jaw) 42 x 28mm. **Reins:** L (to rivet, extant) 266mm and 200mm.

Condition — Stripped and coated. Much fissured. Fractured across the gripping extension (a fracture on one jaw indicates out-turned form, i.e. flat gripping faces). Fractured across the shorter rein and possibly also the other (coatings obscure detail).

Context/date — From a hoard of metalwork found in a cauldron, including tongs No. 42, hammer No. 85, file No. 136, scrap copper alloy, and other metalwork including late Iron Age types, and early Roman types (e.g. Claudian brooches). Deposition c. AD 60. [E]

Reference — Smith 1909, 158, pl. XVII:1 (bottom).

No. 42. **TONGS** **Santon, Norfolk** missing

Description — Small tongs, closed bowed jaws with flat gripping extension. Open reins.
L 6½in [165mm] (incomplete at both ends). **Jaws:** L (est.) 45mm.

Context/date — From a hoard of metalwork found in a cauldron, including tongs No. 41, hammer No. 85, file No. 136, scrap copper alloy, and other metalwork including late Iron Age types, and early Roman types (e.g. Claudian brooches). Deposition c. AD 60. [E]

Reference — Smith 1909, 158, pl. XVII:1 (second from bottom).

No. 43. (Fig. A5) **TONGS** **Llyn Cerrig Bach, Gwynedd** NMW: 44.294.33

Description Almost complete tongs, circular jaws with flat circular gripping faces. The jaws are rectangular-sectioned at the rivet becoming round-sectioned and thicker towards the faces. Tapering rectangular-sectioned reins, square in section at the extant ends; bent. Rivet missing. L 212mm (inc). **Jaws:** L 51mm; L x W (inside jaw) 20 x 26mm; Diam gripping faces 14mm. **Reins:** L 161mm and 147mm.

Condition Substantial metal core. Stripped and some losses. Both reins incomplete; one (L 161mm) was fractured across in antiquity the other is corrosion damaged.

Examination X-ray (1987).

Context/date From probable ritual deposit(s) of metalwork, including individual items which date stylistically to C2nd BC - early C1st AD. See also tongs No. 39. [C]

References Fox 1946, 41-2, 96, no. 132, pls VI and XXIX; Savory 1976a, 59-60, 18:33+19:4, fig. 22, 1).

No. 44. (Fig. A5) **TONGS REIN** **Twyn-y-Gaer, Gwent** NMW

Description Single rein; fractured across the rivet hole and across the rein end. Rectangular section. L 172mm.

Condition Ancient fracture across rivet hole. Recent fracture across rein.

Examination X-ray (1987).

Context/date Not known. Occupation date: C5th - C3rd BC or later. [B]

References L. Probert forthcoming; (Probert 1976, 115).

No. 45. (Fig. A6) **BLOCK ANVIL** **Waltham Abbey, Essex** EFDM

Description Rectangular flat face rounded at the edges, with a few hammer marks, undulations, and shallow fissures. Tapering to a shoulder at about mid-height. Flat sub-rectangular base. Close to the base there is an oval eye. Ht 129mm. Wt 4320g. **Face:** c. 105 x 91mm. **Eye:** 27 x 21mm. **Base:** 70 x 18/25mm.

Condition Superficially corroded. Some ?haematite and hammer-scale present.

Context/date From a probable ritual deposit of ironwork which includes 12 other metalworking tools (Nos 9, 29, 30, 33-37, 49, 50, 58 and 141), woodworking tools, a sword and a linch-pin. The latter 2 items are typologically late C1st BC or early C1st AD. [D]

References Manning 1980, 91, fig. 3c; Manning 1985, 3, A1, pl. 1.

No. 46. (Fig. A6) **BLOCK ANVIL** **Bigbury, Kent** MM

Description Tapering rectangular-sectioned block with a loop at the base. Accretions obscure detail but the X-radiograph suggests that the body narrows sharply towards the base and the loop extends downwards around the base. The face is roughly square, flat or possibly undulating, rounded at the edges(?), and unburred(?). Ht 147mm. Wt 2270g.

Face: c. 80mm square, c. 90mm square (+ corroded layers). (Dimensions from X-ray.)

Condition — Substantial metal core. Soil and corrosion products in situ and infill the loop.

Examination — X-ray (1986).

Context/date — Tr 8 and 9. Set into natural clay in possible smithy in annexe. No associated metalworking debris. Pottery in annexe dated to C2nd BC. [A]

Reference — Thompson 1983, 251, 259, no. 3, fig. 13, no. 6, pls XXXb, XXXIb.

No. 47. (Fig. A6) **BLOCK ANVIL** **Barbury Castle, Wilts** DM

Description — Slightly convex square face, thickened and much burred. A substantial part of the face and stem is missing. Evenly tapered rectangular-sectioned stem, hooked base. Ht 143mm. Wt 1010g. **Face:** max dimension 80mm, below burr 54mm.

Condition — Superficially corroded. Severely fractured (ancient damage) and deeply fissured down one side. Incomplete at the 'hooked' tip.

Examination — Analysis: Ehrenreich 1985, 208, BC7a. Metallography: **Appendix B,** S7.

Context/date — From a group of ironwork, possibly a metalworker's hoard, including Nos 75, 208, 209, 210, 213 and 217. Circumstances of discovery not known. Later Iron Age. [C]

Reference — Macgregor and Simpson 1963, 396, no. 26, fig. 2.

No. 48. (Fig. A6) **STEMMED ANVIL** **Meare Village East, Somerset** SCM

Description — The anvil face is flat and essentially square at the rear, rounded at the edges; tapering inwards and curving downwards and to the tip of the beak. Round-sectioned beak, rounded tip. Rectangular-sectioned stem, tapering to the incomplete base. Ht 153mm. Wt 1770g. **Face:** L 118mm; W (max) 58mm; beak extension c. 60mm.

Condition — Substantial metal core. Surface fissured and spalled, recent corrosion damage across the base. Corrosion products obscure the tip of the beak and other detail.

Context/date — Mound 30, 18ft [5.48m] NNW of the central picket. Found at the bottom of the clay, on the surface or just above the surface of the black earth. Mound also yielded file No. 160 and crucible sherds. C2nd BC - mid C1st AD. [A]

Reference — Coles 1987, 127, no. 170, fig. 3.53.

No. 49. (Fig. A7) **STEMMED ANVIL-SWAGE** **Waltham Abbey, Essex** BMP

Description — The anvil face is flat at the rear, rounded at the edges; tapering, slightly curved downwards to the tip of the round-sectioned beak. The stem is triangular-sectioned with rounded corners, tapering to an almost circular flat base. The flat rear side of the anvil has two parallel transverse swage grooves which are semi-circular in section. The upper (25mm from the anvil face): L 55mm, W 6mm (MP), 7mm (at the ends), D c. 3.5mm. The other (55mm from the anvil face): L 44mm, W 8mm, D c. 4mm. There are 3 semi-circular depressions on the broad sides of the anvil: one side has

a hemi-spherical depression (Diam 12mm, D 7mm), the other side has an oval (12 x 18mm, D 9mm) and a kidney-shaped (17 x 9mm, D 6.5mm) depression. Ht 188mm. Wt 2307g. **Face:** L 158mm; W (max) 62mm. **Base:** Diam 22-25mm.

Condition — Superficially corroded.

Context/date — From a probable ritual deposit of ironwork which includes 12 other metalworking tools (Nos 9, 29, 30, 33-37, 45, 50, 58 and 141), woodworking tools, a sword and a linch-pin. The latter 2 items are typologically late C1st BC or early C1st AD. [D]

References — Manning 1980, 91-3, fig. 3d; Manning 1985, 4, no. A2, pl. 1.

No. 50. (Fig. A7) **STEMMED ANVIL-SWAGE** **Waltham Abbey, Essex** BMP

Description — Part of the anvil face is missing but in plan it is wedge-shaped, flat at the rear and tapering to the tip of the beak. The rear and the side of the anvil face are slightly burred, and the tip of the beak is burred over. The stem is rectangular-sectioned, tapering to a flat base. The rear side of the anvil has two parallel transverse swage grooves which are semi-circular in section. One is 60mm from the anvil face, W 2mm, D 0.8mm. The other is 66mm from the anvil face, W 5mm, D 2mm. Ht 147mm. Wt 848g. **Face:** L 115mm, W (max) 63mm. **Base:** 22 x 15/18mm.

Condition — Superficially corroded. Ancient fracture. Some ?haematite present.

Context/date — From a probable ritual deposit of ironwork which includes 12 other metalworking tools (Nos 9, 29, 30, 33-37, 45, 49, 58 and 141), woodworking tools, a sword and a linch-pin. The latter 2 items are typologically late C1st BC or early C1st AD. [D]

References — Manning 1980, 91-3, fig. 3e; Manning 1985, 4, A3, pl. 1.

No. 51. (Fig. A7) **ANVIL ?** **Danebury, Hants** OIA

Description — Fragment of a ?stemmed anvil: the rear part of the upper (flat) rectangular face and part of the rectangular-sectioned stem. The sides and the rear face also appear to be flat. Possibly curving to the ?beak and also to the stem. L (inc) 112mm. **Upper face:** W (max, extant) c. 54mm. **Rear face:** L x W (extant) c. 54 x c. 35mm.

Condition — Corrosion fractured. Accretions in situ.

Context/date — DA83 layer 864 SF1934. Ceramic phase 7 (300 - 100/50 BC). [A]

Reference — Cunliffe forthcoming, no. 2.275.

No. 52. (Fig. A7) **ANVIL ?** **Meare Village East, Somerset** SCM

Description — Possible stemmed anvil, in 2 pieces. 'Large piece of squared iron' (Gray's catalogue entry). There is a possible join between the two pieces (the smaller frag fitting to the narrow end of the larger piece). Wt (together) 666g. **Large frag:** (max, extant) 101 x 52 x 45mm; 3 flat faces, fractured on the 4th face and across the broad end. **Small frag:** (max, extant) 62 x 35 x 22mm; one flat face.

Condition Substantial metal core but much fissured and fractured.

Context/date Mound 10, 11½ft [3.5m] SW of the central picket, Floor 1. Mound also yielded file No. 120. C2nd BC - mid C1st AD. [A]

Reference Coles 1987, 120, no. 19, fig. 3.47.

No. 53. (Fig. A7) **BENCH ANVIL ?** **Bagendon, Glos** CMC: A 342/10

Description Rectangular burred face, slightly convex. Tapering rectangular-sectioned stem. L 104mm. **Face:** (max) 22 x 20.5mm, (behind burr) 17 x 14mm.

Condition Substantial metal core. Stripped and coated, surface losses, fractured at the tip.

Context/date Not stated, but considered to be related to the Dobunnic mint. Mid C1st AD. [E]

Reference Clifford 1961, 192, pl. XLVI.

No. 54. (Fig. A7) **BENCH ANVIL ?** **Fiskerton, Lincs** XX

Description The stem is roughly square in section, becoming octagonal near the flat face, and tapering to oval section at the rounded tip. The stem is slightly bent near the tip. L 90.4mm. **Face:** 15.5 x 14.0mm.

Condition Superficially corroded.

Examination X-ray (1981-3). Metallography: **Appendix B,** S8 and S9.

Context/date SF 384. From possible ritual deposit(s) found near a C5th/4th BC causeway. The group includes 9 other metalworking tools (Nos 31, 55, 62, 71, 128, 135, 142, 145 and 172), woodworking tools, and a float whose handle dates stylistically to C4th BC. Context 331; 4m away from the main group of tools, with two axeheads. [A]

Reference V. Fell forthcoming.

No. 55. (Fig. A7) **TOP-SWAGE** **Fiskerton, Lincs** XX

Description Tapering stem, rectangular-sectioned at the head, changing to round section 25mm from the tip. Semi-circular groove at the tip. Slightly bent stem. L 100mm. **Stem:** W x T (MP) 10.5 x 9.3mm. **Tip:** 5mm Diam. **Groove:** L 4.5mm, 3.5mm R. **Head:** W (+ burr, extant) 14.5 x 11.5mm, (below burr, extant) 13.4 x 11.2mm.

Condition Totally corroded, fissured, partly voided; the upper part distorted by corrosion pressures. Fractured; losses from the head and for 35mm down one side.

Examination X-ray (1981-3). Metallography: **Appendix B,** S10.

Context/date SF 384. From possible ritual deposit(s) found near C5th/4th BC causeway. The group includes 9 other metalworking tools (Nos 31, 54, 62, 71, 128, 135, 142, 145, 172), woodworking tools, and a float whose handle dates stylistically to C4th BC. [A]

Reference V. Fell forthcoming.

No. 56. (Fig. A8) **SET HAMMER** **Bulbury, Dorset** DCM: 1884.9.117

Description Hammerhead with two square faces, both slightly convex. Oval eye, off-set to one end. Both faces are thickened (?by use). L 153mm. Wt 2852g. **Work face:** 61 x 58mm, irregular outline but ?originally c. 61mm square. **Butt:** 55 x 56mm.

Condition Complete. Stripped and coated, some losses from the edges of the faces.

Examination X-ray (1985).

Context/date From possible hoard(s) which may include also hammer No. 57; ?later Iron Age. [D]

References Cunliffe 1972, 302, no. 16, fig. 6; Cunliffe 1974, fig. 14:4, 1.

No. 57. (Fig. A8) **SET HAMMER** **Bulbury, Dorset** DCM: 1884.9.118

Description Incomplete hammerhead with two rectangular faces. ?Oval eye. L 151mm (inc). Wt 837g. **Work face:** fractured across the face; ?cross pein. **Butt:** 32 x 45mm, slightly convex, losses from the corners; angled (possibly through use).

Condition Stripped and coated, severe losses. Eye filled with accretions.

Examination X-ray (1985).

Context/date From possible hoard(s) which may include also hammer No. 56; ?later Iron Age. [D]

Reference Cunliffe 1972, 302, no. 17, fig. 6.

No. 58. (Fig. A8) **SWAGE-HAMMER** **Waltham Abbey, Essex** BMP

Description Hammerhead with a sub-rectangular plain face and a square face with a swage groove. On the side of the hammer close to the square face is a second swage groove. The eye is off-set to the swage-face and there are slight traces of the wooden handle. L 123mm. Wt 1533g. **Plain face:** 44 x 48mm (behind burr), 46 x 50mm (+ burr); rounded corners; convex; thickened, burred. **Swage-face:** 45mm square, rounded edges and corners; convex, c. 80mm R; slightly burred. Central vertical groove, semi-circular section (c. 4mm Diam), 4.8 - 7mm W (broader at the ends). **Side swage:** semi-circular section (c. 3.5mm Diam), 4.0 - 4.5mm W (broader at centre).

Condition Complete. Superficial corrosion. Some red corrosion products (?haematite).

Context/date From a probable ritual deposit of ironwork which includes 12 other metalworking tools (Nos 9, 29, 30, 33-37, 45, 49, 50 and 141), woodworking tools, a sword and a linch-pin. The latter 2 items are typologically late C1st BC or early C1st AD. [D]

References Manning 1980, 93, fig. 3, f; Manning 1985, 5, A4, pl. 1.

No. 59. (Fig. A9) **HAMMER** **Hod Hill, Dorset** BMP: P1975 7-1 4

Description Hammerhead with two much burred rectangular faces - a cross pein and a straight pein. Large oval eye which is off-set to the small face; expanded about the eye. The front and rear sides are curved to the front. L 124mm. Wt 844g.

Straight pein: c. 36 x c. 47mm (13mm behind burr), 43 x 59mm (+ burr); thickened

and burred; convex, the edges well-rounded, the centre rather flatter. **Cross pein:** c. 22 x c. 19mm (7mm behind burr), 31 x 21mm (+ burr); convex; burred.

Condition — Complete. Substantial metal core.

Context/date — From hoard? of ironwork found at Hod Hill during World War II. Associated items: hooked block, shaft-hole axehead, currency bar, knife, bill-hook. ?Later IA. [C]

Reference — C. Saunders forthcoming.

No. 60. (Fig. A9) **HAMMER** **Danebury, Hants** OIA

Description — Hammerhead with two rectangular faces - a cross pein and a straight pein. Arced front, straight at the rear, expanded about the eye. The eye is oval, extended at the ends, and is off-set to the straight pein. L 102mm. Wt 381g. **Cross-pein:** 18.5 x 12.5mm; convex, rounded edges, no burr. **Straight-pein:** 13.5 x 25mm; convex, rounded edges, slightly thickened.

Condition — Complete. Superficial corrosion.

Context/date — DA90 SF1656 Pit 1586, ceramic phase 6-7 (400 - 100/50 BC). [A]

Reference — B. Cunliffe forthcoming (no. 2.252).

No. 61. (Fig. A9) **HAMMER** **Hunsbury, Northants** NCM: D137 1957-8

Description — Incomplete hammerhead, fractured near the eye; one extant rectangular cross pein. Steeply angled at the front, the apex above the eye, slightly angled at the rear. Expanded about the eye. The oval eye retains traces of the wooden handle and there are 2 iron wedges in situ. L 176mm (inc). Wt 338g. **Cross pein:** 23 x 8.5mm, 23 x 9.0mm (+ burr); flat, angled away from the front; slight burr at the front edge.

Condition — Stripped and coated. Metal core; surface layers lost.

Examination — X-ray (1984). Analysis: Ehrenreich 1985, 214, HNY70a. Metallography: **Appendix B**, S11.

Context/date — Discovered during quarrying. C5th/4th BC - C1st BC/early C1st AD. [C]

Reference — Unpublished.

No. 62. (Fig. A9; Plate IIa) **HAMMER** **Fiskerton, Lincs** XX

Description — Hammerhead with a narrow rectangular cross pein and a much burred, broad rectangular cross pein. Arced, the faces angled away from the front. The rounded-rectangular eye retains part of the handle (mature Rocaceae sub-family Pomoideae) and 2 iron wedges. Expanded about the eye. L 180mm. Wt 476g. **Narrow cross pein:** 27 x 9mm; convex c. 90mm R (L), c. 12mm R (W), rounded edges, flatter at lower centre. **Broad cross pein:** 27 x 16mm (behind burr), 34 x 21mm (+ burr); flat.

Condition — Complete. Surface corroded only; detail is very well-preserved.

Examination — X-ray (1981-3). Metallography: **Appendix B**, S12-S15.

Context/date SF403. From possible ritual deposit(s) found near a C5th/4th BC causeway. The group includes 9 other metalworking tools (Nos 31, 54, 55, 71, 128, 135, 142, 145, 172), woodworking tools, and a float whose handle dates stylistically to C4th BC. [A]

Reference Field 1986, fig. 16; V. Fell forthcoming.

No. 63. (Fig. A10) **HAMMER** **Bigbury, Kent** McM: 35809

Description Hammerhead with a rectangular cross pein and a square face. Possibly a single-faced hammer, the square face non-functional. Slightly arced at the front and rear, the square face angled away from the front. Rounded-rectangular eye, off-set well to the square face; expanded about the eye. L 120mm. Wt 326g. **Cross pein:** 25 x 10mm; convex c. 25mm R (L). **Square face:** 19 x 19mm; ?flat; damaged, ?slightly splayed.

Condition Complete. Stripped; substantial metal core, stringers clearly visible.

Examination Analysis: Ehrenreich 1985, 207, B3b. Metallography: **Appendix B,** S16.

Context/date Discovered during gravel quarrying in 1895. Found with hammer No. 68, possibly with chisel No. 95, spearheads, a dagger, an axehead and agricultural implements. Probably mid/late C1st BC date. [C]

References Boyd Dawkins 1902, 214, pl. 1, 2e; (Jessop 1932, 97-8); Thompson 1983, 265, fig. 14, 17, pl. XXXIV, a.

No. 64. (Fig. A10) **HAMMER** **Casterley Camp, Wilts** DM

Description Hammerhead with a narrow rectangular cross pein and an almost square face. Angled at the front, straight at the rear; both faces angled away from the front. The oval eye is off-set to the broad face. L 128mm. Wt 174g. **Cross pein:** 14 x 5.5mm; convex. **'Square' face:** 17 x 20mm (behind burr), 20.5 x 20.5mm (+ burr); flat.

Condition Complete. Stripped, slight losses from the surface.

Context/date Bottom of ditch 8a, with ashes and iron slag. ?Phase 2: ?early/mid C1st AD. [D]

Reference Cunnington 1913, 103, pl. VIII, 1.

No. 65. (Fig. A10) **HAMMER** **King Harry Lane, Herts** BMP

Description Hammerhead with a narrow rectangular cross pein and a broad rectangular straight pein. Steeply angled at the front, the apex above the eye, the rear almost straight; both faces angled away from the front. Rounded-rectangular eye. L 86mm (almost complete). Wt 130g (+ accretions). **Cross-pein:** L c. 17mm (from iron stains), W c. 6mm (from X-ray); recent fracture across the face but the X-ray suggests that it was originally convex c. 5mm R. **Straight pein:** 14.5 x 17mm (3mm behind burr), 16 x 20mm (+ burr); ?flat; thickened and burred; flaked.

Condition Metal core; much fissured; fractured along the sides and the cross pein. Accretions obscure detail; bone from the burial is attached to the front.

Examination X-ray (1972).

Context/date AA35: AA/HS. Cemetery, Burial 295 (adult cremation in box). Other grave finds: nail from a burnt item, short iron tube, Samian platter dated to AD 50-65, and the 'box' (defined by iron fittings). Phase 4a of cemetery (after AD 60). [D]

References Stead and Rigby 1989, 110-1, 346, fig. 147; Fell 1989, 106-7.

No. 66. (Fig. A10; Plate IIIa) **HAMMER** **Ham Hill, Somerset** SCM

Description Hammerhead with a narrow rectangular cross pein and a burred, almost square face. Steeply angled at the front, the apex to one side of the eye, the rear side almost straight. The rectangular eye if off-set well to the burred face and retains traces of the hafting, and an iron wedge. L 119mm (≈ complete). Wt 92g. **Cross pein:** 13.5 x 2.6mm; convex. **'Square' face:** 10.0 x 11.0mm (4mm behind burr), 13 x 14mm (+ burr); thickened and burred; c. flat; angled away from the front.

Condition Metal core; stripped and coated. Surface losses from the faces.

Examination X-ray (1988). Metallography: **Appendix B,** S17-S19.

Context/date A1517. Context not recorded. Form suggests Iron Age date. [C]

Reference Unpublished; (Burrow 1981, 198-9, 268-73).

No. 67. (Fig. A10) **HAMMER** **Whitcombe, Dorset** DCM

Description Hammerhead with a narrow rectangular cross pein and a square face. Angled at the front, the rear straight. The oval eye is off-set well to the square face and it retains part of the hafting of mature Fraxinus (ash) and 3 iron wedges. The handle survives for a length of 41mm, of which 13mm extends to the rear of the hammerhead. Traces of mineralised fibres (?fleece) on the uppermost side as buried. L 111mm. Wt 142g. **Cross pein:** L 8mm; convex c. 2mm R (W), almost wedge-like, may have a slight bevel at the tip of the face. **Square face:** 13 x 13mm with rounded sides; flat, rounded edges especially at the rear; unburred.

Condition Complete. Metal core; well-preserved detail.

Examination X-ray (1984): Metallography: **Appendix B,** S20.

Context/date Cemetery, Burial 12. Young male inhumation, SE, crouched. Other grave goods: file No. 131, sword, scabbard fittings and suspension rings, spearhead, copper alloy brooch and unidentified artifact, chalk disc. Burial probably dates to first half C1st AD. [B]

References (Aitken 1967; Collis 1972, 125-6, fig. 2; Whimster 1981, 261-2, 345-6); Aitken and Stead forthcoming.

No. 68. (Fig. A10) **HAMMER** **Bigbury, Kent** McM: 35810

Description Hammerhead with a rectangular cross pein and a much burred square face. Central

rounded-rectangular eye; the published illustration (Boyd Dawkins 1902) suggests that it then retained part of the hafting plus wedge(s). L 104mm. Wt 132g. **Cross pein:** 15 x 9mm; convex c. 15mm R (L), c. 10mm R (W). **Square face:** 16 x 16mm (behind burr), c. 22mm Diam (+ burr); flat; angled to the front of the hammer.

Condition — Complete. Stripped; substantial metal core, stringers clearly visible.

Examination — Analysis: Ehrenreich 1985, 207, B13a and B13b. Metallography: **Appendix B**, S21-S23.

Context/date — Discovered during gravel quarrying in 1895. Found with hammer No. 63, possibly with chisel No. 95, spearheads, a dagger, an axehead and agricultural implements. Probably mid/late C1st BC. [C]

References — Boyd Dawkins 1902, 214, pl. 1, 2e; (Jessop 1932, 97-8); Thompson 1983, 265, fig. 14, 18, pl. XXXIV, a.

No. 69. (Fig. A10*) **HAMMER** **Midsummer Hill, Here & Worc** BMAG

Description — 'Corroded hammer head generally the same as ... [No. 70 below] ... but with one end pointed' (Stanford 1981, 128.) L c. 92mm (?complete); rectangular section; one cross pein (?); the eye elongated (after Stanford 1981, fig. 59).

Condition — Now (1985) very severely corroded, fissured and fractured.

Context/date — SF145. T31 layer 39, filling of F25 phase v and vi posthole of hut 8, C1st BC. [A]

Reference — Stanford 1981, 128, fig. 59, 2.

No. 70. (Fig. A10*) **HAMMER** **Midsummer Hill, Here & Worc** BMAG

Description — 'Iron hammer head in good condition with an oval slot for the handle measuring 5 x 17 mm. There is an oval-section iron wedge in the slot.... Both ends ... are flat ... swollen sides ....' (Stanford 1981, 126). L c. 89mm (complete); two rectangular cross peins; the front slightly arced (after Stanford 1981, fig. 59).

Condition — Now (1985) very severely corroded, fissured and fractured.

Context/date — SF85. Unstratified in T33 ('probably Iron Age'). [C]

Reference — Stanford 1981, 126, fig. 59, 1.

No. 71. (Fig. A11; Plate IIa) **HAMMER** **Fiskerton, Lincs** XX

Description — Hammerhead with a rectangular cross pein and a ball pein. Slight expansion about central rounded-rectangular eye. Arced, the faces angled away from the front. L 183mm. Wt 70g. **Cross pein:** 11.5 x 5mm (behind burr), 12 x 5.5mm (+ burr); convex c. 30mm R (L), c. 10mm R (W), rounded edges; slight burr. **Ball-face:** 10.5/10mm Diam (max., 2mm from the tip of the face); curvature c. 7.5mm R.

Condition — Complete. Metal core at each face but the central third is severely corroded.

Examination — X-ray (1981-3). Metallography: **Appendix B**, S24-S26.

Context/date — SF332. From possible ritual deposit(s) found near a C5th/4th BC causeway. Group

includes 9 other metalworking tools (Nos 31, 54, 55, 62, 128, 135, 142, 145, 172), woodworking tools, and a float whose handle dates stylistically to C4th BC. [A]

Reference V. Fell forthcoming.

No. 72. (Fig. A11) **HAMMER** **Hunsbury, Northants** NCM: D141 1957-8

Description Hammerhead with a narrow rectangular cross pein and a round face (probably a ball pein). The front and rear are smoothly arced, the faces angled away from the front. Rounded-rectangular eye; hour-glass form. L 143mm. Wt 43g. **Cross pein:** spalled at the edges, the original form cannot be accurately determined, c. 9 x c. 3mm. **Round face:** Diam c. 5mm; much spalled, the extant lower third is convex and unburred.

Condition Complete. Metal core; much fissured and spalled. Coatings obscure surface detail.

Examination X-ray (1984). Analysis: Ehrenreich 1985, 214, HNY70b. Metallography: **Appendix B**, S27.

Context/date Discovered during quarrying. C5th/4th BC - C1st BC/early C1st AD. [C]

Reference Unpublished.

No. 73. (Fig. A11; Plate IIb) **HAMMER** **Bredon Hill, Glos** BMAG

Description Hammerhead with a narrow rectangular cross pein and a sub-round face. Steeply angled at the front and rear, the apex above the eye. Both faces are angled away from the front, and also angled across the faces (?wear). Elongated oval eye, hour-glass form; expanded about the eye. L 136mm. Wt 40g. **Cross pein:** 8.3+ x 2.3mm; damaged, losses from the edges; convex, c. 3mm R overall, well-rounded edges. **Sub-round face:** 9.8 x 8.0mm (behind burr), 10 x 8.2mm (+ burr); convex, c. 15mm R overall, well-rounded edges. Behind the face the cross-section is rounded-square.

Condition Complete. Substantial metal core, slight surface losses; coatings obscure surface.

Examination X-ray (1985). Metallography: **Appendix B**, S28 and S29.

Context/date Unstratified occupation area behind inner rampart, c. end C1st BC. [A]

Reference Hencken 1938, 73, no. 4, fig. 6.

No. 74. **HAMMER** **Bredon Hill, Glos** lost

Description Possibly like No. 73.

Context/date Unstratified occupation area behind inner rampart, c. end C1st BC. [A]

Reference Hencken 1938, 74, no. 5.

No. 75. **HAMMER** **Barbury Castle, Wilts** lost

Description 'A neat hammerhead (cf. Bredon fig. 6)' Grinsell in accession book at Devizes Museum. Thus, possibly like No. 73 or No. 77 (?).

Context/date From a group of ironwork, possibly a metalworker's hoard, comprising Nos 47, 208,

209, 210, 213 and 227. Circumstances of discovery unknown. Later Iron Age. [C]

Reference MacGregor and Simpson 1963, 396, no. 27.

No. 76. (Fig. A11; Plate IIIa) **HAMMER** **Ham Hill, Somerset** SCM

Description Hammerhead with a narrow rectangular cross pein and a round face. Rounded-rectangular eye; expanded about the eye. Arced, the faces angled away from the front. L 101mm. Wt 40g. **Cross pein:** 8.0 x c. 4mm; convex, c. 10mm R (L), c. 1mm R (W). **Round face:** 9.0mm Diam (+ accretions); c. 7mm Diam (from X-ray); convex c. 6mm R; slightly ?thickened or burred.

Condition Complete. Metal core. Accretions and coatings obscure surface detail.

Examination X-ray (1988); metallography: **Appendix B,** S30-S32.

Context/date (1901 WWW). Context not recorded. Possibly from the Walter collection, principally from the northern spur, which largely comprised Iron Age and C1st Roman deposits. See also hot chisel No. 97 and file No. 132. Form suggests Iron Age date. [C]

Reference Unpublished; (Burrow 1981, 198-9, 268-73).

No. 77. (Fig. A11; Plate IIb) **HAMMER** **Bredon Hill, Glos** BMAG

Description Hammerhead with a narrow rectangular cross pein and a broader sub-rectangular cross pein. Arced at the front and rear, the faces angled away from the front. The eye is rectangular, hour-glass form; expanded about the eye. L 90.4mm. Wt 34g. **Narrow cross pein:** 8.0 x c. 4mm; convex, c. 8mm R (L), c. 3mm R (W); well-rounded edges. **Sub-rectangular face:** 8.5/9.4 x 5.3mm, narrower at the front; convex, c. 12mm R (L), c. 10mm R (W); well-rounded edges.

Condition Complete. Metal core, fissured, surface obscured by coatings.

Examination X-ray (1985). Metallography: **Appendix B,** S33 and S34.

Context/date Hut. First Period, C1st BC. Hut contained occupational debris. [A]

Reference Hencken 1938, 74, no. 3, fig. 6.

No. 78. (Fig. A11) **HAMMER (?)** **Rudston, N. Humberside** BMP

Description Slender ?hammerhead; both 'faces' are rectangular and cross-peined, well-rounded and may be slightly angled or worn, but neither appears to be burred. Rectangular section, expanding about the rectangular eye, which is off-set well to one end. Slightly curved along the length. Within the eye is part of the mineralised hafting of mature Pomoideae family, e.g. apple, pear (J. Watson, pers. comm.). L 82mm. **Narrow face:** c. 5 x c. 1.5mm. **Broader face:** c. 6 x c. 4mm.

Condition Complete. Severely corroded; detail obscured by accretions.

Examination X-ray (1975).

Context/date Cemetery, Burial R154 young ?male inhumation, E/W, extended. Hammer by right

humerus. Other grave finds: tongs and coupler (No. 40), sword, 2 spearheads, possible wooden shield. Burial dates to C1st BC. [A]

References Stead 1976; Stead 1979, 11-15; Fell in Stead forthcoming (FD/CD, fig. 109).

No. 79. (Fig. A11) **HAMMER** **King Harry Lane, Herts** BMP

Description Hammerhead with a narrow rectangular cross pein and a square face. Steeply angled at the front and rear, the apex above the eye, the faces angled away from the front. The eye is circular but slit at the ends. L 60mm. Wt 20g. **Cross pein:** L 7.5mm; 1.5mm bevel on the rear side and along the face, rounded on front side; convex over width. **Square face:** c. 7 x 7mm beneath accretions; ?unburred.

Condition Complete. Metal core; fissured and fractured. Accretions obscure the surface.

Examination X-ray (1968).

Context/date Cemetery, Burial 456 (inurned adult cremation). Other grave finds: 2 iron nails, imported Barbotine beaker (the urn). Phase 2 of cemetery (AD 30 - 55). [D]

References Stead and Rigby 1989, 390, fig. 178; Fell 1989, 107.

No. 80. (Fig. A11) **HAMMER** **Oare, Wilts** DM

Description Hammerhead with two rectangular cross peins. Steeply angled at the front, the apex above the eye, the rear straight. The oval eye tapers from the front to the rear. L 82.5mm. Wt 50g. **Larger face:** 11.5 x 6.0mm; convex; spalled, ?burred at rear of face. **Smaller face:** 9.5/8.5 x 6.0mm (broader at front); angled to the front.

Condition Complete. Metal core; surface losses from the larger face.

Context/date From a rubbish pit from presumed adjacent occupation. Pottery from pit dates to early and mid C1st AD. Some iron slag in the pit. [D]

Reference Cunnington 1909, 134, pl. II, E.

No. 81. (Fig. A12) **HAMMER** **Hod Hill, Dorset** BMP: 1892 9-1 1262

Description Hammerhead with two much thickened and burred faces; both ?rectangular - a cross pein and a straight pein (inferred from the cross-section behind the faces). Angled at the front, the apex above the central oval eye; straight at the rear. L 66mm. Wt 42g. **Cross-pein:** 10 x 6.5mm (8mm behind burr), 14 x 7mm (+ burr); convex; angled away from the front. **Straight-pein:** 9 x 11mm (7mm behind burr), 12 x 13mm (+ burr).

Condition Complete. Metal core; fissured and surface flaked. Accretions obscure the faces.

Context/date Surface find from ploughing; may be Iron Age or from the Claudian fort. Form suggests Iron Age date. (Durden Coll. 44.689.) [C]

References Brailsford 1962, 14, G40; Manning 1985, 6, A7, pl. 2.

No. 82. (Fig. A12) **HAMMER** **Rudston, N. Humberside** BMP

Description Hammerhead with a square face and a rectangular straight pein. Angled at the front, the apex above the eye; arced at the rear; faces angled away from the front. The eye is oval and retains part of the hafting of mature Buxus sp. [Box] (J. Watson pers comm.) and two (iron?) wedges. L 73mm. Wt 43g. **Square face:** 8 x 8mm; flat, burred. **Straight pein:** 7 x 10mm; damaged, losses.

Condition Complete. Metal core; corroded and fissured. Accretions partly obscure detail.

Examination X-ray (1971, 1987).

Context/date Cemetery, Burial R87, young ?male inhumation, E/W, extended. Hammer at left of hips. Other grave find: large iron blade. Burial dates to C1st BC. [A]

References Stead 1976; Stead 1979, 11-15; Fell in Stead forthcoming (FG/BY, fig. 105).

No. 83. (Fig. A12) **HAMMER** **Hod Hill, Dorset** BMP: 1892 9-1 1263

Description Hammerhead with a square(?) face and a rectangular straight pein (inferred from the cross-section behind the burred faces). Arced at the front, the rear essentially straight. Both faces are angled away from the front and are thickened and much burred. L 77mm. Wt 60g. **Square face:** 11 x 11mm (7mm behind burr), 14 x 14mm (+ burr); ?originally square but now slightly damaged. **Straight-pein:** (6mm behind burr) 7 x 11mm, (+ burr) 12 x 14mm.

Condition Complete. Metal core; flaked faces and sides.

Context/date Surface find from ploughing; may be Iron Age or from the Claudian fort. Form suggests Iron Age date. (Durden Coll. 44.688.) [C]

References Brailsford 1962, 14, G41, fig. 13; Manning 1985, 6, A8, pl. 2..

No. 84. (Fig. A12) **HAMMER** **Glastonbury, Somerset** SCM

Description Hammerhead with a broad rectangular cross pein and an almost square (straight-peined) face. Arced, the faces angled away from the front; expanded about the eye. Large, elongated oval eye which retains traces of carbonised wood. L 58mm. Wt 17g. **Cross pein:** 8.5 x 7mm (behind burr), 12 x 10mm (+ burr); convex, c. 12mm R. **'Square face':** 9.5 x 10mm (behind burr), 13.5 x 13.5mm (+ burr); convex, c. 12mm R.

Condition Complete. Metal core; fissured; distorted through corrosion. ?Haematite present.

Examination X-ray (1985). Metallography: **Appendix B,** S35.

Context/date Mound 70, 5½ft [1.68m] N of the central picket, in the peat under the clay floors. Found within 10m of ferrous slag and a crucible. C2nd BC - mid C1st AD. [A]

Reference Bulleid & Gray 1911, fig. 48, I90; 1917, 380-1, I90.

No. 85. HAMMER ? **Santon, Norfolk** missing

Description ?Hammerhead, fractured near the eye. Published photograph suggests this may be a hammerhead though it is described as a pick-head.

Context/date From a hoard of metalwork found in a cauldron, including tongs Nos 41 and 42, file No. 136, scrap copper alloy, and other metalwork comprising late Iron Age, and early Roman types (e.g. Claudian brooches). Deposition c. AD 60. [E]

Reference Smith 1909, 158, pl. XVII, 1 (centre).

No. 86. (Fig. A12; Plate IIb) HAMMER **Bredon Hill, Glos** BMAG

Description Hammerhead with an almost square face and a burred sub-rectangular straight pein. Arced at front and rear, the faces angled away from the front. Expanded about the rectangular eye. L 82mm (complete). Wt 172g. **Square face:** 18 x 17mm, now rather angular across the face; slightly convex? **Straight pein:** 14/18 x 18mm, narrower at front edge; burred and thickened at rear edge; slightly convex?.

Condition Complete. Metal core; surface losses; coatings obscure detail.

Examination Metallography: **Appendix B**, S36.

Context/date Inner gateway, massacre level. Final Period, early-mid C1st AD. [A]

Reference Hencken 1938, 74, no. 2, fig. 6.

No. 87. (Fig. A12*) HAMMER **The Caburn, Sussex** MSA

Description 'Small hammer-head, perforated in the middle for hafting. One end appears to have been burred out by use.' (Curwen 1927, 12). L c. 66mm (inc, fractured across the body, one face missing). The extant face is broad and much burred; fractured at one side. Oval eye of hour-glass form. (After Curwen 1927).

Context/date Pit 101. Probably late in occupation period; later Iron Age. [A]

Reference Curwen 1927, 12, no. 16, pl. IV.

No. 88. (Fig. A12) HAMMER ? **Sheepen, Essex** CEM

Description Possible hammerhead with a rounded-rectangular face and a round face. Large central rectangular eye, with a corresponding expansion in the sides. Both faces are thickened and possibly burred. L 87mm. **Rectangular face:** c. 11.5/10.5 x c. 13mm (behind burr, broader at the front), 13/11 x 14.5mm (+ burr); flat. **Round face:** Diam c. 12mm (behind burr), 13.5mm (+ burr); ?flat.

Condition Complete. Metal core. Surface detail and the eye obscured by accretions.

Examination X-ray (1988).

Context/date Unstratified in Region 1, area H, Period IV, AD 49-61. [C]

Reference Hawkes and Hull 1947, 343, pl. CV, 2 (described as a bridle-cheekpiece).

No. 89. (Fig. A12; Plate IIb) **HAMMER** **Bredon Hill, Glos** BMAG

Description Hammerhead with a sub-rectangular cross pein and a burred square face. Arced at the front, the faces angled to the front of the hammer. Expanded about the rectangular eye. L 65mm. Wt 49g. **Cross pein:** 10/11 x 8mm, narrower at front edge. **Square face:** 9.5 x 9.5mm (behind burr), 15 x 10mm (+ burr).

Condition Complete. Surface losses; metal core; coatings obscure detail.

Examination X-ray (1985). Metallography: **Appendix B,** S37.

Context/date Inner gateway, massacre level. Final period; early-mid C1st AD. [A]

Reference Hencken 1938, 73-4, no. 1, fig. 6.

No. 90. (Fig. A13) **HOT SET** **Hod Hill, Dorset** BMP: 1960 4-5 3242

Description Rectangular in section, tapering to the straight, narrow, cutting edge. Expanded about the rectangular eye. Large, much burred and domed head. L 165mm. Wt 1351g. **Cutting edge:** W 25mm, T (extant) 3mm. **Stem:** W (max, at eye) 41mm. **Head:** (+ burr) 70 x 50mm, (below burr) 59 x 37mm. **Eye:** L x W 44/47 x 20mm.

Condition Complete; superficial corrosion, possibly slight losses from the cutting edge.

Context/date Surface find from ploughing. May be IA or from the Claudian fort. (Bean Coll.) [E]

Reference Manning 1985, 31, C3, pl. 13.

No. 91. (Fig. A13) **HOT CHISEL** **Hunsbury, Northants** NCM: D331 1956-7

Description Round in section at the upper stem, rounded-rectangular thereafter. Slightly splayed cutting edge. Thickened head. L 283mm. **Cutting edge:** W (extant) 11.6mm. **Stem:** Diam (MP) 10mm. **Head:** 17 x 15.5mm.

Condition Complete. Metal core; fissured and spalled. Stripped: losses from the cutting edge and head; coatings obscure the surface.

Examination Analysis: Ehrenreich 1985, 212, HNY23b. Metallography: **Appendix B,** S41.

Context/date Discovered during quarrying. C5th/4th BC - C1st BC/early C1st AD. [E]

Reference Fell 1936, 66, no. 9.

No. 92. (Fig. A13*) **HOT CHISEL ?** **Glastonbury, Somerset** missing?

Description Head and the greater part of the stem of a ?hot chisel, the cutting edge missing. 'Long bolt, found in a much corroded condition in five pieces ... length 258mm.... The head is of oblong form, measuring 24mm. by 16mm.; height of head about 9mm. At a short distance from the head the bolt is of round section, with a diam. of 12mm, tapering to about 10mm. at the smaller end.' (Bulleid and Gray 1917, 388.)

Context/date Mound 75, 9ft [2.74m] ENE of the central picket, in black earth below clay. Same mound yielded file No. 161 and non-ferrous metal debris; adjacent mound yielded files Nos 130 and 133, ferrous slag and bronze debris. C2nd BC - mid C1st AD. [A]

Reference Bulleid and Gray 1917, 388, I108, fig. 137.

No. 93. (Fig. A13) **HOT CHISEL** **Bigbury, Kent** MM

Description Round-sectioned stem, slightly tapering, becoming rounded-rectangular towards the tip. Bent cutting edge, ?splayed. Flat round head, thickened stem. L 239mm (inc). **Cutting edge:** W (est.) c. 18mm. **Stem:** Diam (MP) 12mm. **Head:** Diam (max) 18mm.

Condition Metal core; fissured and fractured at the cutting edge. ?Sampled at the head.

Context/date Considered to be from Bigbury; possibly found in 1887, during gravel quarrying. ?Mid/late C1st BC. [E]

Reference Unpublished; (Jessop 1932, 95-7).

No. 94. (Fig. A13) **HOT CHISEL** **Hunsbury, Northants** NCM: D332 1956-7

Description Tapering stem, round in section becoming rectangular c. 30mm from the tip. Domed circular head, the stem much thickened beneath. L 229mm (≈ complete). **Cutting edge:** W (extant) 9mm. **Stem:** Diam (MP) 11/12mm. **Head:** Diam (max) 25.5mm.

Condition Metal core; stripped; surface losses. Much damaged at the cutting edge.

Examination Analysis: Ehrenreich 1985, 212, HNY18a. Metallography: **Appendix B,** S42.

Context/date Discovered during quarrying. C5th/4th BC - C1st BC/early C1st AD. [E]

Reference Fell 1936, 66, no. 9.

No. 95. (Fig. A13) **HOT CHISEL** **Bigbury, Kent** McM: 35811

Description Tapering stem, round in section becoming rounded-rectangular c. 70mm from the tip. Straight cutting edge. Large flat round head, the stem thickened beneath. L 225mm (≈ complete). **Cutting edge:** W (est.) c. 13.5mm, (extant) 9mm; T (extant) 1.7mm. **Stem:** Diam (MP) 12mm. **Head:** Diam (max) 28mm.

Condition Metal core; stripped; likely to have surface losses. Cutting edge slightly damaged.

Examination Analysis: Ehrenreich 1985, 207, B6b. Metallography: **Appendix B,** S40.

Context/date Discovered during gravel quarrying, c. 1895, possibly with hammers Nos 63 and 68. ?Mid/late C1st BC. [E]

References Boyd Dawkins 1902, 215, pl. II, 4c; Thompson 1983, 265, fig. 19, 52.

No. 96. (Fig. A14) **HOT CHISEL ?** **Rainsborough Camp, Northants** OAM: 1969.656

Description Round-sectioned stem, fractured and bent at the tip, the edge missing. Circular, flat head, thickened. L 210mm (inc). **Stem:** Diam (MP) c. 9mm. **Head:** Diam (max) 14mm.

Condition Incomplete, the cutting edge missing. Accretions and coatings obscure the surface.

Context/date North Guard Room R19. Phase 2b: ?early 4th century BC. [A]

No. 97. (Fig. A14) **HOT CHISEL** **Ham Hill, Somerset** SCM

Description Tapering stem, rectangular in section. The straight cutting edge has a 4mm bevel on both sides. Flat burred head. L 218mm. **Cutting edge:** W 14mm, T 1mm. **Stem:** (MP) 19 x 8mm. **Head:** (+ burr) 22 x 13mm, (below burr) 22 x 8mm.

Condition Complete. Superficially corroded. Very slight losses from the cutting edge.

Context/date A1605. WWW 1901. Context not recorded; probably from the Walter collection, predominantly from the northern spur, which largely comprised Iron Age and C1st Roman deposits. See also hammer No. 76 and file No. 132. May not be Iron Age. [E]

Reference Unpublished; (Burrow 1981, 198-9, 268-73).

No. 98. (Fig. A14) **HOT CHISEL** **Worthy Down, South Wonston, Hants** WCM

Description Almost square in section, slightly splayed at the tip. Straight cutting edge, bevelled on both sides. Much burred head. L 210mm. **Cutting edge:** W 17mm. **Stem:** (MP) 16 x 14mm. **Head:** (+ burr) 29 x 31mm, (below burr) 17 x 17mm. Dimensions from X-ray.

Condition Complete. Superficial corrosion.

Examination X-ray (1985).

Context/date SF705. Context 5310, in Middle Iron Age grain storage pit. [A]

Reference R. Whinney forthcoming.

No. 99. (Fig. A14) **HOT CHISEL** **Meare Village East, Somerset** SCM

Description Round or rounded-rectangular in section at the top of the stem, rectangular at the centre and lower stem. Convex cutting edge, ?bevelled. Burred circular head. L 210mm. **Cutting edge:** W 13mm. **Stem:** (MP) 13 x 8mm. **Head:** (max) 29 x 22mm.

Condition Complete. Much corroded; 2 fractures across the stem; accretions obscure detail.

Context/date Top of Mound 19. Mound also yielded ferrous slag. C2nd BC - mid C1st AD. [E]

References Orme et al. 1983, 68-9, no. 339, fig. 68; Coles 1987, 130, I82.339, fig. 3.55.

No. 100. (Fig. A14) **HOT CHISEL** **Hunsbury, Northants** NCM: D334 1956-7

Description Rectangular section, thickened in width near the top. Bent sideways at the incomplete cutting edge. L 205mm (≈ complete). **Cutting edge:** W 10mm. **Stem:** W (max) 22mm, (MP) 12 x 6mm. **Head:** (+ burr) 17.5 x 12mm, (below burr) 15 x 7mm.

Condition Metal core; stripped; some losses from the surface. Cutting edge damaged.

Examination Analysis: Ehrenreich 1985, 212, HNY21a. Metallography: **Appendix B,** S44.

Context/date Discovered during quarrying. C5th/4th BC - C1st BC/early C1st AD. [E]

Reference Fell 1936, 66, no. 9.

No. 101. (Fig. A14) **HOT CHISEL ?** **Glastonbury, Somerset** SCM

Description Head and part of the stem of a ?hot chisel. The top 70mm of the stem is round in

section, thereafter square. Circular domed head, thickened and much burred. L 100mm (extant). **Stem:** Diam 14mm. **Head:** Diam (+ burr) 29mm, (below burr) 16mm.

Condition — Totally corroded; stable. Corrosion fractured across the stem.

Context/date — Mound 41, 6.75ft [2.06m] ESE of the central picket. Found 10m from file No. 146. C2nd BC - mid C1st AD. [B]

Reference — Bulleid and Gray 1917, 388, I35, pl. LXI.

No. 102. (Fig. A14) **HOT CHISEL** **Gussage All Saints, Dorset** DCM

Description — Round in section near the head, square at the centre, rectangular and tapering in thickness thereafter. Slightly bent near the tip. The cutting edge is slightly convex and ?bevelled. Slightly domed, circular head, the stem thickened beneath. L 182mm. **Cutting edge:** W 15mm. **Stem:** (MP) 13mm square. **Head:** Diam (max) 21mm.

Condition — Complete. Superficially corroded. Soil obscures detail of the edge.

Examination — AML727940. X-ray (1973).

Context/date — Pit 359 layer 5. Phase 3: C1st BC/AD. [B]

References — Wainwright 1979, 108, no. 1105, fig. 82; Fell 1988, 74, no. 2.

No. 103. (Fig. A14) **HOT CHISEL** **Hunsbury, Northants** NCM: D333 1956-7

Description — Round section at the top 40mm of the stem, thereafter rectangular and tapering in thickness. Slightly bent at mid-length. Straight cutting edge. Flat, circular burred head. L 182mm (≈ complete). **Cutting edge:** W (est.) 13mm, (extant) 5mm. **Stem:** (MP) 15 x 8mm. **Head:** Diam (+ burr) 20/22mm, (below burr) 15/16mm.

Condition — Damaged cutting edge. Metal core; stripped; surface obscured by coatings.

Examination — Analysis: Ehrenreich 1985, 211, HNY10b. Metallography: **Appendix B,** S43.

Context/date — Discovered during quarrying. C5th/4th BC - C1st BC/early C1st AD. [E]

Reference — Fell 1936, 66, no. 9.

No. 104. (Fig. A15) **HOT CHISEL** **Hunsbury, Northants** NCM: D335 1956-7

Description — Rounded-rectangular sectioned stem, splayed and slightly bent near the tip. Straight cutting edge. Burred head. L 181mm (≈ complete). **Cutting edge:** W (est.) 18mm, (extant) 14mm. **Stem:** (MP) 14 x 8.5mm. **Head:** W (max) 13mm.

Condition — Metal core; fissured and spalled; stripped. Losses from the head and cutting edge.

Examination — Analysis: Ehrenreich 1985, 213, HNY55b. Metallography: **Appendix B,** S45.

Context/date — Discovered during quarrying. C5th/4th BC - C1st BC/early C1st AD. [E]

Reference — Fell 1936, 66, no. 9.

No. 105. (Fig. A15) **CHISEL** **Weelsby Avenue, S. Humberside** GWG

Description — Slender stem, round in section at the head, oval at the centre, rounded/oval near

the cutting edge. Slightly splayed over the terminal 10mm; straight cutting edge, bevelled on both sides. Burred head. L 181mm. **Cutting edge:** W (est.) c. 9.5mm, (extant) 8.5mm. **Stem:** (MP) 10 x 9mm. **Head:** Diam (+ burr) 9mm, (below burr) c. 7mm.

Condition — Complete other than a slight loss from the cutting edge, but much fissured and fractured. Now in 2 pieces. Metal core.

Examination — X-ray (1988).

Context/date — (F1 59.2 SF18). W sector of main ditch in dump comprising waste from iron-smithing, bronze-founding and wrought working, and chisel/punch No. 204. Mid C1st BC. [A]

Reference — J. Sills forthcoming.

No. 106. (Fig. A15) **CHISEL** **Hod Hill, Dorset** BMP: 1960 4-5 3268

Description — Long slender chisel, possibly a hot chisel for fine work, or a cold chisel. Rectangular section. Damaged ?straight cutting edge which appears to be bevelled on one side. Burred head. L 167mm (≈ complete). **Cutting edge:** W (extant) 13mm. **Stem:** (MP) 14 x 8 mm. **Head:** (+ burr) 16 x 14mm, (below burr) 13 x 10mm.

Condition — Much fissured and fractured; losses from the head, stem, and the cutting edge.

Context/date — Surface find from ploughing. May be IA or from the Claudian fort. (Bean Coll.) [E]

Reference — Manning 1985, 9, A22, pl. 5.

No. 107. (Fig. A15) **COLD CHISEL** **Madmarston, Oxon** OAM: 1969.777

Description — Round section, becoming rounded-rectangular and very slightly splayed at the damaged cutting edge. Flat, circular and slightly burred head. L 148mm (≈ complete). **Cutting edge:** W (est.) c. 11mm, (extant) 7mm. **Stem:** Diam (MP) 9mm. **Head:** (+ burr) 11 x 10mm, (below burr) 10.5 x 10mm.

Condition — Stripped and coated; surface losses from the stem and the cutting edge.

Context/date — Behind inner rampart, above pre-rampart surface: end C2nd BC - mid C1st AD. [A]

Reference — Fowler 1960, 44, no. 18, fig. 18, 11.

No. 108. (Fig. A15) **HOT SET/CHISEL** **Hunsbury, Northants** NCM: D336 1956-7

Description — Slender hot set, or chisel. Square section, tapering near the tip. There is an oval eye just below the flat burred head. L 132mm (≈ complete). **Cutting edge:** W (est.) c. 10mm, (extant) 4mm. **Stem:** (MP) 8mm square. **Head:** (+ burr) 11 x 14.5mm, (below burr) 8 x 9.5mm. **Eye:** 8 x 6mm.

Condition — Metal core; stripped; losses especially from the cutting edge.

Examination — Analysis: Ehrenreich 1985, 212, HNY20a. Metallography: **Appendix B**, S38.

Context/date — Discovered during quarrying. C5th/4th BC - C1st BC/early C1st AD. [E]

Reference — Fell 1936, 66, no. 9.

No. 109. (Fig. A15) **CHISEL** **Danebury, Hants** OIA

Description ?Cold chisel. Round section at the stem top, broader at mid-stem, rect-angular at the tip. Narrow convex cutting edge. Much burred head. L 130mm. **Cutting edge:** W 13.5mm, T 1.7mm. **Stem:** (MP) 17 x 11mm. **Head:** Diam (+ burr) 25mm, (below burr) 17mm.

Condition Complete. Superficially corroded.

Examination Analysis: Ehrenreich 1985, 211, D185-6. Metallography: Salter 1984, 435, Mf. 13:C4, nos D185 and D186.

Context/date DA79 F68 layer 9 SF?1522: ceramic phase 7 (300 - 100/50BC). [A]

Reference B. Cunliffe forthcoming.

No. 110. (Fig. A15*) **COLD CHISEL ?** **South Cadbury, Somerset** XX

Description Tip of a cold chisel(?). Rectangular section; straight cutting edge. L (extant) 120mm. **Cutting edge:** W 12mm. **Stem:** (MP) 14 x 11mm. (After Spratling 1970b).

Context/date Area N, possibly a metalworking area, with associated hearths, scrap wrought bronze, scriber No. 222. Stratigraphy suggests C1st BC or early C1st AD. [A]

References Spratling 1970a, 190, fig. 3; Spratling 1970b, 14, no. 1, fig. p. 24, A.

No. 111. (Fig. A15) **COLD CHISEL** **Meare Village West, Somerset** SCM

Description Rectangular section. Straight cutting edge. Flat head, thickened. L 76.5mm. **Cutting edge:** W (est.) 13mm, (extant) 7mm. **Stem:** W (MP) 13mm. **Head:** 13 x 12mm.

Condition Complete in length but damaged at the cutting edge. Metal core; fissured.

Context/date Margin of Mound 38, 11½ft [3.5m] NE of central picket. Mound also yielded crucible sherds, ferrous slag, file No. 158 and punch No. 187. C3rd BC - mid C1st AD. [B]

Reference Gray and Bulleid 1953, 239, 156, pl. LI.

No. 112. (Fig. A15) **COLD CHISEL ?** **Twyn-y-Gaer, Gwent** NMW: 409-79

Description Rectangular section. Straight cutting edge, bevelled on one side. Domed, burred head. L 70mm. **Cutting edge:** W c. 11mm. **Stem:** (MP) 12 x 8mm. **Head:** (+ burr) 16 x 16mm, (below burr) 12 x 10mm.

Condition Complete. Metal core; detail obscured by accretions.

Examination X-ray (1987).

Context/date Not known. Occupation of site c. C5th BC - C3rd BC or later. [B]

Reference (Probert 1976, 115); L. Probert forthcoming.

No. 113. (Fig. A15) **COLD SET ?** **Worthy Down, Headbourne Worthy, Hants** WCM: 321.17

Description Cold set/chisel, or wedge. The lower stem is rectangular in section; the upper stem is concave on the opposing broad sides and convex on the narrow sides. Rounded blunt edge. Much burred, domed head. L 92mm. **Cutting edge:** W 17mm. **Stem:** (MP)

19 x 10mm. **Head:** (+ burr) 31 x 20mm, (below burr) 19 x 14mm.

Condition — Complete. Substantial metal core.

Examination — Analysis: Ehrenreich 1985, 215, WD11a. Metallography: Ehrenreich 1985, 63, fig. 3.9; Salter and Ehrenreich 1984, 156-7, fig. 10.9B; **Appendix B**, S39.

Context/date — Pit No. 2: early C2nd BC. [A]

Reference — Hooley 1931, 184, no. 45, pl. VI.

No. 114. (Fig. A15) **COLD SET ?** **Gussage All Saints, Dorset** DCM

Description — Cold set/chisel, or wedge. Rectangular section, expanding to the blunt edge. Much burred head, bent to one side, the stem necked just below the burr. L 65mm. **Cutting edge:** W 30mm. **Stem:** (MP) 24 x 10mm. **Head:** (+ burr) 20 x 13mm, (behind burr) T 10mm. **Shoulders:** 23 x 13mm. (Dimensions from X-ray.)

Condition — Complete. Metal core; accretions in situ.

Examination — AML727923. X-ray (1973, 1985).

Context/date — Pit 437 layer 3. Pit contained debris from bronze-founding and iron-smithing, and file No. 143, punches Nos 166, 167, 174 and 199, and ?scriber No. 229. Phase 2: C3rd BC - C1st BC. [A]

References — Wainwright 1979, 106, no. 1044, fig. 81; Fell 1988, 74, no. 1.

No. 115. (Fig. A15*) **COLD SET ?** **Maiden Castle, Dorset** DCM

Description — Cold set/chisel, or wedge. Rectangular section tapering to the broad edge. Much burred head. L c. 58mm. (complete). **Cutting edge:** W c. 23, T c. 7mm. **Head:** (+ burr) c. 38 x c. 30mm, (below burr) c. 27 x c. 18mm. (After Wheeler 1943)

Context/date — Eastern entrance; level dated c. AD 25-70. An iron-smithing area was situated just outside the east entrance. [E]

Reference — Wheeler 1943, 284, fig. 94, no. 6.

No. 116. (Fig. A15) **COLD SET ?** **Gussage All Saints, Dorset** BMP: [283]

Description — Cold set/chisel, or wedge. Rectangular section, tapering in thickness to the blunt edge. The head is unevenly burred and angled to one side. L 56mm. **Cutting edge:** W 23mm, T 2.2mm. **Stem:** (MP) 21 x 11mm. **Head:** (+ burr) 30 x 26mm, (behind burr) 25 x 13mm. (Dimensions from X-ray.)

Condition — Complete when excavated, now in 2 pieces as a result of metallography.

Examination — AML726204. X-ray (1973, 1987). Metallography: Tylecote 1975, 5-6, no. 283; Spratling et al. 1980, 284, no. 283; Tylecote and Gilmour 1986, 86, fig. 36.

Context/date — Pit 209 layer 11 0-5cm. Pit contained at least 20 other metalworking tools (files Nos 152-156, punches Nos 164, 169, 186, 191-193, 202, ?gravers Nos 207, 215-218, ?scribers Nos 221 and 228, and ?scraper/burnisher No. 230), debris from wrought and

cast bronzeworking, and iron-smithing. Phase 2: C1st BC. [A]

References Tylecote and Gilmour 1986, fig. 36; Fell 1988, 74, no. 3.

No. 117. (Fig. A15*) **COLD SET ?** **Groundwell Farm, Wilts** SM

Description Cold set, or wedge. Rectangular section, tapering; blunt edge. Much burred head. L 36mm (complete). **Cutting edge:** W 15mm. **Head:** W (max) 29mm. (After Gingell 1981).

Context/date Unphased structure ?associated with house 3: C5th BC - C3rd BC. [A]

Reference Gingell 1981, 64, no. 4, fig. 18.

No. 118. (Fig. A16*) **FILE** **Glastonbury, Somerset** missing

Description Incomplete file, the point and part of the tang missing. **Blade:** L (extant) c. 195mm. `Heavy file, much corroded, length 242mm. An iron ferrule, length 23.5mm., covers the upper part of the broken tang, and divides the file from the wooden handle which is still traceable. The file is of quadrangular section, max width 19mm., thickness 8mm.; at the top it tapers to a width of 10mm. The file-markings are at right angles to the length of the tool, and extend from the ferrule to the point. There are twenty-four grooves and the same number of ridges to the inch [9.5 cuts/cm] ... ' (Bulleid and Gray 1917, 387).

Context/date Mound 72: 10¼ft [3.12m] SSE of the central picket. Found within 5m of a `furnace'/hearth and copper alloy `dross'. C2nd BC - mid C1st AD. [B]

Reference Bulleid and Gray 1917, 387, 13, fig. 141; Cunliffe 1974, fig. 14:4, 7.

No. 119. (Fig. A16) **FILE** **Hunsbury, Northants** NCM: D326 1956-7

Description ?Complete file, rectangular section, cut on one broad side. Tapering to the rounded point. The cuts are transverse, raked forwards, and clearly defined. Tapering rectangular-sectioned tang. L 188mm. **Tang:** L 53mm. **Blade:** L 135mm, (cut length = 132mm); W x T (max) 7.5 x 11mm, (min) 4.3 x 3.0mm. **Cuts:** 6.5/cm; D c. 0.4mm. (Only 4 cuts in 14mm near the tang, D 0.7mm).

Condition Complete at the point, ?complete at the tang (coatings obscure detail). Metal core.

Examination X-ray (1984). Analysis: Ehrenreich 1985, 214, HNY68a. Metallography: **Appendix B**, S47.

Context/date Discovered during quarrying. C5th/4th BC - C1st BC/early C1st AD. [E]

Reference Unpublished.

No. 120. (Fig. A16) **FILE** **Meare Village East, Somerset** SCM

Description Almost complete file, sub-rectangular section, cut on the broadest side. Tapering to the rounded point. The cuts are transverse, unevenly cut, raked forwards, rounded and ?worn. Tapering rectangular-sectioned tang. L 189mm (inc). **Tang:** L

43mm (inc). **Blade:** L 146mm; W x T (max) 9.0 x 6.0mm, (min) 3.6 x 2.2mm. **Cuts:** 12/cm near the tang, 10.5 - 11.5/cm (MB), 13/cm towards the point; D to 0.4mm.

Condition Recent fracture at tang tip. Fissured; some surface losses; metal core. Now repaired from 2 major fragments; a 3rd fragment (Gray's catalogue entry indicates that there were originally 3 frags) is lost (presumably from the tang tip).

Examination X-ray (1985). Metallography: **Appendix B**, S48

Context/date Mound 10, 3ft [0.91m] WSW of the central picket, on surface of top hearth. Mound also yielded anvil No. 52. C2nd - mid C1st AD. [B]

Reference Coles 1987, 120, 110, fig. 3.47.

No. 121. (Fig. A16; Plate Vb) **FILE** **Weelsby Avenue, Grimsby, S. Humberside** GWG

Description File blade fragment, cut on one side. Tapering, rectangular section. The ridges are transverse, raked forwards, but poorly defined. The broad end of the fragment appears to be uncut for 20mm (? the tang junction). L 55mm (inc); W x T (max) 7.7 x 4.0mm, (min) 6.0 x 3.3mm. **Cuts:** 11/cm, D c. 0.3mm.

Condition Ancient fracture at the broad end, recent fracture at the narrow end. No metal core; poorly preserved and distorted.

Examination X-ray (1989).

Context/date (NFH). SW sector of main ditch, in debris dump comprising waste from iron-smithing, bronze founding and wrought working, files Nos 122, 144, 151, 157, and punch No. 179. Mid C1st BC. [A]

Reference J. Sills forthcoming.

No. 122. (Fig. A16; Plates IVb and Vb) **FILE** **Weelsby Avenue, Grimsby, S. Humberside** GWG

Description File fragment; tang and part of blade. Plano-convex section, slightly tapering, cut on the flat side. The ridges are transverse, raked forwards, and clearly defined. Two non-ferrous inclusions in the cuts. Tapering tang, rectangular in section but marginally rounded near the blade. L 91mm (inc). **Tang:** L 45mm. **Blade:** L 46mm (inc); W x T (max) 8.7 x 4.8mm, (min) 7.0 x c. 2.5mm. **Cuts:** 7 - 8/cm, D (max) 1mm.

Condition Recent fracture across the blade. Metal core.

Examination X-ray (1989); Metallography: **Appendix B**, S49.

Context/date (FKJ). SW sector of main ditch, in debris dump comprising waste from iron-smithing and bronze founding and wrought working, files Nos 121, 144, 151, 157, and punch No. 179. Mid C1st BC. [A]

Reference J. Sills forthcoming.

No. 123. (Fig. A16) **FILE** **Danebury, Hants** AMIA

Description Almost complete file, tapering plano-convex section, cut on the flat side. Slightly

bent at the point. The ridges are transverse and raked forwards. Broad, plano-convex sectioned tang junction. L 68mm (inc). **Blade:** L (extant) 56.5mm; W x T (max) 8.0 x 2.8mm, (min) 3.2 x 2.0mm. **Cuts:** 7 - 8/cm.

Condition Slight loss from the point; and fractured across the tang. Fissured and fractured and distorted though corrosion. Partial metal core. Surface obscured by accretions.

Examination Analysis: Ehrenreich 1985, 210, D133-134. Metallography: Salter 1984, 435, Mf13:C4.

Context/date DA77 layer 393 SF1227; doorway of CS7/8. Ceramic phase 7 (300 - 100/50 BC). [A]

Reference Sellwood 1984, 354, no. 2.55, fig. 7.12, Mf 9:C6, 1227.

No. 124. (Fig. A16) **FILE** **Wetwang Slack, N. Humberside** XX

Description File fragment; tang and part of blade. Plano-convex section, tapering, cut on the flat side. The ridges are transverse, unevenly spaced, raked forwards, and clearly defined. Square-sectioned tapering tang. L 63mm (inc). **Tang:** L 26mm. **Blade:** L (extant) 37mm; W x T (max) 9.5 x 5.5mm. **Cuts:** 6.5 - 7.5/cm, D 0.3 - 0.8mm.

Condition Recent fracture across the blade. Partial metal core; fissured, distorted.

Examination X-ray (1988). Metallography: **Appendix B,** S50.

Context/date Tr VII WE249 II. Feature contained residual IA pottery and bronze-working debris. Later Iron Age or Romano-British. [E]

Reference J. Dent forthcoming (no. 2.12).

No. 125. (Fig. A16) **FILE ?** **Bagendon, Glos** CMC

Description Almost complete ?file, tapering, rectangular section. There are a few transverse lines on one side (c. 10 - 15/cm). Slightly bent sideways near the point. Tapering rectangular-sectioned tang. The overall form and presence of some transverse markings suggest that this was a file. L 144mm (inc). **Tang:** L 38mm. **Blade:** L (extant) 106mm; W x T (max) 7.8 x 6.2mm, (MB) 7.0 x 2.0mm.

Condition Incomplete at the point. Metal core; little original surface surviving (stripped).

Context/date Not known. See also bench anvil No. 54. [E]

Reference Clifford 1961, 192, pl. XLVIII, 4.

No. 126. (Fig. A16) **FILE** **Gussage All Saints, Dorset** DCM

Description Complete file, rectangular section tapering to the rounded point, cut on the 2 opposing broad sides. Transverse ridges, unevenly cut, upright or raked forwards, shallow and ?worn. Two copper inclusions in the cuts. Rectangular sectioned tang with traces of wood. L 139mm. **Tang:** L 37mm. **Blade:** L 102mm; W x T (max) 7.5 x 5mm, (min) 3 x 2mm. **Cuts:** 10 - 15/cm on one side, 7 - 13/cm on the other; D c. 0.1mm.

Condition Metal core; well-preserved.

Examination AML727918. X-ray (1973, 1983). Metallography: Fell 1985; **Appendix B,** S51.

Inclusions: Table 3:8, G-H, Fig. 3:6, G-H.

Context/date Pit F410 Layer 6 (above a burial). Phase 3 (C1st BC/AD). [B].

References Wainwright 1979, 108, no. 1066, fig. 82; Fell 1985; 1988, 74, no. 13.
This is the file mentioned by Tylecote in Tylecote and Gilmour 1986, 106.

No. 127. (Fig. A16*) **FILE** **Midsummer Hill, Here & Worc** BMAG

Description `File of square section, the thin end curled over and broken. Seven low teeth survive on one face within 10mm; there is one possible tooth on an adjacent face.' (Stanford 1981, 128). L (inc) c. 83mm (after Stanford 1981).

Condition Incomplete at both ends. Now (1985) much fissured and fractured.

Context/date SF130. Unstratified in T32. `Probably Iron Age'. [E]

Reference Stanford 1981, 128, fig. 59, 5.

No. 128. (Fig. A16, Pl. IVa) **FILE** **Fiskerton, Lincs** XX

Description Fragment of a file blade, tapering square section, cut on three sides. The ridges are transverse, poorly preserved, raked towards the narrow end (some are upright). L 78mm; W x T (max) 10 x 10mm, (min) 6 x 6 mm. **Cuts:** 7 - 9/cm; D to 0.8mm.

Condition Totally corroded, partly voided, distorted, corrosion damaged at both ends.

Examination X-ray (1981-3).

Context/date SF171. From possible ritual deposit(s) found near a C5th/4th BC causeway. Group includes 9 other metalworking tools (Nos 31, 54, 55, 62, 71, 135, 142, 145, 172), woodworking tools, and a float whose handle dates stylistically to C4th BC. [A]

Reference V. Fell forthcoming.

No. 129. (Fig. A17) **FILE** **Glastonbury, Somerset** SCM

Description Fragment of a file, cut on 4 sides. Now in 3 pieces. The complete end (the shortest fragment) is rectangular-sectioned (13.0 x 5.5mm) and appears to be uncut for at least 61mm, possibly the handle. Over the greater length, the section is square with angled corners (10.5 x 10mm), the cuts traceable on all 4 sides. Transverse cuts, poorly preserved, rake not discernible. There is a copper alloy `rod' of uneven wedge section (c. 3 x 1.5mm at one end) inside the two longer (cut) fragments of the file. The X-ray suggests that the copper alloy is discontinuous; possibly copper alloy waste (e.g. droplets), or may be a rod incorporated (?accidentally) during forging. Lengths 74mm, 54mm, 27.5mm. **Cuts:** 11/cm (range 10.5 - 11.5/cm); D to 0.5mm.

Condition Severely corroded, partly voided, distorted by corrosion pressures. Surface detail poorly preserved. No ferrous metal core.

Examination X-ray (1985).

Context/date Mound 15: 5¼ft [1.60m] NW of the central picket. A few crucible sherds were found in the adjacent mound. C2nd BC - mid C1st AD. [B]

Reference Bulleid and Gray 1917, 388, I84.

No. 130. (Fig. A17) **FILE** **Glastonbury, Somerset** SCM

Description File fragment, rectangular section tapering at both ends, cut on 4 sides. Both ends are incomplete; the broader end is fractured longitudinally to a point, the other is blunt but also damaged (bent 50mm from this end). The ridges are transverse, unevenly spaced, and poorly preserved; the majority are raked towards the narrow end, though some ridges near the narrow end (over terminal 40mm) are raked in the reverse direction. The overall form suggests that the broad end was tanged. However, file cuts are visible at both ends which suggests that the file may have been reformed, or is substantially incomplete. L 152mm (inc, bent), L (extant, if straight) 154mm; W x T (max) 9.0 x 7.5mm. **Cuts:** 7 - 10.5 cuts/cm; D to 0.6mm.

Condition Fractures may be ancient(?). Bent (?modern damage). Metal core; surface distortion.

Examination X-ray (1985). Metallography: **Appendix B,** S52.

Context/date Mound 74, 9½ft [2.9m] S of the central picket, in the section dug 1902 at the level of the 3rd floor. Same mound yielded file No. 133, crucible sherds, ferrous slag, and copper alloy waste metal. Adjacent mound yielded file No. 161 and hot chisel No. 92. C2nd BC - mid C1st AD. [A]

Reference Bulleid and Gray 1917, 388, I102, fig. 137.

No. 131. (Fig. A17) **FILE** **Whitcombe, Dorset** DCM

Description File, tapering, square section, cut on 4 sides. The ridges are transverse, raked forwards, but poorly defined. The square-sectioned tapering tang retains traces of mineralised wood. L (extant) 107mm; L (original, complete) 130mm. Originally 2 fragments, L 114mm & 17mm (the tip, now lost). **Tang:** L (complete) 37mm. **Blade:** L (original, complete) 93mm; W x T (max) 8 x 7mm. **Cuts:** 8 - 11/cm; D c. 0.5mm.

Condition Complete when originally X-rayed (both ends rounded), but in 2 pieces, the blade tip fragment now missing. Much fissured, fractured, and distorted.

Examination X-ray (original R1067 at AML, 1970. Also 1984).

Context/date Cemetery: Burial 12. Young male inhumation, SE, crouched. Other grave goods: hammer No. 67, sword, scabbard fittings, spearhead, copper alloy brooch and unidentified object, chalk disc. Burial probably dates to first half of C1st AD. [B]

References (Aitken 1967; Collis 1972, 125-6, fig. 2; Whimster 1981, 261-2, 345-6); Aitken and Stead forthcoming.

No. 132. (Fig. A17) **FILE** **Ham Hill, Somerset** SCM

Description Almost complete file, tapering, rectangular section, cut on 4 sides. The ridges are transverse, unevenly cut, and some are raked forwards. Tapering rectangular-sectioned tang. L (extant) 97mm. **Tang:** L (extant) 22mm. **Blade:** L (extant) 75mm; W x T (max) 8.8 x 7.0mm. **Cuts:** typically 10 - 12.5/cm (range 6 - 12.5/cm, the finer towards the point); D to 0.5mm.

Condition Slight losses from both ends and from the surface. Much fractured, fissured and distorted. Partial metal core.

Examination X-ray (1985). Metallography: **Appendix B**, S53.

Context/date (1901 WWW); context not recorded. Probably from the Walter, predominantly from the northern spur, which largely comprised Iron Age and C1st Roman deposits. See also Hammer No. 76 and hot chisel No. 97. May not be Iron Age. [E]

Reference Unpublished; (Burrow 1981, 198-9, 268-73).

No. 133. (Fig. A17) **FILE** **Glastonbury, Somerset** SCM

Description Almost complete file, tapering, rectangular section, cut on 4 sides. The ridges are transverse, raked forwards, unevenly cut and corrosion damaged. Tang: rectangular-sectioned tapering. L 82mm (inc). **Blade:** cut L (extant) 49mm; W x T (max) 7.5 x 5.0mm. **Cuts:** 10/cm (range 9 - 12/cm); D 0.4mm.

Condition Incomplete; recent fracture across the point, complete at tang. Fractured, spalled, distorted through corrosion. Partial metal core. Traces of ?haematite on the tang.

Examination X-ray (1985). Metallography: **Appendix B**, S54.

Context/date Mound 74 near the edge, 16ft [4.88m] WNW of the central picket, within the peat. Same mound yielded file No. 130, crucible sherds, ferrous slag, and copper alloy waste metal. Adjacent mound yielded file No. 161 and hot chisel No. 92. C2nd BC - mid C1st AD. [B]

Reference Bulleid and Gray 1917, 388, I98, fig. 137.

No. 134. (Fig. A17) **FILE** **Meare Village West, Somerset** SCM

Description File blade fragment, cut on 4 sides. Rectangular section, tapering in width. The cuts are transverse on one side; the other 3 sides have both diagonal and transverse cuts. Some of the ridges are raked to the narrow end of the file. L (extant) 55mm; W x T (max) 10 x 6mm. **Cuts:** 10 - 13/cm; D to 0.5mm.

Condition Corrosion fractured at both ends. Poorly preserved. No metal core.

Examination X-ray (1985).

Context/date Mound 39, 7½ft [2.28m] SE of the central picket. Mound also yielded copper alloy waste metal and a crucible sherd. C3rd BC - mid C1st AD. [B]

Reference Gray and Bulleid 1953, 247, I116.

No. 135. (Fig. A17) **FILE ?** **Fiskerton, Lincs** XX

Description Fragment of a knife file blade (?), cut on two sides. Tapering; wedge section, flat on one side, slightly convex on the other, and uncut on the flat back. The ridges are shallow and discontinuous. On the convex side there are traces equivalent to 8 cuts/cm. On the flat side there are 9 cuts in 2.7mm (≡ 33 cuts/cm) towards the edge at mid-length, and traces at 5mm from the narrow end (≡ 12 cuts/cm). L (extant) 95mm; W x T (max) 14.5 x 5.4mm, (min) 9.6 x 3.7mm.

Condition Totally corroded and partly voided. Corrosion damaged at both ends.

Examination X-ray (1981-3). Metallography: Appendix B, S46.

Context/date SF292. From possible ritual deposit(s) found near a C5th/4th BC causeway. The group includes 9 other metalworking tools (Nos 31, 54, 55, 62, 71, 128, 142, 145, 172), woodworking tools, and a float whose handle dates stylistically to C4th BC. [A]

Reference V. Fell forthcoming.

No. 136. **FILE** **Santon, Norfolk** missing

Description `a tapering spigot of square section in an iron socket with transverse grooving on one face' (Smith 1909, 158).

Context/date From a hoard of metalwork found in a cauldron, including tongs Nos 41 and 42, hammer No. 85, scrap copper alloy sheet, and other metalwork comprising late Iron Age types and Claudian brooches. Date of deposition c. AD 60. [E]

Reference Smith 1909, 158, pl. XVII:1 (?third down from top left).

No. 137. (Fig. A17) **FILE ?** **Gussage All Saints, Dorset** missing

Description Almost complete ?file, rectangular section tapering to the rounded point. From the X-ray (in plan), cuts/ridges are not visible, but the overall form suggests that this was probably a file. L c. 192mm. **Tang:** L c. 28mm (fractured at tip). **Blade:** L c. 164mm (complete); W (max) c. 9mm. (Dimensions from X-ray).

Condition Incomplete at tang tip. ?Metal core.

Examination AML727959. X-ray (1973).

Context/date Pit 481 Layer 3 Phase 3. C1st BC/AD. [B]

References Wainwright 1979, 109, no. 1140, fig. 83; Fell 1988, 74, no. 14.

No. 138. (Fig. A17) **FILE ?** **Tŵyn-y-Gaer, Gwent** NMW: lab. no. 76-267

Description Almost complete ?file, rectangular section, tapering at both ends. The surface layer has been lost or is obscured by coatings; no ridges are visible. The overall form suggests that this was a file. L 170mm (inc). **Tang:** L c. 44mm (inc). **Blade:** L c. 126mm (inc); W x T (max, towards one end) 9 x 2mm.

Condition Incomplete; slight losses from ends. Metal core. Stripped; coatings obscure detail.

Examination X-ray (1987).

Context/date SF11. Context not known. Occupation date: C5th - C3rd BC or later. [B]

Reference L. Probert forthcoming; (Probert 1976, 115).

No. 139. (Fig. A17) **FILE ?** **Mynydd Bychan, Glamorgan** NMW: 49.418

Description Almost complete ?file, rectangular section and tapering at both ends. The surface layer has been lost and no ridges are visible. The overall form suggests that this was a file. L (extant) 130mm. **Blade:** L c. 100mm; W x T (max, MB) 9 x 4mm.

Condition Metal core. Stripped; no surface layer.

Examination X-ray (1987).

Context/date Outside the entrance, in collapse of the bastion. Late C1st BC - mid C1st AD. [A]

Reference Savory 1955, 44, no. 14, fig. 4, 7; Savory 1976a, 72, 100:11.

No. 140. (Fig. A17) **FILE ?** **Midsummer Hill, Here and Worc** BMAG

Description Incomplete ?file. Rectangular section, slightly tapering. No cuts traceable but the overall form suggests that this was file. L c. 160mm (extant). **Blade:** W x T c. 12 x c. 7mm. (After Stanford 1981)

Condition Fractured across the blade; `deeply corroded'.

Context/date T16 layer 11 SF55. Probably Iron Age. [B]

Reference Stanford 1981, 128, fig. 59, 9.

No. 141. (Fig. A18) **FILE** **Waltham Abbey, Essex** BMP

Description Essentially complete file, cut on one side. Rectangular section with one slightly convex (cut) side. The blade tapers, the central portion is more slender and undulated. The ridges are transverse; some are raked forwards and they appear to be evenly cut. Tapering rectangular-sectioned tang. L 232.5mm. **Tang:** L 45mm (slight loss from tip). **Blade:** L 187.5mm; W x T (max) 8.5 x 7.5mm, (near point) 4 x 4mm; convex c. 25 - 30mm R. **Cuts:** 10 - 12.5/cm.

Condition Slight losses from both ends. Superficially corroded. Accretions obscure detail.

Context/date From a probable ritual deposit of ironwork which includes 12 other metalworking tools (Nos 9, 29, 30, 33-37, 45, 49, 50, 58), woodworking tools, a sword and a linch-pin. The latter 2 items are typologically late C1st BC or early C1st AD. [D]

Reference Manning 1980, 89, fig. 3a; Manning 1985, 11, A37, pl. 6.

No. 142. (Fig. A18; Plate IVa) **FILE** **Fiskerton, Lincs** XX

Description Almost complete file, cut on the 2 opposing narrow edges. Sub-rectangular section convex (c. 15mm R) on the 2 cut edges. Slightly tapering in width across the plain sides. The ridges are transverse and raked forwards; some are clearly defined (but

corroded) with little indication of wear. Many pink/yellow, and white metal inclusions in the cuts. Well-defined, angled, and pointed shoulders (one damaged). Tapering square-sectioned tang. L 182mm (inc). **Tang:** L (extant) 42/46mm. **Blade:** L (extant) 136mm; W x T (max) 11 x 9.0mm, (min) 9.5 x 9.0mm. **Cuts:** 8.5 - 10/cm; D to 0.5mm. **Shoulders:** W (extant) 12.5mm (est. 13.5mm originally).

Condition — Corrosion fractured across the point; recent fracture across the tang tip. Severely corroded, fissured, partly voided, and distorted by corrosion pressures. Metal survives only at the tang and tang-blade junction.

Examination — X-ray (1981-3). Metallography: **Appendix B,** S55. **Inclusions:** Table 3:8, A-F, Fig. 3:6, A-B.

Context/date — SF312. From possible ritual deposit(s) found near a C5th/4th BC causeway. The group includes 9 other metalworking tools (Nos 31, 54, 55, 62, 71, 128, 135, 145, 172), woodworking tools, and a float whose handle dates stylistically to C4th BC. [A]

Reference — V. Fell forthcoming.

No. 143. (Fig. A18) **FILE** **Gussage All Saints, Dorset** BMP:[822]

Description — Complete file, cut on one side. Tapering, rounded-rectangular section over the greater part of the blade becoming round at the point. The cutting face is thus slightly convex near the tang and markedly convex at the point. The ridges are transverse, very evenly spaced, raked forwards, rounded and ?worn. Tapering square-sectioned tang. L (as excavated, complete) c. 162 (from initial X-ray). **Tang:** L 36mm. **Blade:** L c. 126mm; W x T (max) 8.0 x 5.5mm; W (min) 4.2mm; R (near the tang) 11mm, (MB) 7mm, (point) 4mm. **Cuts:** 9/cm near tang, 10/cm MB and point; D c. 0.3mm.

Condition — Now in 2 pieces as a result of sampling (c. 12mm missing). Fissured, flaked.

Examination — AML7320012. X-ray (1973, 1987). Metallography: Tylecote 1975, 6-7; Spratling et al. 1980, 284-5 (misprinted as `882' on page 284).

Context/date — Pit 437 Layer 5. Pit contained debris from bronze-founding and iron-smithing, ?cold set No. 114, punches Nos 166, 167, 174, 199, and ?scriber No. 229. Phase 2 (C3rd - C1st BC). [A]

Reference — Fell 1988, 74, no. 12, fig. 1, pl. 1.

No. 144. (Fig. A18; Plate Vb) **FILE** **Weelsby Avenue, Grimsby, S. Humberside** GWG

Description — Complete file, cut on one side. Slightly tapering, rectangular section rounded on the cut side. The ridges are transverse, evenly spaced, and raked forwards. Tapering, rectangular-sectioned tang with a straight portion at the blade junction. There is a line of copper alloy inclusions in the terminal six teeth. L 129mm. **Tang:** L 34mm, (tapered = 26mm). **Blade:** L 95mm; W x T (max) 7.0 x 5.0mm, (MB) 6 x 5mm, (tip) 3 x 2.5mm; convex c. 8mm R (MB). **Cuts:** 12 - 15/cm, D (max) c. 0.4mm.

Condition Now in 3 fragments (recent fractures). Corroded; no metal core, some distortion.

Examination X-ray (1989).

Context/date (PDL + FYN). SW sector of main ditch, in debris dump with waste from iron-smithing, bronze founding and wrought working, files Nos 121, 122, 151, 157, and punch No. 179. Mid C1st BC. [A]

Reference J. Sills forthcoming.

No. 145. (Fig. A18; Plate IVa) **FILE** **Fiskerton, Lincs** XX

Description Almost complete file, cut on the 2 opposing narrow edges. Tapering, rectangular section with one (cut) convex edge (c. 3-4mm R). The cuts are transverse, evenly cut, and clearly defined (but corroded). There are many pink/yellow, and white metal inclusions in the cuts. The file has pronounced square-set shoulders, the file cuts start at 3.5mm from the shoulder on the convex side, 2.5mm on the other. Tapering rectangular-sectioned tang. L 107.5mm (inc). **Tang:** L (extant) 16.5mm. **Blade:** L (extant) 91mm, cut length 88mm; W x T (max) 8.2 x 4.5mm, (min) 5.7 x 3.8mm. **Cuts:** 10 - 14/cm (typically 11/cm); D 0.5mm.

Condition ?Ancient fracture across the point; corrosion damaged at the tang tip. Totally corroded, fissured, and substantially voided.

Examination X-ray (1981-3).

Context/date SF329. From possible ritual deposit(s) found near a C5th/4th BC causeway. The group includes 9 other metalworking tools (Nos 31, 54, 55, 62, 71, 128, 135, 142, 172), woodworking tools, and a float whose handle dates stylistically to C4th BC. [A]

Reference V. Fell forthcoming; this is one of the files mentioned by Tylecote in Tylecote and Gilmour 1986, 106.

No. 146. (Fig. A18) **FILE** **Glastonbury, Somerset** SCM

Description Complete file (as excavated), trapezoid section, cut on one broad side. Tapering to the rounded point. The cutting face is essentially flat near the tang but convex along the blade. The ridges are transverse, very evenly cut, raked towards the narrow end of the fragment, clearly defined but corroded and slightly rounded. The cuts are deeper along the centre of the blade. The tang is of similar section and tapering; the file cuts extend 6mm down the `tang'. L (as excavated) 72mm. **Blade:** L (as excavated) 39.5mm; W x T (max) 6.0 x 3.5mm; 7mm R (MB), 5mm R point. **Cuts:** 14/cm over the greater part of the blade, 14.5/cm near the point; D c. 0.4mm.

Condition Now incomplete at the tang tip, flaked near the point, broken into 2 pieces which do not join; L 20.5mm (tang frag) & 39.5mm. Red corrosion products, ?haematite.

Examination X-ray (1985).

Context/date Mound 72, 13ft [3.96m] S of central picket, on the 1st floor. From adjacent mounds

(within 15m) were crucible sherds, copper alloy waste metal, a stone mould, and hot chisel No. 101. C2nd BC - mid C1st AD. [A]

Reference Bulleid and Gray 1917, 387, I47, fig. 141.

No. 147. (Fig. A18) **FILE** **Glastonbury, Somerset** SCM

Description Almost complete file, plano-convex section, cut on both sides. Tapering to the bent point. The ridges are transverse and raked forwards, and are more clearly defined on the flat side, very shallow and barely traceable on the convex side. Tapering tang, sub-rectangular in section. L 189mm (inc and bent); L (extant, if straight) c. 194mm. **Blade:** L (extant, if straight) c. 171mm; W x T (max) 10.5 x 6.0mm; 5mm R (MB), 3.5mm R near the point. **Cuts:** flat side, 10/cm near the tang, 12/cm MB and the point, D 0.4mm; convex side, c. 9 cuts/cm, D 0.1mm.

Condition Incomplete; recent damage at both ends; ?almost complete at the point. Metal core; surface-damaged by corrosion. Some red corrosion products, ?haematite.

Examination X-ray (1985). Metallography: **Appendix B,** S56.

Context/date Mound 5, 8.75ft [2.67m] W of the central picket, in the timber substructure. Within 5m were crucible sherds, a `furnace', and ferrous slag. C2nd BC - mid C1st AD. [A]

Reference Bulleid and Gray 1917, 387-8, I81, fig. 141; Cunliffe 1974, fig. 14:4, 8; Harding 1974, fig. 22, E.

No. 148. (Fig. A18) **FILE** **Meare Village West, Somerset** SCM

Description Almost complete file, tapering plano-convex section, cut on both sides. Slightly bent sideways at mid-length. The ridges are transverse, some are slightly raked forwards but others appear to be upright; none is well-defined. The extant portion of the tang is plano-convex in section. L 130mm (inc). **Blade:** L (cut length on convex side) 113mm; L (max W to point) 104mm; W x T (max) 11.0 x 5.5mm, (min) 5.0 x 2.5mm. Convex side; R (at point) 2.5mm, (MB) 5mm, (tang junction) 6mm. **Cuts:** convex side 10.5 - 12/cm, D c. 0.3mm; flat side 10 - 11/cm; D c. 0.2mm.

Condition Ancient fracture (or ?complete) at the point, recent fracture across the tang tip. Metal core; much fissured and spalled.

Examination X-ray (1985). Metallography: **Appendix B,** S57.

Context/date Mound 9, 18ft [5.49m] SW of the central picket, in black earth under the clay. Within 10m was punch No. 200, ?graver No. 212, stone moulds, crucible sherds, and ferrous slag. C3rd BC - mid C1st AD. [A]

Reference Gray and Bulleid 1953, 238, I27.

No. 149. (Fig. A18*) **FILE ?** **Woodeaton, Oxon** ..

Description Tapering, plano-convex section. L (?complete) c. 142mm. **Tang:** L (complete) c.

35mm. **Blade:** W x T (max) c. 10 x 5mm. (After Harding 1987).

Context/date BII/BIII. Baulk. Layer 4. C3rd - C1st BC. Site has metalworking associations. [A]

Reference Harding 1987, 43, no. 13, fig. 12.

No. 150. (Fig. A18) **FILE** **Meare Village West, Somerset** SCM

Description File blade fragment, tapering, plano-convex section, cut on both sides. The ridges are transverse, unevenly cut, and raked towards the narrow end of the fragment. L (extant) 63mm; W x T (max) 10 x 3.5mm; convex side c. 12mm R at max width. **Cuts:** flat side 11/cm; convex side 8/cm; D to 0.4mm.

Condition Ancient fracture at the broad end, recent fracture at the narrow end. Metal core; spalled, very little of the original surface survives.

Examination X-ray (1985). Metallography: **Appendix B,** S58.

Context/date Mound 13, 10ft [3.05m] S of the central picket 2, on the 4th floor. Mound yielded crucible sherds and ferrous slag. C3rd BC - mid C1st AD. [A]

Reference Gray and Bulleid 1953, 238, I39.

No. 151. (Fig. A19; Plate Vb) **FILE** **Weelsby Avenue, Grimsby, S. Humberside** GWG

Description Essentially complete file, the section square at the tang junction and the first part of the blade, becoming more rounded, and then circular at the point. Cut on the flat side near the tang; cuts are barely traceable where the cross-section becomes rounded, and none visible near the point. The ridges are transverse and raked forwards; it is not known if the tip of the file was cut or if the teeth no longer survive due to wear. Tapering square-sectioned tang. L 63mm (≈ complete). **Tang:** L 15mm (inc). **Blade:** L 48mm; W x T (tang junction and MB) 4 x 4mm, D (min, at tip) 3mm. **Cuts:** (near tang) 12/cm, (MB) 14/cm; D c. 0.2mm.

Condition Incomplete at tang tip (corrosion damage). Poorly preserved surface.

Examination X-ray (1989).

Context/date (QTX). SW sector of main ditch, in debris dump with waste from iron-smithing, bronze founding and wrought working, files Nos 121, 122, 144, and 157, and punch No. 179. Mid C1st BC. [A]

Reference J. Sills forthcoming.

No. 152. (Fig. A19; Plate Va) **FILE** **Gussage All Saints, Dorset** BMP:[470]

Description Blade tip fragment, plano-convex section tapering to the rounded point, cut on the convex side. The ridges are transverse, raked forwards, rounded and ?worn. Pink-yellow metal fleck (L 0.3mm) within the corrosion adjacent to a cut. L (extant) 11.8mm; W x T (max) 4.2 x 2mm; convex c. 2mm R. **Cuts:** 12 - 14/cm; D c. 0.2mm.

Condition Fissured and distorted through corrosion. Complete fragment as buried.

Examination AML726678. X-ray (1973, 1987).

Context/date Pit 209/2 Layer 10 I. Pit contained 4 other fragments of files (Nos 153-156), punches Nos 164, 169, 186, 191-3, 202, ?gravers Nos 207, 215-218, ?scribers Nos 221 and 228, ?scraper No. 230, plus debris from wrought and cast bronzeworking, and iron-smithing. Phase 2 (C1st BC). [A]

Reference Fell 1988, 74, no. 9, fig. 1, pl. 1.

No. 153. (Fig. A19; Plate Va) **FILE** **Gussage All Saints, Dorset** BMP:[401]

Description File fragment; tang and part of blade. Fractured longitudinally along one side, the cross-section now half-round but was probably originally round. Ridges survive around the extant surface of the blade; distorted, upright and worn. Tapering, square-sectioned tang, bent 5mm from the tip. L (extant, bent tang) 30mm. **Tang:** L (complete, bent) 19mm, (if straight) c. 20mm. **Blade:** L (extant) 11mm; W x T 4.5 x 4.5mm. **Cuts:** 11/cm; D 0.4mm.

Condition Partial metal core; fissured and distorted. Repaired. ?Complete as buried.

Examination AML726701. X-ray (1973, 1987).

Context/date Pit 209/2 Layer 10 C. Pit contained 4 other fragments of files (Nos 152, 154-156), punches Nos 164, 169, 186, 191-3, 202, ?gravers Nos 207, 215-218, ?scribers Nos 221 and 228, ?scraper No. 230, plus debris from wrought and cast bronzeworking, and iron-smithing. Phase 2 (C1st BC). [A]

Reference Fell 1988, 74, no. 8, fig. 1, pl. 1.

No. 154. (Fig. A19; Plate Va) **FILE** **Gussage All Saints, Dorset** BMP:[713]

Description Blade tip fragment, trapezoid section with parallel broad sides, tapering to a blunt point, cut on the broadest side. The ridges are transverse, evenly spaced, forward raked, and clearly defined. A copper alloy droplet is attached at one edge by iron corrosion products. Similar cross-section to file fragment No. 155, and may be part of that file. L (extant) 22.7mm; W x T (max) 3.4 x 2.0mm, (min) 2.0 x 1.0mm. **Cuts:** 12/cm; D c. 0.2mm.

Condition Complete fragment as buried. Metal core.

Examination AML728397. X-ray (1973, 1987).

Context/date Pit 209/2 Layer 11 T (layer adjacent to file No. 155). Pit contained 4 other fragments of files (Nos 152, 153, 155, 156), punches Nos 164, 169, 186, 191-3, 202, ?gravers Nos 207, 215-218, ?scribers Nos 221 and 228, ?scraper No. 230, plus debris from wrought and cast bronzeworking, and iron-smithing. Phase 2 (C1st BC). [A]

Reference Fell 1988, 74, no. 10, fig. 1, pl. 1.

No. 155. (Fig. A19; Plate Va) **FILE** **Gussage All Saints, Dorset** BMP:[775]

Description File blade fragment, trapezoid section with parallel broad sides, tapering, cut on the broadest side. The ridges are transverse, unevenly spaced, raked towards the narrow end. Similar cross-section to file fragment No. 154, and may be part of that file. L (extant) 29mm; W x T (max) 5.0 x 4.5mm, (min) 3.8 x 2.8mm. **Cuts:** 14 - 17/cm; D c. 0.3mm.

Condition Complete fragment as buried. Fissured, distorted, surface losses.

Examination AML728352. X-ray (1973, 1987).

Context/date Pit 209/2 Layer 11 W (layer adjacent to file No. 154). Pit contained 4 other fragments of files (Nos 152-154, 156), punches Nos 164, 169, 186, 191-3, 202, ?gravers Nos 207, 215-218, ?scribers Nos 221 and 228, ?scraper No. 230, plus debris from wrought and cast bronzeworking, and iron-smithing. Phase 2 (C1st BC). [A]

Reference Fell 1988, 74, no. 11, fig. 1, pl. 1.

No. 156. (Fig. A19; Plate Va) **FILE** **Gussage All Saints, Dorset** BMP:[371]

Description File blade fragment, tapering plano-convex section, cut on the flat side. The ridges are transverse, evenly spaced, raked towards the narrow end of the fragment, clearly defined but rounded, ?worn. Four pink/yellow metal inclusions in the cuts. L (extant) 19mm; W x T (max) 6.7 x 2.6mm, (min) 6 x 2mm. **Cuts:** 20.5/cm; D c. 0.1mm.

Condition Complete fragment (as buried). No metal core; well-defined surface detail.

Examination AML726895. X-ray (1973, 1987).

Context/date Pit 209 Layer 12. Pit contained 4 other fragments of files (Nos 153-155), punches Nos 164, 169, 186, 191-3, 202, ?gravers Nos 207, 215-218, ?scribers Nos 221 and 228, ?scraper No. 230, plus debris from wrought and cast bronzeworking, and iron-smithing. Phase 2 (C1st BC). [A]

Reference Fell 1988, 74, no. 7, fig. 1, pl. 1.

No. 157. (Fig. A19; Plate Vb) **FILE** **Weelsby Avenue, Grimsby, S. Humberside** GWG

Description File fragment; tang and part of blade. Rectangular section, slightly tapering, cut on one side. Transverse cuts, evenly spaced, shallow. Tapering, rectangular sectioned tang. L 41mm (inc). **Tang:** L 18mm. **Blade:** L 23mm (inc); W x T (max) 3.7 x 3.0mm, (min, at fracture) 3.0 x 2.5mm. **Cuts:** 20 - 22/cm.

Condition Ancient fracture across the blade. No metal core.

Examination X-ray (1989).

Context/date (YYX). SW sector of main ditch, in debris dump comprising waste from iron-smithing, bronze founding and wrought working, and files Nos 121, 122, 144 and 151, and punch No. 179. Mid C1st BC. [A]

Reference J. Sills forthcoming.

No. 158. (Fig. A19) **FILE** **Meare Village West, Somerset** SCM

Description File fragment, cut on 4 sides. No tang. Rectangular section, tapering at both ends. The file cuts survive discontinuously but are visible to within 8mm of the broader end, and to the extant tip at the other. On one of the broad sides and one of the narrow sides some of the cuts are diagonal and others are transverse. On the other two sides they are transverse (only) and evenly cut. Ridges are not raked. L 46mm (inc). W x T (max) 8.5 x 4mm, at broader end 5 x 2mm, at narrow end 3.7 x 0.7mm. **Cuts:** typically 10 - 12.5/cm (range 8 - 12.5/cm); D to 0.5mm.

Condition Ancient (or corrosion) fractured at both ends. Poorly preserved; no metal core.

Examination X-ray (1985).

Context/date Mound 38, margin, 13ft [3.96m] NE of the central picket. Mound also yielded chisel No. 111, punch No. 187, ferrous slag, crucible sherds. C3rd BC - mid C1st AD. [B]

Reference Gray and Bulleid 1953, 238, 155.

No. 159. (Fig. A19) **FILE** **Meare Village West, Somerset** SCM

Description File fragment, cut on 4 sides. No tang. Rectangular section, essentially complete at one end (rounded, with slight losses), fractured across the other. Tapering in width at both ends and also tapering in thickness at the fractured end. The file cuts extend the full length of the fragment but survive discontinuously. Most of the cuts are transverse although on one broad face there is a greater number of diagonal cuts. Ridges are not raked. L 45mm; W x T (at max W) 8 x 5mm, (rounded end) 3.5 x 5mm, (fractured end) 4 x 3mm. **Cuts:** c. 10/cm; D to 0.5mm.

Condition ?Ancient break at the fractured end. Partial metal core. Surface losses.

Examination X-ray (1985). Metallography: **Appendix B**, S59.

Context/date Mound 22 [file A]. Mound also yielded poker No. 18, ferrous slag, a crucible sherd, and a fragment of a coarse-cut file [file B]. C3rd BC - mid C1st AD. [B]

Reference Gray and Bulleid 1953, 247 (`Much fragmentary iron' = 6 pieces).

No. 160. **FILE ?** **Meare Village East, Somerset** missing

Description `Part of a file (?), corroded' (Gray's catalogue entry).

Context/date Mound 30, 4ft [1.22m] NW of the central picket, on Floor iv. Mound also yielded anvil No. 48 and crucible sherds. C2nd - mid C1st AD. [A]

Reference Coles 1987, 123, I67.

No. 161. **FILE ?** **Glastonbury, Somerset** missing?

Description `Much corroded pointed end of a large object, perhaps part of a file; length 92mm; max width about 28mm.' (Bulleid and Gray 1917, 388)

Context/date Mound 75, 2ft [0.61m] S of central picket, on the 2nd floor. The same mound yielded

hot chisel No. 92, a crucible sherd, and a piece of copper alloy waste metal. Adjacent mound yielded 2 files (Nos 130 and 133), ferrous slag, and further crucible sherds and copper alloy waste metal. C2nd BC - mid C1st AD. [A]

Reference Bulleid and Gray 1917, 388, I107.

No. 162. (Fig. A20*) **PUNCH, ?HOT** **Hod Hill, Dorset** BMP: 1893 6-1 11

Description Oval-sectioned stem, slightly expanded at the lower stem, then tapering to a flat rectangular tip. Burred head. L 169mm (complete). (After Manning 1985.)

Context/date Surface find from ploughing. May be IA or from the Claudian fort. (Durden Coll) [E]

References Brailsford 1962, 14, G45, fig. 13. Manning 1985, 10, A29, pl. 6.

No. 163. (Fig. A20) **PUNCH, ?HOT** **Danebury, Hants** AMIA

Description Rectangular in section at the flat ?bevelled head and upper 20mm of the stem, round-sectioned thereafter. Tapering over the terminal 15mm to a blunt point. L 143mm (complete). **Stem:** Diam (MP) 6mm. **Head:** 6 x 3mm.

Condition Fissured; very slight loss from the tip. Accretions and coatings obscure detail.

Context/date DA78 layer 453 SF1296. Ceramic phase 7 (300 - 100/50 BC). [A]

Reference Sellwood 1984, 354, no. 2.63, fig. 7.13, Mf. 9:C7.

No. 164. (Fig. A20) **PUNCH, ?HOT** **Gussage All Saints, Dorset** BMP:[510]

Description Oval section, evenly tapered to a broad convex tip. Burred domed head. L 112mm (complete; from X-ray). **Stem:** (MP) 12 x 10mm, (5mm from tip) 10 x 8mm. **Head:** (behind burr) 16 x 14mm, (+ burr) 18 x 18mm.

Condition Now in 2 pieces as a result of metallography (L 38mm + 55mm). Fissured; fractured; losses from head, lower stem, tip 5mm. Accretions in situ. (X-ray reconstruction).

Examination AML726856. X-ray (1973, 1987). Metallography: Tylecote 1975, 6, no. 510; Spratling et al. 1980, 285, no. 510.

Context/date Pit 209/2 layer 10 J. Pit contained at least 20 other metalworking tools (cold set No. 116, files Nos 152-156, punches Nos 169, 186, 191-193, 202, ?gravers Nos 207, 215-218, ?scribers Nos 221 and 228, and ?scraper No. 230), and debris from iron-smithing, and wrought and cast bronzeworking. Phase 2: C1st BC. [A]

Reference Fell 1988, 74, no. 5, fig. 1.

No. 165. **PUNCH, ?HOT** **Dragonby, S. Humberside** SBM

Description Rectangular section, tapering, with an eye below the head. (Information supplied by Professor Manning.)

Context/date Ditch 3 (FN3) in cutting 23. Associated pottery Ceramic Stage 5: ?late C1st BC. [A]

Reference W. H. Manning forthcoming.

No. 166. (Fig. A20) **PUNCH, ?HOT** **Gussage All Saints, Dorset** DCM

Description Round section, tapering, the tip damaged. Domed burred head, possibly necked below the head (X-ray evidence). L 93mm (almost complete). **Stem:** Diam (MP) 16mm. **Head:** (behind burr) 19 x 17mm, (+ burr) 25 x 21mm.

Condition Fractured across the tip. Metal core; flaking.

Examination X-ray (1985).

Context/date Pit 437 layer 3. Pit contained debris from iron-smithing and bronze-founding, and ?cold set No. 114, file No. 143, punches Nos 167, 174, 199, and ?scriber No. 229. Phase 2: C3rd BC - C1st BC. [A]

References Wainwright 1979, 106, no. 1046; Fell 1988, 74, no. 4, fig. 1.

No. 167. (Fig. A20) **PUNCH, ?HOT** **Gussage All Saints, Dorset** BMP:[834]

Description Tapered stem; the section is rectangular at the head, rounded-rectangular at the centre, round at the tip. Blunt tip. Rectangular head, domed and much burred across the narrow sides. L 71.5mm (complete, from X-ray). **Stem:** (MP) 13.5 x 13mm; Diam at tip 1.5mm. **Head:** (behind burr) 18 x 13mm, (+ burr) 26 x 13mm.

Condition Now in 2 pieces as a result of metallography; lengths 27mm and 34mm. Fissured; losses from the head and near the tip.

Examination AML7320024. X-ray (1973, 1987). Metallography: Tylecote 1975, 7, no. 834; Spratling et al. 1980, 285, no. 834.

Context/date Pit 437 layer 5. Pit contained debris from iron-smithing and bronze-founding, and ?cold set No. 114, file No. 143, punches Nos 166, 174, 199, and ?scriber No. 229. Phase 2: C3rd BC - C1st BC. [A]

Reference Fell 1988, 74, no. 6, fig. 1.

No. 168. (Fig. A20) **PUNCH, ?HOT** **Ham Hill, Somerset** SCM

Description Round section, tapering. Flat head, burred to one side. L 67mm (inc). **Stem:** Diam (MP) 16mm. **Head:** Diam (behind burr) 18mm, (+ burr) 17.5/19.5mm.

Condition Fractured across the tip; metal core.

Context/date A'07 RHW A1565. Context not recorded. Conceivably I3 'iron chisel, damaged, length 2½ins. In black earth' from cutting VI 1923, NW corner of northern spur, which largely comprised Iron Age and C1st AD Roman deposits. [E]

Reference ?Gray 1924, 111, I3; (Burrow 1981, 198-9, 268-73).

No. 169. (Fig. A20) **PUNCH ?** **Gussage All Saints, Dorset** BMP: [575]

Description Rectangular section expanded at the centre. Both ends are c. 9mm square, slightly convex, the edges rounded. L 91mm (complete). **Stem:** (max, MP) c. 14 x c. 11mm. (Dimensions from X-ray.)

Condition Much fissured and fractured due to corrosion, now in 2 pieces due to metallography.

Examination AML728386. X-ray (1973). Metallography: Tylecote 1975, 6, no. 575; Spratling et al. 1980, 285, no. 575.

Context/date Pit 209/2 layer 10 O. Pit contained at least 20 other metalworking tools (cold set No. 116, files Nos 152-156, punches Nos 164, 186, 191-193, 202, gravers Nos 207, 215-218, ?scribers Nos 221 and 228, and ?scraper No. 230, and debris from wrought and cast bronzeworking, and iron-smithing. Phase 2: C1st BC. [A]

Reference Fell 1988, 75, no. 25, fig. 1.

No. 170. (Fig. A20) **PUNCH** **Hod Hill, Dorset** BMP: 1892 9-1 -

Description Round section, slightly tapering. Damaged tip but probably originally blunt and rounded. Burred head. L 74mm (inc). **Stem:** Diam (MP) 10mm. **Head:** Diam (behind burr) 11mm, (+ burr) 13mm.

Condition Fissured; losses from the tip and head. Metal core.

Context/date Surface find from ploughing. May be IA or from the Claudian fort. (Durden Coll) [E]

Reference Manning 1985, 10, A31, pl. 6.

No. 171. (Fig. A20) **PUNCH** **Hod Hill, Dorset** BMP: 1892 9-1 -

Description Rectangular section, tapering over the lower part of the stem. Burred head. L 75mm (inc). **Stem:** (MP) 10 x 8.5mm. **Head:** (behind burr) 10 x 8.5mm.

Condition Incomplete, fractured across the tip. Metal core; fissured.

Context/date Surface find from ploughing. May be IA or from the Claudian fort. (Durden Coll) [E]

Reference Manning 1985, 10, A32, pl. 6.

No. 172. (Fig. A20) **PUNCH? TIP** **Fiskerton, Lincs** XX

Description Round section expanding to a domed circular end. L 71mm (inc). **Stem:** Diam (MP) 9mm. **Tip:** Diam (max) 10.5mm; c. 30mm R.

Condition Corrosion fractured across the stem. Metal core.

Examination X-ray (1981-3).

Context/date SF327. From possible ritual deposit(s) found near a C5th/4th BC causeway. The group includes 9 other metalworking tools (Nos 31, 54, 55, 62, 71, 128, 135, 142, 145), woodworking tools, and a float whose handle dates stylistically to C4th BC. [A]

Reference V. Fell forthcoming.

No. 173. (Fig. A20*) **PUNCH** **Danebury, Hants** OIA

Description Tapering stem, square in section but rounded towards the tip. Blunt rounded point. Much burred head. L 84mm (complete). **Stem:** (MP) 9 x 9mm. **Head:** W (+ burr) 14mm, (behind burr) 10mm. (After Cunliffe forthcoming.)

Context/date Ceramic phase 7 (300 - 100/50 BC). [A]

Reference B. Cunliffe forthcoming (no. 2.256).

No. 174. (Fig. A20) **PUNCH ?** **Gussage All Saints, Dorset** DCM

Description The upper stem is almost square in section, but oval over the terminal 7mm. Tapering to an oval blunt tip. L 78mm (inc). **Stem:** (MP) 10 x 9mm.

Condition Ancient loss from the side of the head. Metal core; flaking. Accretions in situ.

Examination X-ray (1985).

Context/date Pit 437 layer 3. Pit contained debris from bronze-founding and iron-smithing, and ?cold set No. 114, file No. 143, punches Nos 166, 167, 199, and ?scriber No. 229. Phase 2: C3rd BC - C1st BC. [A]

References Wainwright 1979, 106, no. 1045; Fell 1988, 75, no. 18, fig. 1.

No. 175. (Fig. A20) **PUNCH** **Gussage All Saints, Dorset** DCM

Description Tapering, rectangular section, bent and fissured 8mm from the convex tip. Domed, ?bevelled head. L 79mm (complete). **Stem:** (MP) 8 x 6mm, (at fracture) 6 x 3mm.

Condition Originally complete when excavated, the tip now missing (reconstruction from X-ray). Metal core. Accretions in situ.

Examination X-ray (1973, 1985).

Context/date Pit 191 layer 3. Phase 3: C1st BC/AD. [B]

References Wainwright 1979, 108, no. 1083, fig. 82; Fell 1988, 75, no. 19.

No. 176. (Fig. A20*) **PUNCH** **Danebury, Hants** OIA

Description Almost square-sectioned stem, tapering to a blunt tip. Convex, unburred head. L 72mm (complete). **Stem:** (MP) 8 x 7mm. (After Cunliffe forthcoming.)

Context/date Ceramic phase 7 (300 - 100/50 BC). [A]

Reference B. Cunliffe forthcoming (no. 2.257).

No. 177. (Fig. A20*) **PUNCH** **Skeleton Green, Herts** HM

Description Rectangular section, tapering to a blunt tip. L c. 56mm. (After Partridge 1981.)

Context/date Pit F.9, layer 2 SF412. Phase ii of Period I: late C1st BC - early C1st AD. [A]

Reference Partridge 1981, 72, no. 6, fig. 32.

No. 178. (Fig. A21) **PUNCH** **Fison Way, Thetford, Norfolk** NAU

Description Tapering stem; the section is rectangular near the burred head, square at the centre, round over the terminal 8mm. The upper stem is bent: this may have been through use or may have been a feature incorporated to assist holding the punch. ?Blunt tip. L 74mm (complete). **Stem:** (MP) 8.5 x 8.0mm. **Head:** (+ burr) 8.5 x 6.0

mm, (behind burr) 8.2 x 5.5mm.

Condition Complete in length but spalled at the tip. Metal core. Accretions in situ.

Examination X-ray (+ 1989).

Context/date Ditch of enclosure 13 (1831) SF471. Phase II (early-mid C1st AD). [A]

Reference A. Gregory forthcoming.

No. 179. (Fig. A21) **PUNCH** **Weelsby Avenue, Grimsby, S. Humberside** GWG

Description Tapering, rectangular section at the upper stem, rounded-square near the convex tip. Burred head. L 68.5mm (complete). **Stem:** (MP) 7 x 5mm. **Tip:** (2mm from tip) 4 x 3.5mm. **Head:** (+ burr) 9.6 x 5.2mm, (behind burr) 8.7 x 5.0mm.

Condition Metal core; surface detail well-preserved.

Examination X-ray (1989).

Context/date (RDH). SW sector of main ditch, in debris dump comprising waste from iron-smithing, bronze founding and wrought working, and files Nos 121, 122, 144, 151 and 157. Mid C1st BC. [A]

Reference J. Sills forthcoming.

No. 180. (Fig. A21) **PUNCH** **Ham Hill, Somerset** SCM

Description Rounded-rectangular section becoming round near the blunt tip. Tapered over the lower half of the stem. Flat, slightly bevelled, unburred head. L 70mm (?complete). **Stem:** (MP) 9 x 8mm. **Tip:** Diam c. 2mm. **Head:** 8 x 6.5mm.

Condition Metal core. Coatings obscure detail; possibly slight losses from the tip.

Context/date A'07 RHW. Context not recorded. Conceivably I3 'pointed implement of iron, length 2.75ins. ... In black earth.' from cutting VI 1923, NW corner of northern spur, which largely comprised Iron Age and C1st Roman deposits. [E]

Reference ?Gray 1924, 111, I3.

No. 181. (Fig. A21*) **PUNCH** **Wakerley, Northants** ..

Description Tapering, round-sectioned stem. Convex round tip. Head missing. L 70mm (inc). **Stem:** Diam (max, extant) c. 7mm. (After Jackson and Ambrose 1978).

Context/date Surface of ditch C.b. ?Iron Age. [E]

Reference Jackson and Ambrose 1978, 221, no. 30, fig. 59.

No. 182. (Fig. A21) **PUNCH** **Gussage All Saints, Dorset** DCM

Description Round-sectioned stem, tapering over the lower 30mm, slightly bent near the convex round tip. Domed burred head. L 55mm (complete). **Stem:** Diam (MP) 8mm. **Head:** Diam (+ burr) 12mm, (behind burr) 10mm.

Condition Metal core. Accretions in situ.

Examination X-ray (1985).

Context/date Pit 290 layer 3. Phase 3: C1st BC/AD. [Incorrectly phased in metalwork catalogue; pit 290 shown as Phase 3 in Wainwright 1979, 33, and fig. 19.] [B]

References Wainwright 1979, 104, no. 1035; Fell 1988, 75, no. 16, fig. 1.

No. 183. (Fig. A21*) **PUNCH** **Danebury, Hants** AMIA

Description Tapering, round section, bent near the tip. Domed burred head. L 43mm (inc.). **Stem:** Diam (MP) 7mm. **Head:** Diam (+ burr) 11mm.

Condition Slight loss from the tip.

Context/date DA77 layer 416. Ceramic phase 6: 400-300 BC. [A]

References Sellwood 1984, Mf 9:F12, no. 1269.

No. 184. (Fig. A21*) **PUNCH ?** **Woodeaton, Oxon** ..

Description Round-sectioned stem, tapering to a point. L c. 91mm (?complete). **Stem:** Diam (max) c. 6mm. (After Harding 1987.)

Context/date CII layer 4. Site has metalworking associations. C3rd - C1st BC. [A]

Reference Harding 1987, 43, no. 16, fig. 12.

No. 185. (Fig. A21) **PUNCH** **Wetwang Slack, N. Humberside** XX

Description Round section, tapering over the terminal 6mm to a round blunt point. Burred flat head. L 74mm (complete). **Stem:** Diam (MP) 3.8/4.0mm. **Tip:** Diam c. 1mm. **Head:** Diam (+ burr) 3.8/4.2mm, (behind burr) 3.5/4.0mm.

Condition Metal core; well-preserved surface detail.

Examination X-ray (+ 1987).

Context/date XI. WN 539 TE. Feature contained residual Iron Age pottery and bronzeworking debris. Later Iron Age or Romano-British. [E]

Reference J. Dent forthcoming (no. 2.26).

No. 186. (Fig. A21) **PUNCH** **Gussage All Saints, Dorset** BMP: [375]

Description Round-sectioned upper stem, tapering and square in section over the terminal 8mm. The tip is probably incomplete. Flat head. Bent stem. L 60mm (almost complete). **Stem:** Diam 3.5mm. **Tip:** (extant) c. 1 x 1mm.

Condition Probable ancient fracture across the tip (accretions covered the tip). Now much fissured and fractured.

Examination AML728345. X-ray (1973, 1987).

Context/date Pit 209 layer 12. Pit contained at least 20 other metalworking tools (cold set No. 116, files Nos 152-156, punches Nos 164, 169, 191-193, 202, ?gravers Nos 207, 215-218, ?scribers Nos 221 and 228, and ?scraper No. 230), and debris from wrought and

cast bronzeworking, and iron-smithing. Phase 2: C1st BC. [A]

Reference Fell 1988, 75, no. 33, fig. 1.

No. 187. (Fig. A21) **PUNCH, ?TRACER** **Meare Village West, Somerset** SCM

Description Round or rounded-rectangular in section at the upper stem, rectangular at the lower stem. Tapering over the terminal 20mm to a rectangular, almost flat tip. L 121mm (?complete at excavation). **Stem:** (30mm from tip) 5 x 4mm. **Tip:** c. 2.5 x 1mm.

Condition Head missing; now 95mm long. Much fissured and fractured.

Examination X-ray (1985).

Context/date Mound 38, 8ft [2.44m] W of the central picket. Mound also yielded chisel No. 111, file No. 158, crucible sherds, and ferrous slag. C3rd BC - mid C1st AD. [B]

Reference Gray and Bulleid 1953, 247, I84.

No. 188. (Fig. A21) **PUNCH, ?TRACER** **Gussage All Saints, Dorset** DCM

Description Square section, tapering over the terminal 20mm to an oval convex tip. Domed ?bevelled head. Bent at both ends. L 74mm (complete). **Stem:** (MP) 3.5mm square. **Tip:** c. 2 x 1mm.

Condition Accretions in situ.

Examination X-ray (1985).

Context/date Pit 104 layer 3. Phase 1: C5th - C3rd BC. [A]

References Wainwright 1979, 105, no. 1130; Fell 1988, 75, no. 20, fig. 1.

No. 189. (Fig. A21) **? TRACER OR GRAVER** **Meare Village East, Somerset** SCM

Description Rectangular-sectioned stem, tapering in thickness at the tip and bevelled on both sides to a convex edge. L 70mm (inc). **Stem:** (top) 4.5 x 3.5mm; 2mm from tip c. 5.5 x 2mm. **Tip:** W c. 5.5mm, R c. 5mm.

Condition Incomplete at the head. No metal core.

Context/date Mound 20, top. Late in period C2nd BC - mid C1st AD. [E]

References Orme et al. 1983, 68-9, no. 2344, fig. 68; Coles 1987, 130, I82.2344, fig. 3.55.

No. 190. (Fig. A21) **PUNCH, ?TRACER** **Gussage All Saints, Dorset** DCM

Description Tapered, rectangular-sectioned stem; convex tip. Burred head. Bent stem. L 68mm (complete). **Stem:** (MP) 5 x 4mm. **Tip:** c. 3 x 1.5mm. **Head:** (+ burr) 7 x 6mm.

Condition Accretions in situ.

Examination X-ray (1985).

Context/date Enclosure ditch F310 U layer 3. Phase 3: C1st BC/AD. [B]

References Wainwright 1979, 109, no. 1152; Fell 1988, 75, no. 21, fig. 1.

No. 191. (Fig. A21) **PUNCH ?** **Gussage All Saints, Dorset** BMP: [678]

Description Rectangular section, tapering near the tip, broad convex tip. Bent stem. Tapering to a flat and unburred head. L 60mm (complete, bent), c. 62mm if straight. **Stem:** (max, 10-15mm from tip) 6 x 4mm. **Tip:** c. 4 x 2mm. **Head:** 3.5 x 2.0mm.

Condition Expanded by corrosion pressures, fissured, and fractured.

Examination AML728571. X-ray (1973, 1987).

Context/date Pit 209/2 layer 11 S. Pit contained at least 20 other metalworking tools (cold set No. 116, files Nos 152-156, punches Nos 164, 169, 186, 192, 193, 202, ?gravers Nos 207, 215-218, ?scribers Nos 221 and 228, and ?scraper No. 230), and debris from wrought and cast bronzeworking, and iron-smithing. Phase 2: C1st BC. [A]

Reference Fell 1988, 76.

No. 192. (Fig. A21) **PUNCH ?** **Gussage All Saints, Dorset** BMP: [501]

Description Square in section at the upper stem, tapering and rectangular in section over the terminal 10mm. The tip is convex in one plane, flat at the very tip. Bent near the tip. Flat, ?bevelled head. L 47.5mm (complete). **Stem:** 4mm square. **Tip:** c. 3 x 2mm.

Condition Fissured and fractured; partial metal core.

Examination AML726846. X-ray (1973, 1987).

Context/date Pit 209 layer 10 J. Pit contained at least 20 other metalworking tools (cold set No. 116, files Nos 152-156, punches Nos 164, 169, 186, 191, 193, 202, ?gravers Nos 207, 215-218, ?scribers Nos 221 and 228, and ?scraper No. 230), and debris from wrought and cast bronzeworking, and iron-smithing. Phase 2: C1st BC. [A]

Reference Fell 1988, 75, no. 24, fig. 1.

No. 193. (Fig. A21) **PUNCH? TIP** **Gussage All Saints, Dorset** BMP: [615]

Description Square section, tapering over the terminal 20mm to a rectangular convex tip. Bent near the tip. Head missing. L 45mm (inc). **Stem:** (max) 4.5 x 4.5mm. **Tip:** c. 3 x 2mm.

Condition Ancient fracture across the stem. Fissured and fractured.

Examination AML728493. X-ray (1973, 1987).

Context/date Pit 209/2 layer 11 P. Pit contained at least 20 other metalworking tools (cold set No. 116, files Nos 152-156, punches Nos 164, 169, 186, 191, 192, 202, ?gravers Nos 207, 215-218, ?scribers Nos 221 and 228, and ?scraper No. 230), and debris from wrought and cast bronzeworking, and iron-smithing. Phase 2: C1st BC. [A]

Reference Fell 1988, 76.

No. 194. (Fig. A21) **PUNCH? TIP** **Gussage All Saints, Dorset** DCM

Description Round section, barely tapering to the slightly convex rectangular tip. Bent stem. L 46mm (inc). **Stem:** Diam (MP) c. 5mm. **Tip:** 3.5 x 2mm.

Condition Head missing; ancient fracture across the stem. Metal core. Accretions in situ.

Examination X-ray (1973, 1985).

Context/date Pit 292. Pit contained a 'cast lump' of bronze. Phase 1: C5th - C3rd BC. [Incorrectly phased in metalwork catalogue; Pit 292 shown as Phase 1 in Wainwright 1979, fig. 16 and table XV.] [A]

References Wainwright 1979, 108, no. 1092; (Spratling 1979, table XIV); Fell 1988, 76.

No. 195. (Fig. A21) **PUNCH, ?TRACER** **Gussage All Saints, Dorset** DCM

Description Tapering stem, round/oval in section, rounded-rectangular at the convex tip. Bent 6mm from the tip. Flat ?bevelled head. L 60mm (complete). **Stem:** (MP) 5 x 4mm. **Tip:** c. 4 x 1mm. **Head:** Diam 5mm.

Condition Much fissured and spalled. Accretions in situ.

Examination X-ray (1973, 1985).

Context/date Pit 428 layer 3. Phase 2: C3rd BC - C1st BC. [A]

References Wainwright 1979, 106, no. 1040; Fell 1988, 75, no. 17, fig. 1.

No. 196. (Fig. A21) **PUNCH** **Gussage All Saints, Dorset** DCM

Description Oval or D-sectioned stem, tapering over the terminal 20mm to a convex round tip. The head is flat or very slightly domed; traces of a burr. L 62mm (complete). **Stem:** (max, MP) 4mm. **Tip:** Diam c. 2mm. **Head:** (max) 4mm. (Dimensions from X-ray.)

Condition Much fissured. Accretions in situ.

Examination X-ray (1973, 1985).

Context/date Pit 426 layer 5. Phase 2: C3rd BC - C1st BC. [A]

References Wainwright 1979, 105, no. 1014; Fell 1988, 74, no. 15, fig. 1.

No. 197. (Fig. A21) **PUNCH ?** **Gussage All Saints, Dorset** DCM

Description Sub-square section, tapering over the terminal 8mm to a flat, angled, square tip. Slightly bent. Bevelled head. L 37mm (complete). **Stem:** (max) 5 x 4mm. **Tip:** 3 x 3mm.

Condition Metal core. Accretions in situ.

Examination X-ray (1973, 1987).

Context/date Pit 46 layer 6. Phase 3: C1st BC/AD. [B]

References Wainwright 1979, 108, no. 1118; Fell 1988, 76.

No. 198. (Fig. A22) **PUNCH** **The Breiddin, Powys** NMW

Description Tapering stem, square or rectangular in section. The tip is rectangular, convex, and slightly bent. Burred ?flat head. L 113mm (complete). **Stem:** (MP) c. 8mm square. **Tip:** W x T c. 3 x c. 1.5mm. (Dimensions from X-ray.)

Condition Much fissured and distorted; losses from stem and head. Accretions obscure detail.

Examination X-ray (1987).

Context/date SF B520301. Unstratified in the interior of the hillfort: Iron Age or Roman. [E]

Reference C. Saunders forthcoming (no. 219); (Thorburn 1986).

No. 199. (Fig. A22) **PUNCH** **Gussage All Saints, Dorset** BMP: [824]

Description Tapering stem, slightly bent; the section is rectangular at the top, almost rhomboidal towards the tip, and oval at the blunt convex tip. ?Bevelled head, unburred. L 83mm (from X-ray, ?complete). **Stem:** (MP) 9.5 x 8mm. **Tip:** c. 4 x c. 2mm.

Condition Complete as buried; possibly damaged in antiquity at the head. Much corroded, fissured, and distorted by corrosion pressures, and corrosion damaged at tip. Now in 2 main pieces as a result of metallography: lengths 36mm and 43mm.

Examination AML7320014. X-ray (1973, 1987). Metallography: Tylecote 1975, 7, no. 824; Spratling et al. 1980, 285, no. 824.

Context/date Pit 437 layer 5. Pit contained debris from bronze founding and iron-smithing, and ?cold set No. 114, file No. 143, punches Nos 166, 167, 174, and ?scriber No. 229. Phase 2: C3rd - C1st BC. [A]

Reference Fell 1988, 76, no. 26, fig. 1.

No. 200. (Fig. A22) **PUNCH ?** **Meare Village West, Somerset** SCM

Description Rounded-rectangular stem, tapering to a bevelled, convex tip. Bevelled rounded head. L 74mm (complete). **Stem:** (max) 12.5 x 10.5mm. **Tip:** 4 x 2.5mm. **Head:** W 7mm.

Condition Now fractured near the head. Totally corroded; corrosion blister on the tip.

Examination X-ray (1985).

Context/date Mound 9, 23½ft [7.162m] SW of central picket, in black earth. Within 10m was file No. 150, ?graver No. 212, stone moulds, crucible sherds, copper alloy waste metal, and ferrous slag. C3rd BC - mid C1st AD. [B]

Reference Gray and Bulleid 1953, 239, I41.

No. 201. (Fig. A22) **PUNCH ?** **Worthy Down, Headbourne Worthy, Hants** WCM: 321.20

Description Rectangular section, tapering to a convex rounded-square tip. Slightly burred head. L 96mm (complete). **Stem:** (MP) 5 x 4mm. **Tip:** 3 x 3mm. **Head:** (+ *burr*) 7 x 3mm.

Condition Accretions and coatings obscure detail.

Examination X-ray (1985). Metallography: Ehrenreich 1985, 215, WD11b.

Context/date Pit No. 2 at depth 3-4 feet [0.9-1.2m]. Early C2nd BC. [A]

Reference Hooley 1931, 184, no. 46, pl. VI.

No. 202. (Fig. A22) **PUNCH ?** **Gussage All Saints, Dorset** BMP: [180]

Description Almost square in section, tapering to the flat rounded-square tip. Bent 20mm from

the tip. More rounded in section near both ends. The head is square and unburred. L 86mm (complete). **Stem:** (MP) 6 x 5mm. **Tip:** 3 x 3mm.

Condition — Much fissured and distorted by corrosion pressures. Part of the head is missing.

Examination — AML726562. X-ray (1973, 1987).

Context/date — Pit 209 layer 10. Pit contained at least 20 other metalworking tools (cold set No. 116, files Nos 152-156, punches Nos 164, 169, 186, 191-193, ?gravers Nos 207, 215-218, ?scribers Nos 221 and 228, and ?scraper No. 230), and debris from wrought and cast bronzeworking, and iron-smithing. Phase 2: C1st BC. [A]

Reference — Fell 1988, 75, no. 22, fig. 1.

No. 203 (Fig. A22*) **PUNCH** **South Cadbury, Somerset** XX

Description — Rectangular section, slightly tapering. Broad, rounded tip. L 44mm (?complete). **Stem:** (MP) c. 9 x c. 7mm (After Alcock 1980).

Context/date — From Iron Age rampart. Cadbury phase 9B; mid C1st AD. [A]

Reference — Alcock 1980, 673, no. 4, fig. 8.

No. 204. (Fig. A22) **CHISEL OR PUNCH** **Weelsby Avenue, Grimsby, S. Humberside** GWG

Description — Tapering square section. Broad, angled, blunt tip. Burred head. L 81mm (complete). **Tip:** W 5.5mm. **Head:** (+ burr) 8 x 8mm, (behind burr) 7 x 7mm.

Condition — Much fissured; dimensional distortion (expanded along stem).

Examination — X-ray (1988).

Context/date — W sector of main ditch, in debris dump comprising waste from iron-smithing, bronze founding and wrought working, and hot chisel No. 105. Mid C1st BC. [A]

Reference — J. Sills forthcoming.

No. 205. (Fig. A22) **CHISEL OR PUNCH** **Wetwang Slack, N. Humberside** XX

Description — Square section, evenly tapered stem, the tip lost. Burred flat head. L 61mm (almost complete). **Stem:** (MP) 6 x 6mm. **Tip:** W (extant) 5.5mm. **Head:** (+ burr) 8 x 8mm, (behind burr) 7 x 7mm.

Condition — Recent fracture at the tip; fissured at the lower stem. Metal core.

Examination — X-ray (+ 1987).

Context/date — VII. WE + IE. Feature contained residual Iron Age pottery and bronzeworking debris. Later Iron Age or Romano-British. [E]

Reference — J. Dent forthcoming (no. 2.28).

No. 206. (Fig. A22*) **CHISEL OR TRACER** **Meare Village West, Somerset** SCM

Description — Evenly tapered stem, rounded-rectangular section. Straight ?bevelled edge. ?Burred head. L 47mm (complete). **Tip:** W 5mm. **Head:** W 8mm. (After Bulleid and Gray 1953).

Reference MacGregor and Simpson 1963, 394, no. 22, fig. 2.

No. 210. (Fig. A22) **GRAVER ?** **Barbury Castle, Wilts** DM

Description Rectangular-sectioned stem. Flat tip, rectangular with rounded corners, bevelled on both sides to a blunt edge. The tang is almost square in section. L 101mm (inc.). **Stem:** L c. 80mm; 6 x 2.5mm. **Tip:** 6 x c. 1mm.

Condition Fractured across the tang tip and the stem tip, spalled along the stem; metal core.

Examination X-ray (1985).

Context/date From a group of ironwork, possibly a metalworker's hoard, comprising also Nos 47, 75, 208, 209, 213 and 227. Circumstances of discovery unknown. Later Iron Age. [C]

Reference MacGregor and Simpson 1963, 394, no. 23, fig. 2.

No. 211. (Fig. A23) **GRAVER ?** **Wetwang Slack, N. Humberside** XX

Description Slightly tapering, rectangular-sectioned stem. The tip is rectangular with rounded edges. Tapering tang which has traces of mineralised handle (?horn). L 82mm (complete). **Stem:** L 62mm; (max) 7 x 4mm. **Tip:** c. 4 x c. 2mm.

Condition Complete other than a flake missing from the tip. Accretions in situ.

Examination X-ray (+ 1987).

Context/date XI. WN 43 GV. Feature contained residual Iron Age pottery and bronzeworking debris. Later Iron Age or Romano-British. [E]

Reference J. Dent forthcoming (no. 2.25).

No. 212. (Fig. A23) **GRAVER ?** **Meare Village West, Somerset** SCM

Description Slightly tapering, the stem round in section at the centre, oval at the terminal 13mm. The tip is convex across the broader face, biconvex in sectional contour, the edge sharp. Tapering rectangular-sectioned tang. L 75mm (complete). **Stem:** L 66mm; Diam (max, at tang junction) 4.8mm. **Tip:** W 3.5mm.

Condition Fissured and spalled.

Examination X-ray (1985).

Context/date Mound 9, 24ft [7.31m] SW of central picket, in black earth. Within 10m was file No. 150, punch No. 200, stone moulds, crucible sherds, copper alloy waste metal, and ferrous slag. C3rd BC - mid C1st AD. [B]

Reference Gray and Bulleid 1953, 239, 142.

No. 213. (Fig. A23) **GRAVER ?** **Barbury Castle, Wilts** DM

Description Tapering stem, round in section at the centre. The exact form of the tip cannot be determined but it was probably rectangular and well-rounded. L 71mm (almost complete). **Stem:** L 45mm; Diam (max) c. 6mm.

Condition Incomplete at the tang tip (ancient damage). Metal core; much fissured, spalled.

Examination X-ray (1985).

Context/date From a group of ironwork, possibly a metalworker's hoard, comprising also Nos 47, 75, 208, 209, 210 and 227. Circumstances of discovery unknown. Later Iron Age. [C]

Reference MacGregor and Simpson 1963, 394, no. 20, fig. 2.

No. 214. (Fig. A23) **GRAVER ?** **Danebury, Hants** AMIA

Description Rounded-square stem, tapering to an angled flat edge which is biconvex in sectional contour. Tapering tang. L 71mm (complete). **Stem:** L c. 41mm; (max, tang junction) 7 x 5.5mm. **Tip:** W (working edge) 3.5mm; (1.5mm from tip) 5.5mm.

Condition Complete other than a flake lost from tip. Accretions and coatings obscure detail.

Context/date Pit 252. SF90. Ceramic phase 7-8 (300 BC - 50 AD). [A]

Reference Sellwood 1984, 354, no. 2.65, fig. 7.13, Mf. 9:C8.

No. 215. (Fig. A23) **GRAVER ?** **Gussage All Saints, Dorset** BMP: [651]

Description Square-sectioned stem tapering to a convex rectangular tip. Slightly bent stem. Rectangular-sectioned tapering tang. L 67mm (complete). **Stem:** L c. 52mm; (max) 5.5mm square. **Tip:** c. 3 x c. 2mm.

Condition Accretions and plate hammer-scale in situ. Fractured.

Examination AML728510. X-ray (1973, 1987).

Context/date Pit 209/2 layer 11 Q. Pit contained at least 20 other metalworking tools (cold set No. 116, files Nos 152-156, punches Nos 164, 169, 186, 191-193, 202, ?gravers Nos 207, 216-218, ?scribers Nos 221 and 228, and ?scraper No. 230), and debris from wrought and cast bronzeworking, and iron-smithing. Phase 2: C1st BC. [A]

Reference Fell 1988, 76, no. 29, fig. 1.

No. 216. (Fig. A23) **GRAVER ?** **Gussage All Saints, Dorset** BMP: [174]

Description Oval-sectioned stem, curved or bent 15mm from the tip. The edge is convex but angled (worn); the two broader faces convex in sectional contour. Tapering square-sectioned tang. L 52mm (complete). **Stem:** L 30mm; W (max) 4mm. **Tip:** W (max) 2.7mm.

Condition Fractured. Metal at the tang only.

Examination AML726557. X-ray (1973, 1987).

Context/date Pit 209 layer 10. Pit contained at least 20 other metalworking tools (cold set No. 116, files Nos 152-156, punches Nos 164, 169, 186, 191-193, 202, ?gravers Nos 207, 215, 217, 218, ?scribers Nos 221 and 228, and ?scraper No. 230), and debris from wrought and cast bronzeworking, and iron-smithing. Phase 2: C1st BC. [A]

Reference Fell 1988, 76, no. 28, fig. 1.

No. 217. (Fig. A23) **GRAVER? TIP** **Gussage All Saints, Dorset** BMP: [677]

Description Tapering stem, rectangular-sectioned, the orientation altering towards the tip. Convex tip, bevelled on one side, rounded on the other. L 85mm (inc). **Stem:** (max, extant) 3 x 3.5mm; (10mm from tip) 2 x 3mm. **Tip:** c. 2 x c. 1mm.

Condition Ancient fracture across the stem.

Examination AML728570. X-ray (1973, 1987).

Context/date Pit 209/2 layer 11 S. Pit contained at least 20 other metalworking tools (cold set No. 116, files Nos 152-156, punches Nos 164, 169, 186, 191-193, 202, ?gravers Nos 207, 215, 216, 218, ?scribers Nos 221 and 228, and ?scraper No. 230), and debris from wrought and cast bronzeworking, and iron-smithing. Phase 2: C1st BC. [A]

Reference Fell 1988, 76.

No. 218 (Fig. A23) **GRAVER? TIP** **Gussage All Saints, Dorset** BMP: [344]

Description Rectangular section, slightly curved or bent near the tip. The edge is convex, bevelled on one side. L 57.5mm (inc). **Stem:** 4 x 2.5mm. **Tip:** W c. 2mm.

Condition Recent fracture across the stem. Accretions and adhering iron slag obscure detail.

Examination AML726236. X-ray (1973, 1987).

Context/date Pit 209 layer 11, 10-15cm. Pit contained at least 20 other metalworking tools (cold set No. 116, files Nos 152-156, punches Nos 164, 169, 186, 191-193, 202, ?gravers Nos 207, 215-217, ?scribers Nos 221 and 228, ?scraper No. 230), and debris from wrought and cast bronzeworking, and iron-smithing. Phase 2: C1st BC. [A]

Reference Fell 1988, 76.

No. 219. (Fig. A23) **SCORER/SCRIBER ?** **Danebury, Hants** AMIA

Description Slender square-sectioned rod, tapering at both ends, bent at the broadest part of the stem (66mm from one end). The shorter 'arm' is thicker and tapers more markedly over the terminal 10mm to a sharp point; the other tapers more evenly to a ?blunter tip. L (bent) 152mm (complete?); L (if straight) 155mm; (MP, max) 4mm square.

Condition Sampled for metallography through the blunter end (probably originally complete).

Examination Metallography: Ehrenreich 1985, 209, D33b; **Appendix B**, S61.

Context/date DA77 layer 374 SF1200 Ceramic phase 5 (late C5th BC). [A]

Reference Sellwood 1984, Mf. 9:F10, no. 1200.

No. 220. (Fig. A23) **SCORER/SCRIBER ?** **Worthy Down, Headbourne Worthy, Hants** WCM: 321.19

Description Round sectioned, tapering at both ends, curved at one end. L 102mm (inc, bent), c. 108mm if straight. **Stem:** Diam (max) 5mm; extant ends c. 2mm; dimensions from X-ray.

Condition Recent fracture at the curved end. The straight end may have been complete before it was sampled. Accretions and coatings obscure detail.

Examination X-ray (1985). Metallography: Ehrenreich 1985, 215, WD13b; Appendix B, S62.

Context/date Late pit or ditch: mid C1st BC - mid C1st AD. [A]

Reference Hooley 1931, 189, no. 85, pl. VI.

No. 221. (Fig. A23) **SCORER/SCRIBER ? TIP** **Gussage All Saints, Dorset** BMP: [712]

Description Rectangular-sectioned rod, curved along the length, tapering. The end is pointed but has a bevel at the very tip. Two pink metal flecks are attached near the tip (?debris through burial). L 67.5mm (inc). **Stem**: (max) 3.2 x 2.8mm.

Condition Complete as buried. Now fissured and fractured; partial metal core at the tip only.

Examination AML728396. X-ray (1973, 1987).

Context/date Pit 209/2 layer 11 T. Pit contained at least 20 other metalworking tools (cold set No. 116, files Nos 152-156, punches Nos 164, 169, 186, 191-193, 202, ?gravers Nos 207, 215-218, ?scriber No. 228, and ?scraper No. 230), and debris from wrought and cast bronzeworking, and iron-smithing. Phase 2: C1st BC. [A]

Reference Fell 1988, 76.

No. 222. (Fig. A24) **SCORER/SCRIBER ?** **South Cadbury, Somerset** XX

Description Square in section at mid-length, tapering and round in section at both ends, pointed tips. L 65mm (complete). **Stem**: (max) c. 4 x 4mm. (After Spratling 1970b).

Context/date Area N, possibly a metalworking area, with associated hearths, scrap wrought bronze, and chisel No. 110. Stratigraphy suggests C1st BC or early C1st AD. [A]

References Alcock 1970, 47, pl. VIII, 7; Spratling 1970a, 190, fig. 3; Spratling 1970b, 15, no. 2, fig. p. 24, B.

No. 223. (Fig. A24*) **SCORER/SCRIBER ?** **Danebury, Hants** AMIA

Description Round in section at one end, square-sectioned and tapering at the other. L 109mm (complete). **Stem**: Diam (MP) 6mm (after Sellwood 1984). Blunt tip.

Examination X-ray

Condition Accretions and coatings obscure the surface.

Context/date DA74 pit 589 layer 4 SF625. Same layer also yielded No. 224. Ceramic phase 7: 300-100/50 BC. [A]

Reference Sellwood 1984, 354, no. 2.57, fig. 7.13, Mf 9:C6.

No. 224. (Fig. A24*) **SCORER/SCRIBER?** **Danebury, Hants** AMIA

Description Round section, tapering at both ends and sharply pointed at one end. L 85mm (complete). **Stem**: Diam (max) 5.5mm (after Sellwood 1984).

Examination X-ray

Condition Accretions and coatings obscure the surface.

Context/date DA74 pit 589 layer 4 SF624. Same layer also yielded No. 223. Ceramic phase 7: 300-100/50 BC. [A]

Reference Sellwood 1984, 354, no. 2.59, fig. 7.13, Mf 9:C6.

No. 225. (Fig. A24*) **SCORER/SCRIBER? or SCRAPER?** **Croft Ambrey, Here & Worc** HCM

Description Narrow stem, round in section at the top, square near the tapered and pointed tip. L c. 89mm (?inc). **Stem:** Diam (max) c. 4mm. (After Stanford 1974.)

Condition Not known if the stem is complete at the top.

Context/date Quarry-ditch occupation layer 9, Site G, SF114(a). Same layer also yielded No. 226. Phase vi, period VID; mid C2nd BC. [A]

Reference Stanford 1974, 174, fig. 82, no. 17.

No. 226. (Fig. A24*) **SCORER/SCRIBER ?** **Croft Ambrey, Here & Worc** HCM

Description Round-sectioned at one end, tapering to a pointed tip. Tapering and rectangular-sectioned at the other end (possibly a long tang ?). L c. 110mm (?complete). **Stem:** Diam (max) c. 6mm. (After Stanford 1974.)

Context/date Quarry-ditch occupation layer 9, Site G, SF114(b). Same layer also yielded No. 225. Phase vi, period VID; mid C2nd BC). [A]

Reference Stanford 1974, 174, fig. 82, no. 20.

No. 227. (Fig. A24) **SCORER/SCRIBER ?** **Barbury Castle, Wilts** DM

Description Tapering, round-sectioned stem; pointed end, the tip missing. Rectangular-sectioned tang. L 72.5 (almost complete). **Stem:** L c. 45mm; Diam (MP) 4mm.

Condition Incomplete at the tip; metal core.

Examination X-ray (1985).

Context/date From a group of ironwork, possibly a metalworker's hoard, comprising also Nos 47, 75, 208, 209, 210 and 213. Circumstances of discovery unknown. Later Iron Age. [C]

Reference MacGregor and Simpson 1963, 394, no. 24, fig. 2.

No. 228. (Fig. A24) **SCORER/SCRIBER ?** **Gussage All Saints, Dorset** BMP: [218]

Description Round-sectioned stem, tapering to a blunt point which is slightly bent to one side. Tapering square-sectioned tang. L 36mm (complete). **Stem:** L 22mm; Diam (MP) 4mm.

Condition No metal core; intact and well-defined surface.

Examination AML726589. X-ray (1973, 1987).

Context/date Pit 209 layer 10. Pit contained at least 20 other metalworking tools (cold set No. 116, files Nos 152-156, punches Nos 164, 169, 186, 191-193, 202, ?gravers Nos 207, 215-218, ?scriber No. 221, and ?scraper No. 230), and debris from wrought and cast bronzeworking, and iron-smithing. Phase 2: C1st AD. [A]

Reference Unpublished.

No. 229. (Fig. A24) **SCORER/SCRIBER ?** **Gussage All Saints, Dorset** DCM

Description Rounded-sectioned and sharply pointed at one end, flattened (oval-section) at the other. Bent at both ends. L 27mm (complete). **Stem:** (MP) c. 3 x c. 2mm.

Condition Accretions in situ.

Examination X-ray (1985).

Context/date Pit 437 layer 5 SF1153. Pit contained debris from bronze-founding and iron-smithing, cold set No. 114, file No. 143, punches Nos 166, 167, 174, and 199. Phase 2: C3rd - 1st BC. [A]

Reference Unpublished.

No. 230. (Fig. A24) **SCRAPER OR BURNISHER ?** **Gussage All Saints, Dorset** BMP: [346]

Description Round-sectioned stem. The tip is bevelled (≈ 40°) to a triangular flat face on one side, convex on the opposing side. The leading edge is slightly angled and is broader than the stem. Tapering squat square-sectioned tang. L 74mm (complete). **Stem:** L c. 54mm; Diam (MP) 7.5mm. **Tip:** W 9mm, the bevel is 7mm deep.

Condition Much fissured and fractured. Metal core.

Examination AML726238. X-ray (1973, 1987).

Context/date Pit 209 layer 11, 10-15cm. Pit contained at least 20 other metalworking tools (cold set No. 116, files Nos 152-156, punches Nos 164, 169, 186, 191-193, 202, ?gravers Nos 207, 215-218, and ?scribers Nos 221 and 228), and debris from wrought and cast bronzeworking, and iron-smithing. Phase 2: C1st BC. [A]

Reference Fell 1988, 76, no. 30, fig. 1.

No. 231. (fig. A24) **BURNISHER ?** **Danebury, Hants** AMIA

Description Tapering stem; rounded-rectangular in section near the tang, oval near the blunt tip. Slightly bent near the tip. Square-sectioned tang with traces of the handle. L 53mm (inc). **Stem:** L 42mm (complete); (max) 8 x 7mm, (3mm from tip) 6 x 2mm.

Condition Fractured across the tang and spalled along the stem. Accretions obscure detail.

Context/date DA74 F63 layer 3 SF178. Ceramic phase 7 (300 - 100/50 BC). [A]

Reference Sellwood 1984, 354, no. 2.58, fig. 7.13, Mf. 9:C6.

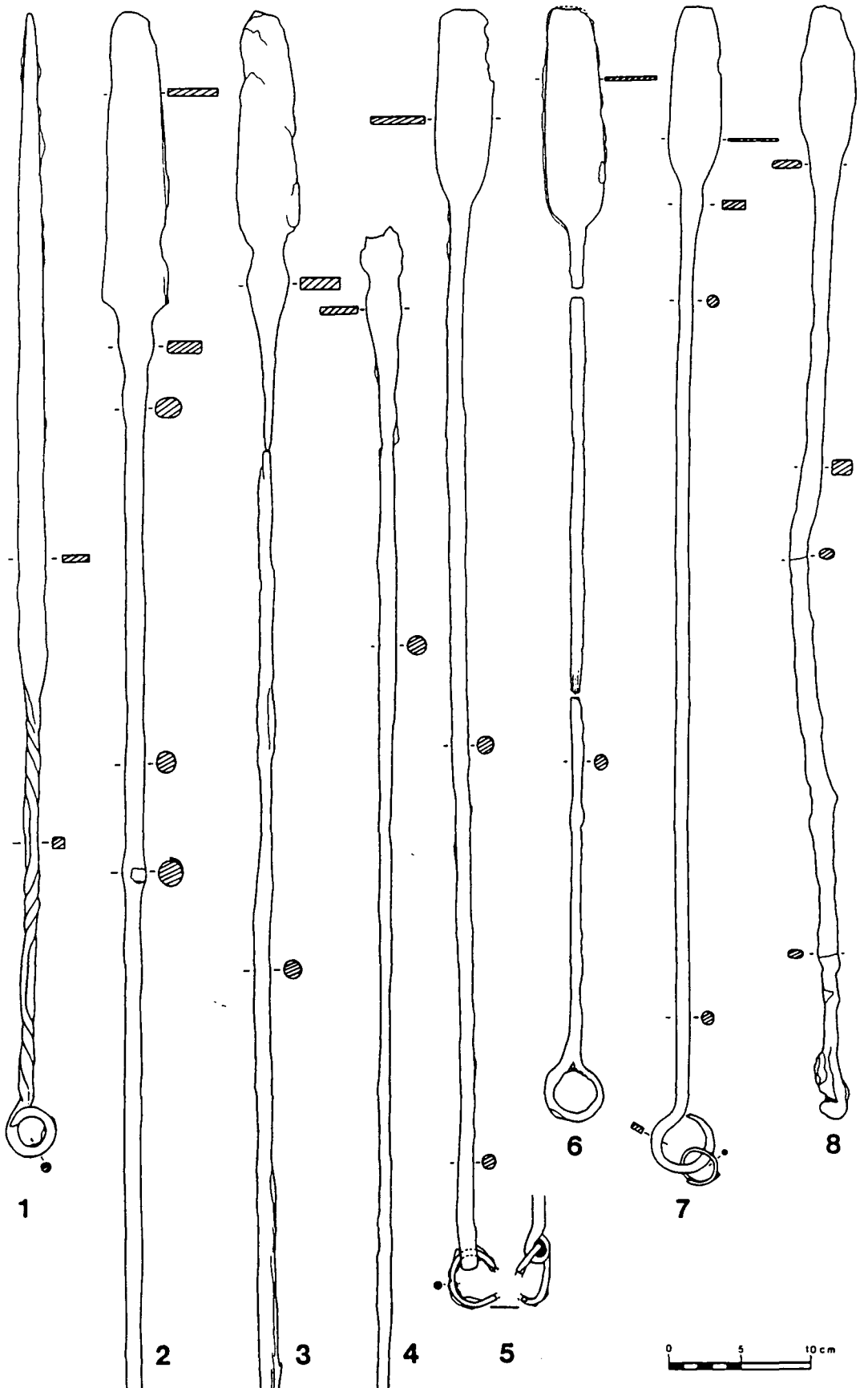


Figure A1. Pokers (Nos 1-8).
Scale 1:4

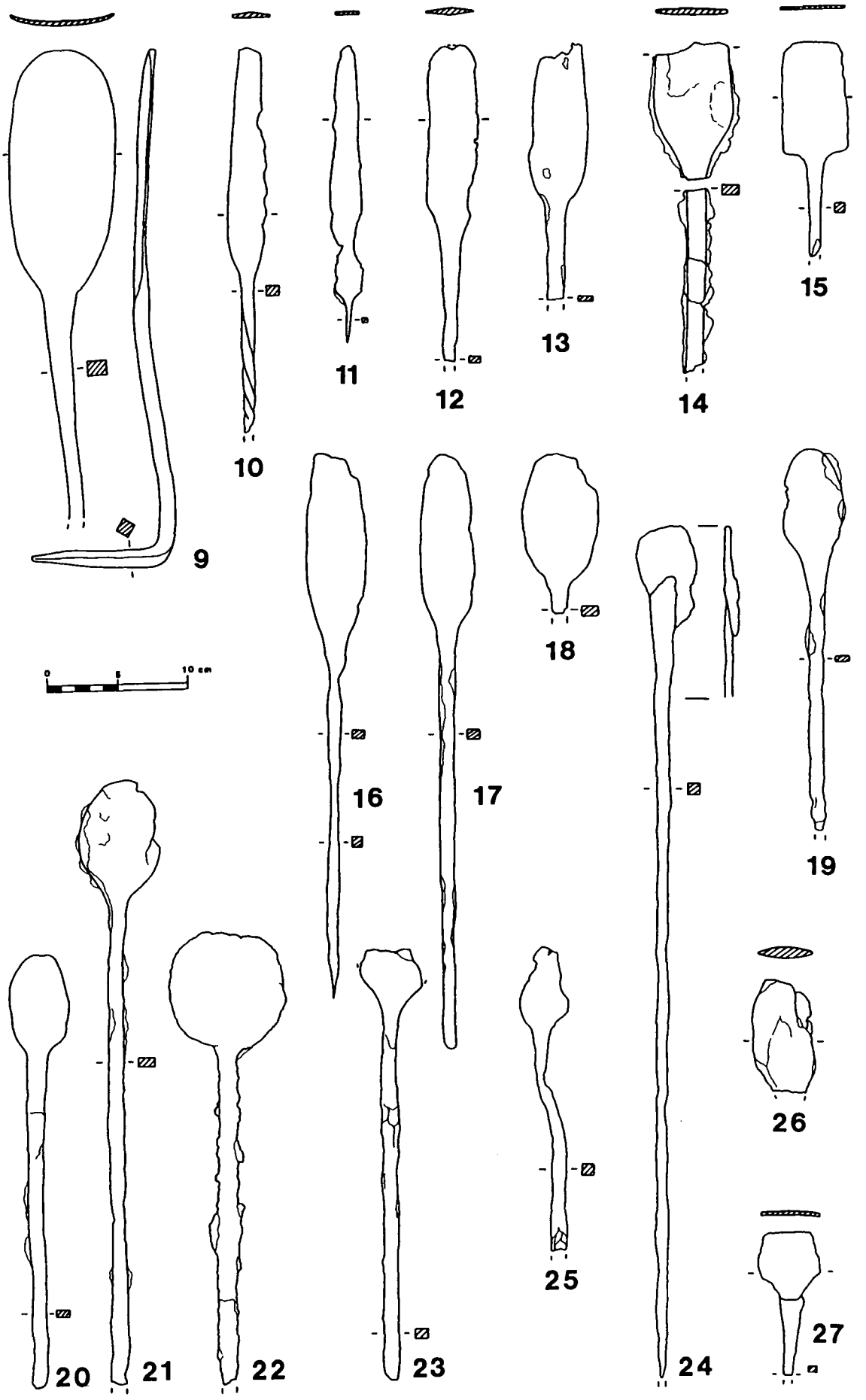


Figure A2. Pokers (Nos 9-27). Scale 1:4

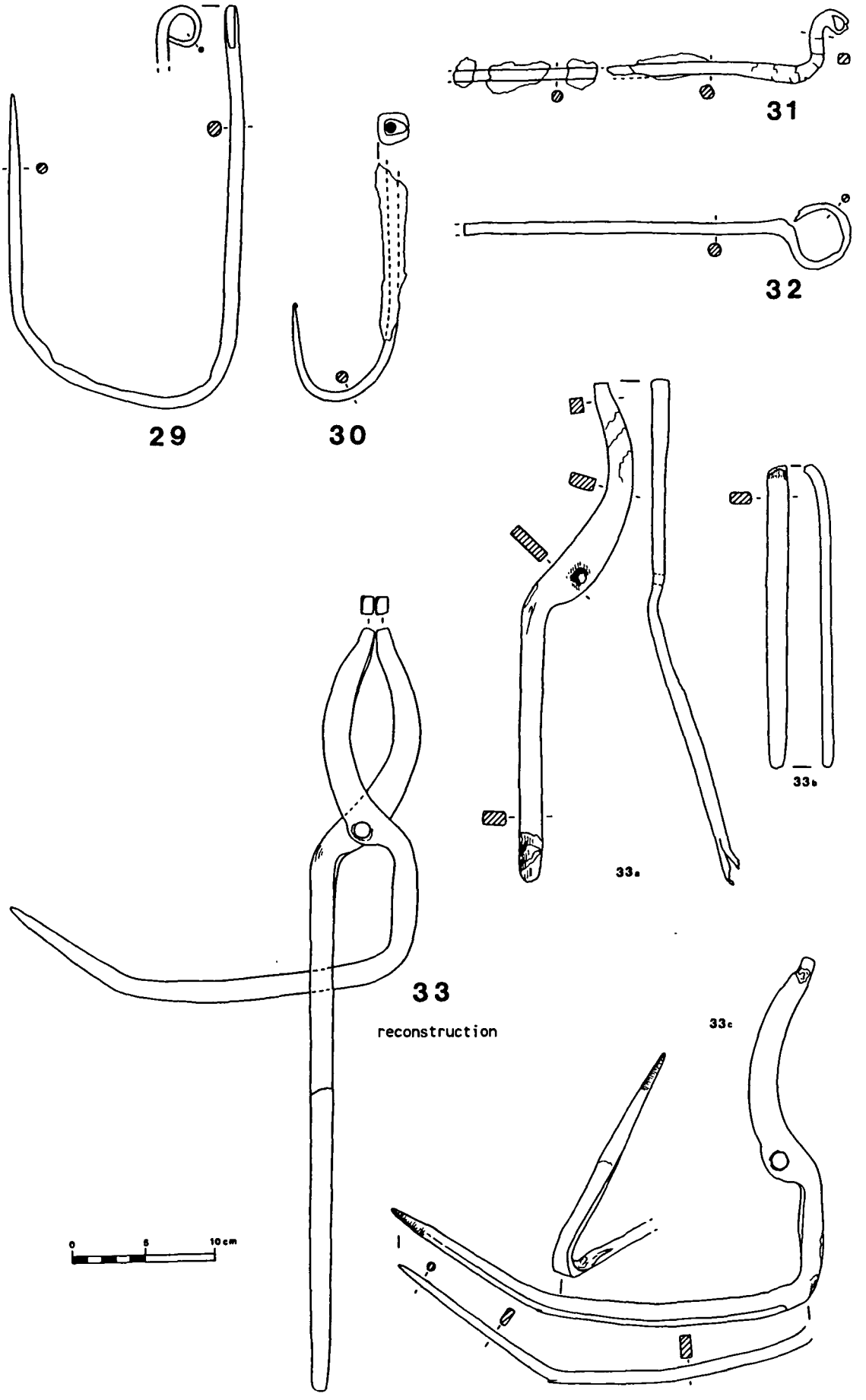


Figure A3. Pokers (Nos 29-32) and tongs (No. 33). Scale 1:4

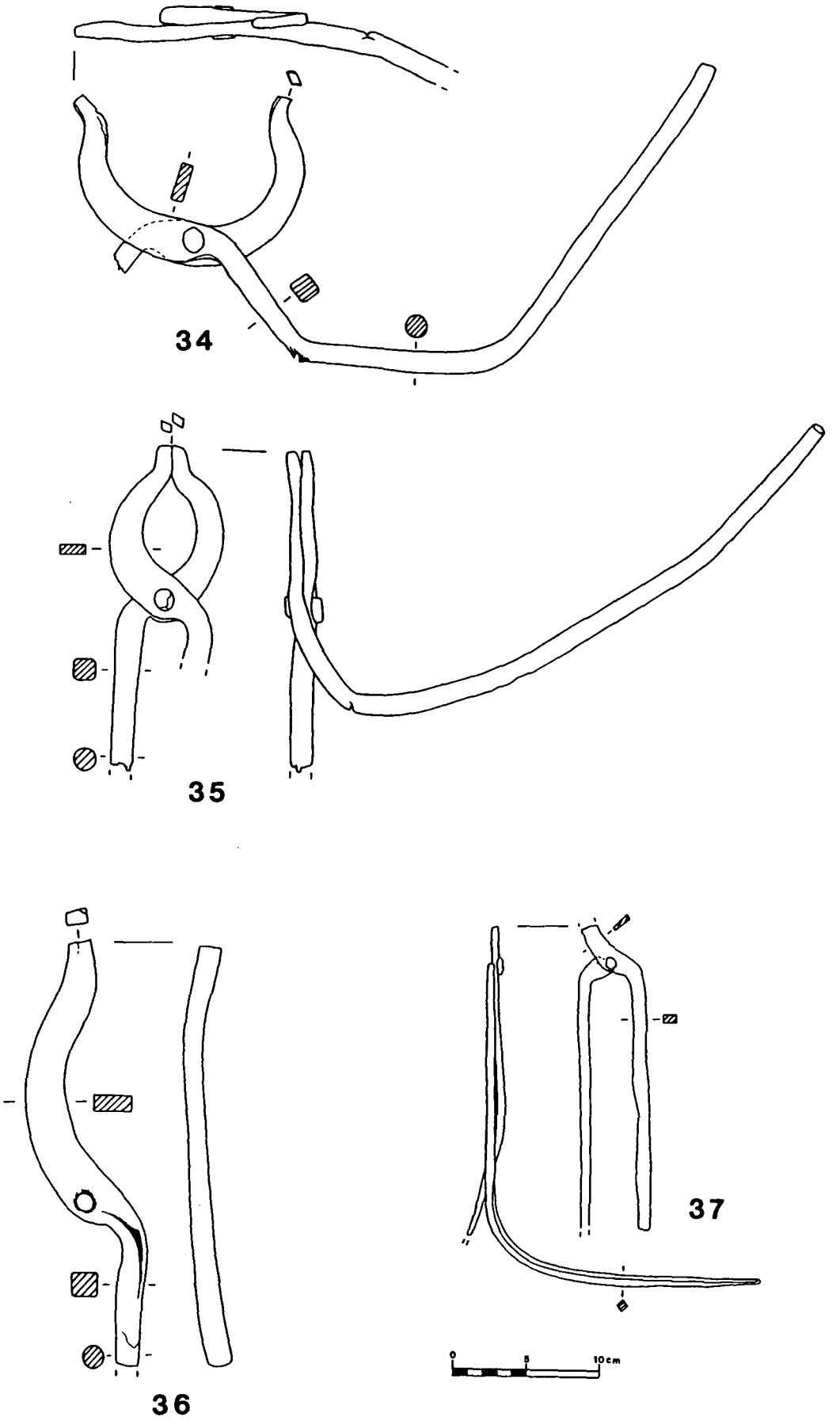


Figure A4. Tongs (Nos 34-37). Scale 1:4

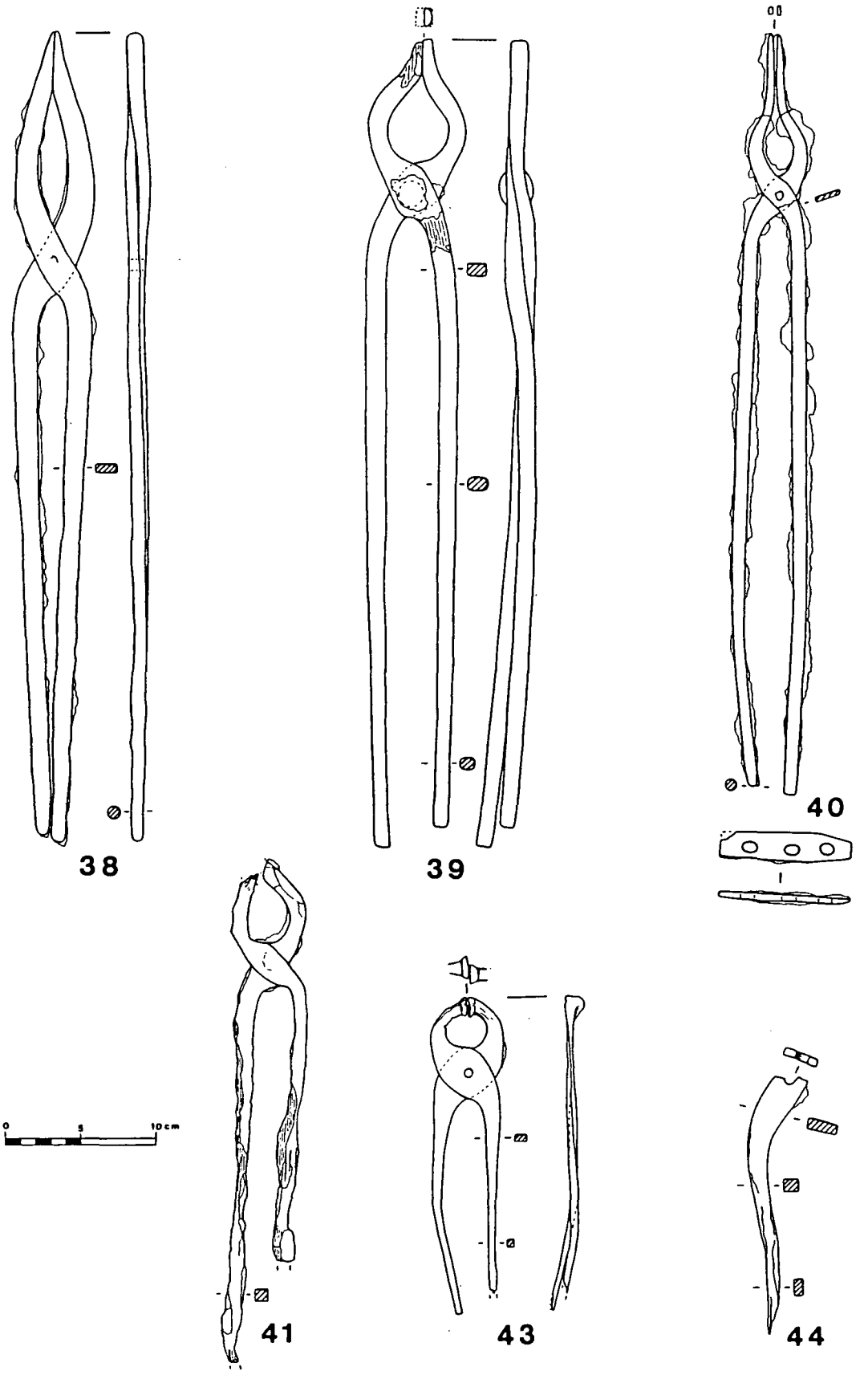
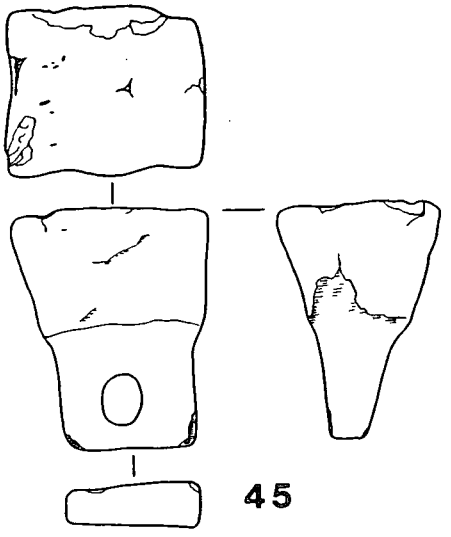
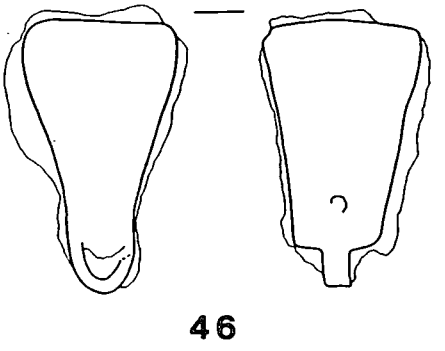
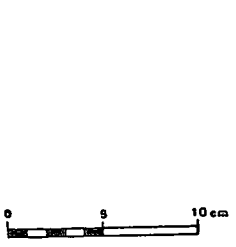
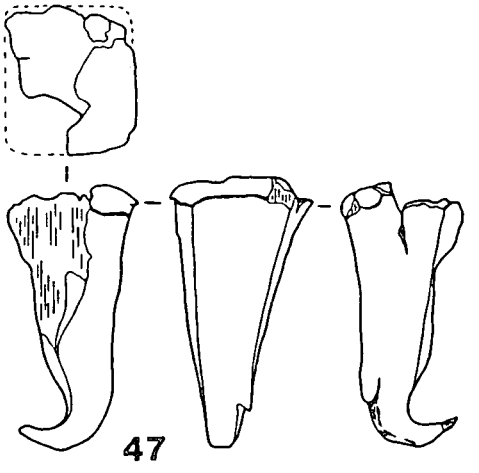


Figure A5. Tongs (Nos 38-41, 43-44). Scale 1:4









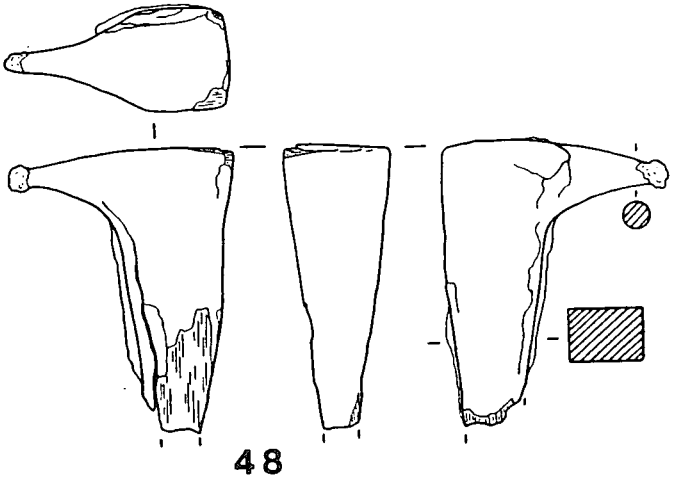


Figure A6. Anvils (Nos 45-48). Scale 1:4

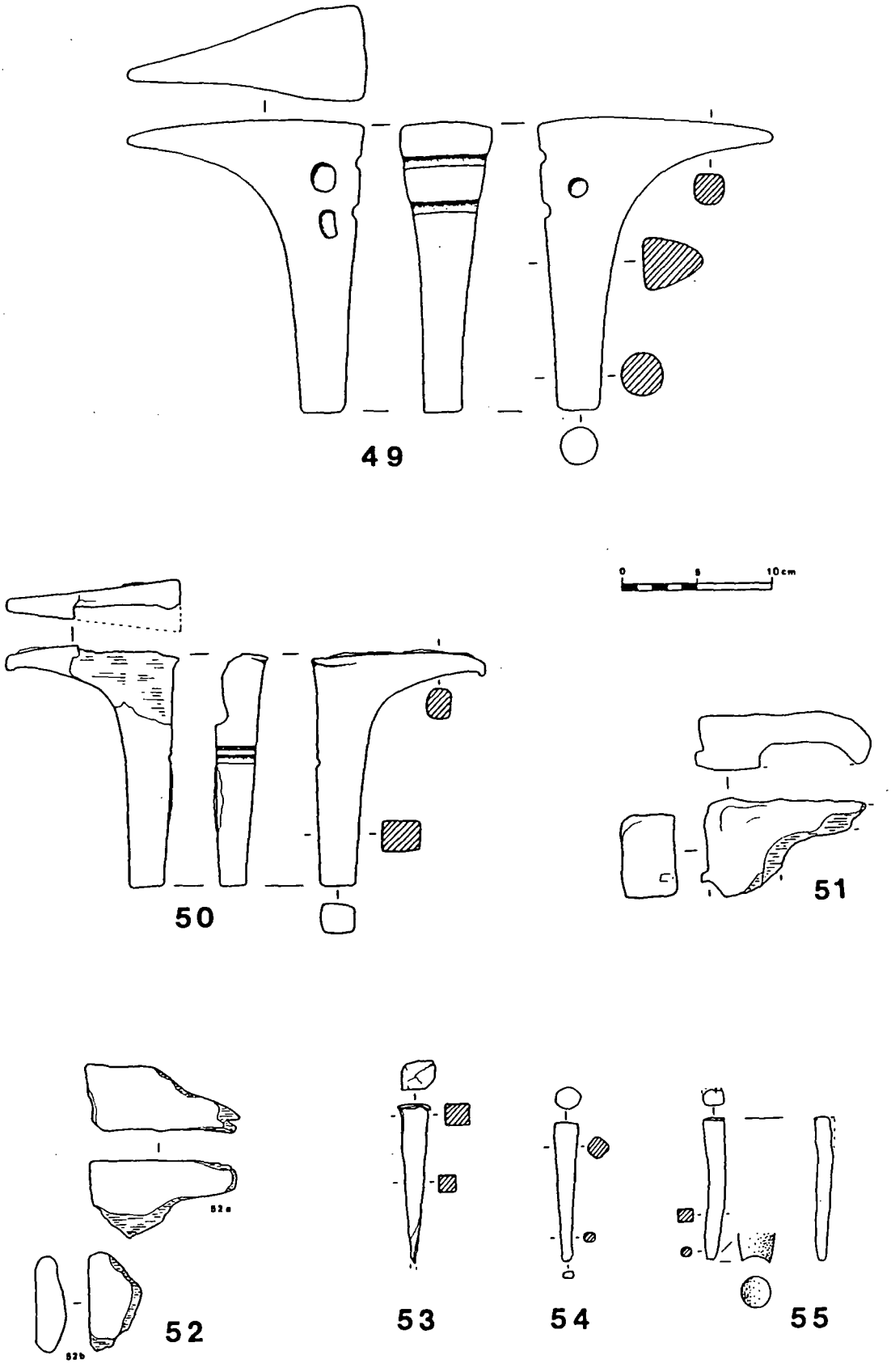


Figure A7. Anvils and swages (Nos 49-55).
Scale 1:4, No. 55 (detail) 1:1

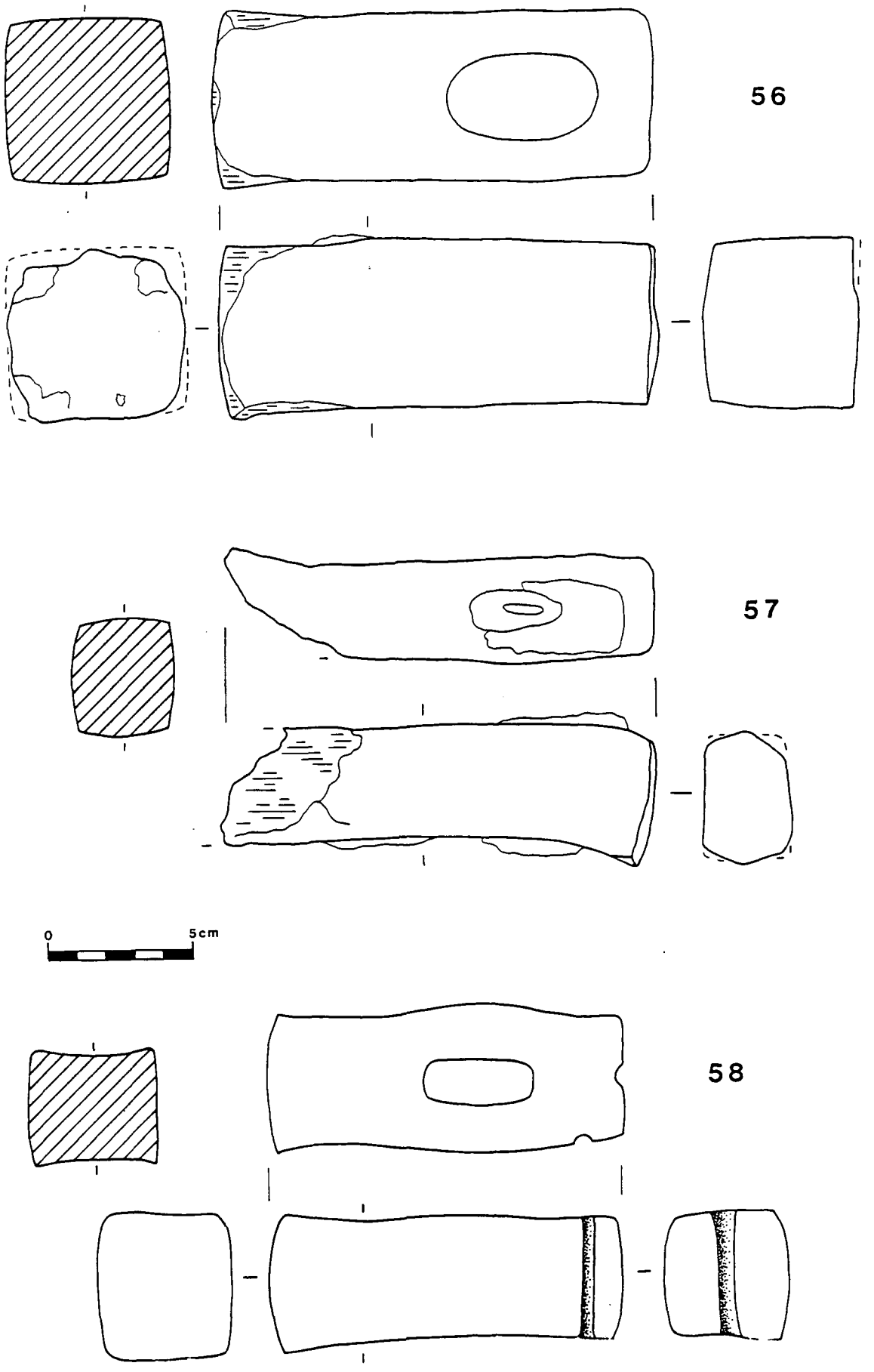


Figure A8. Hammers (Nos 56-58). Scale 1:2

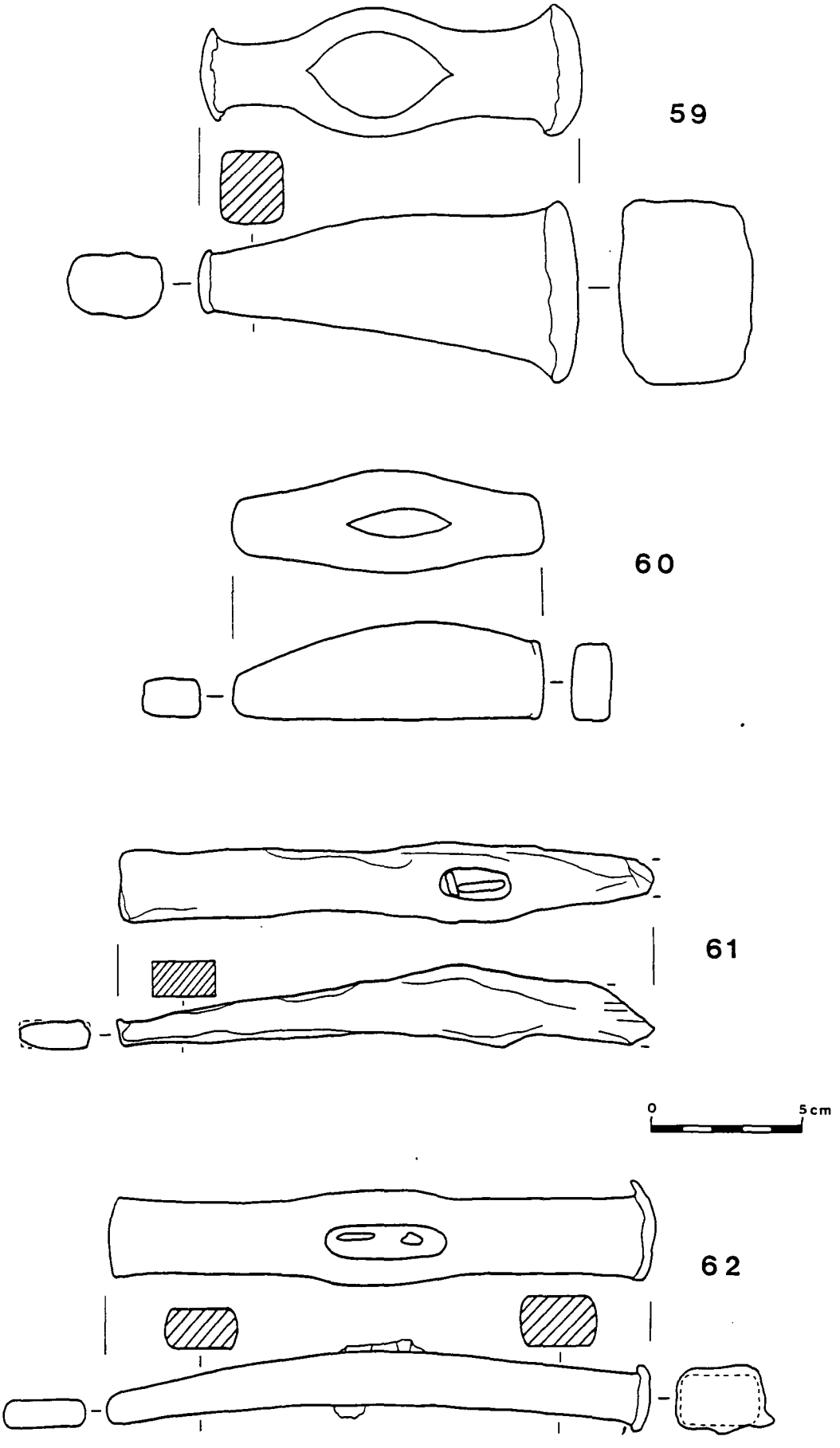


Figure A9. Hammers (Nos 59-62). Scale 1:2

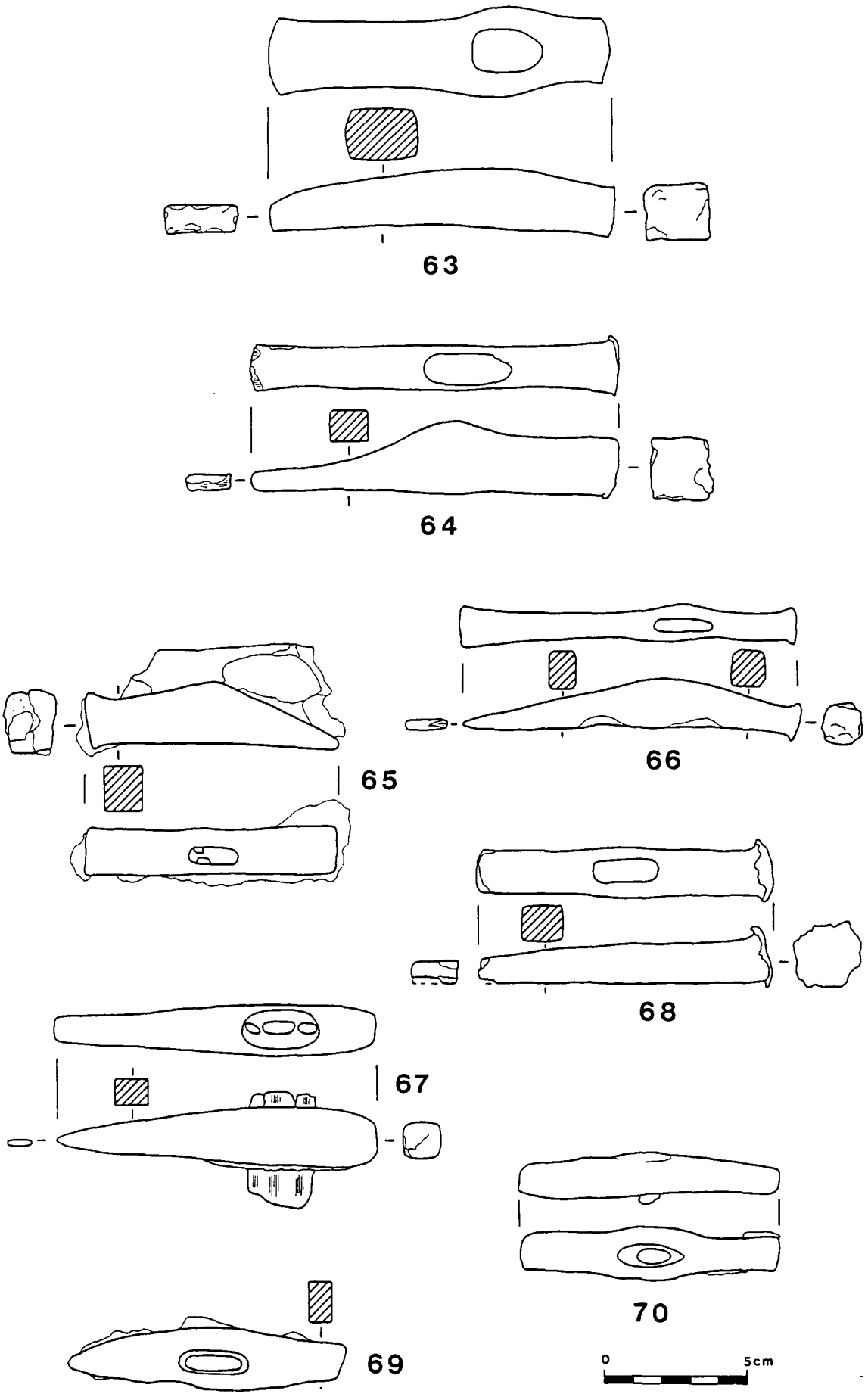


Figure A10. Hammers (Nos 63-70). Scale 1:2

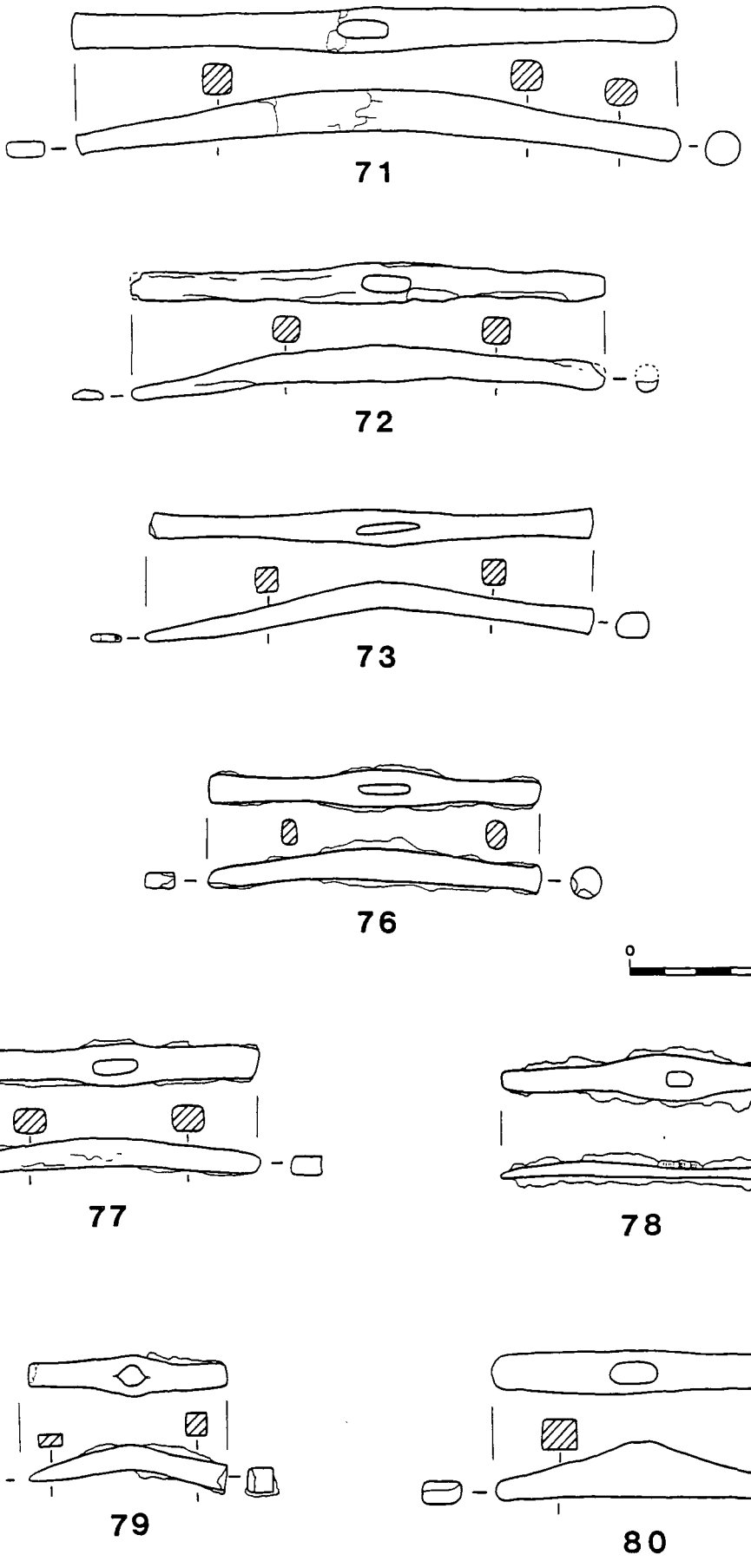


Figure A11. Hammers (Nos 71-73, 76-80). Scale 1:2

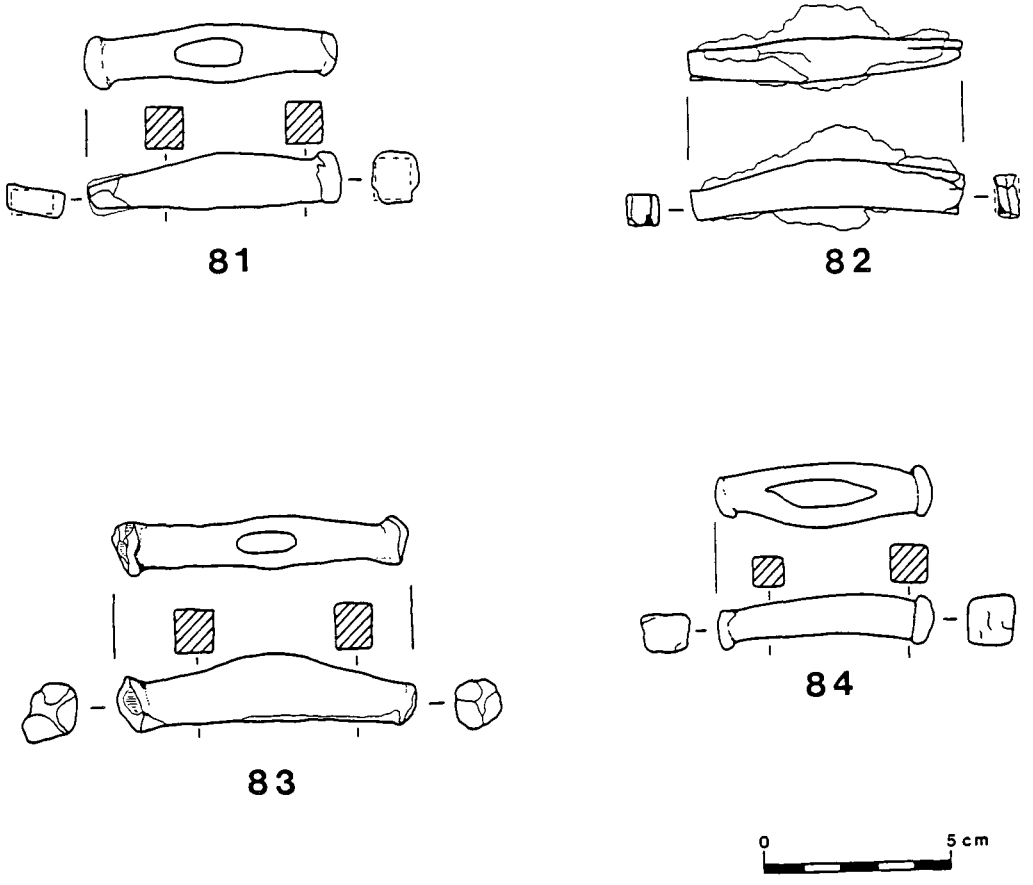


Figure A12. Hammers (Nos 81-84, 86-89). Scale 1:2

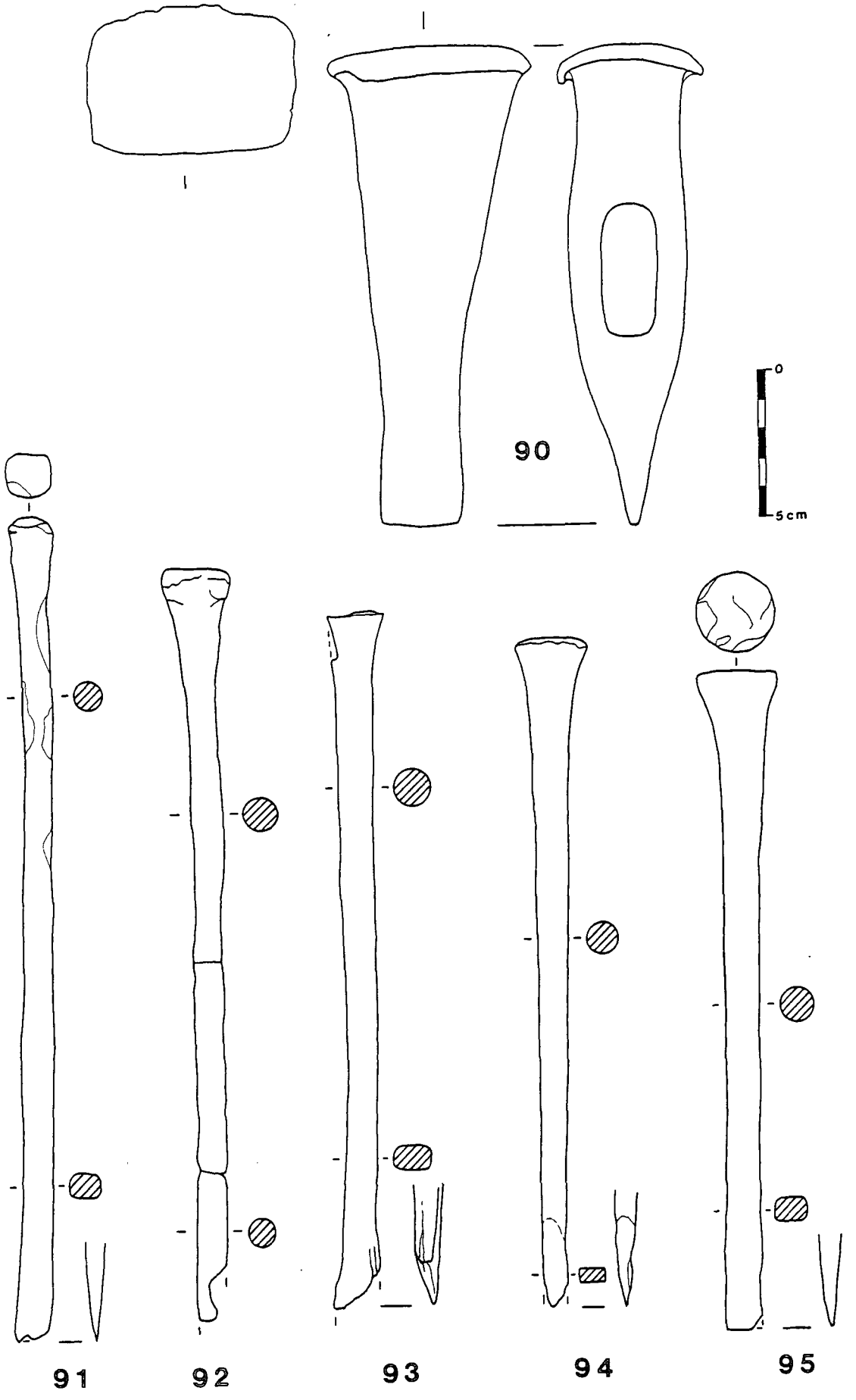


Figure A13. Hot set (No. 90) and hot chisels (Nos 91-95). Scale 1:2

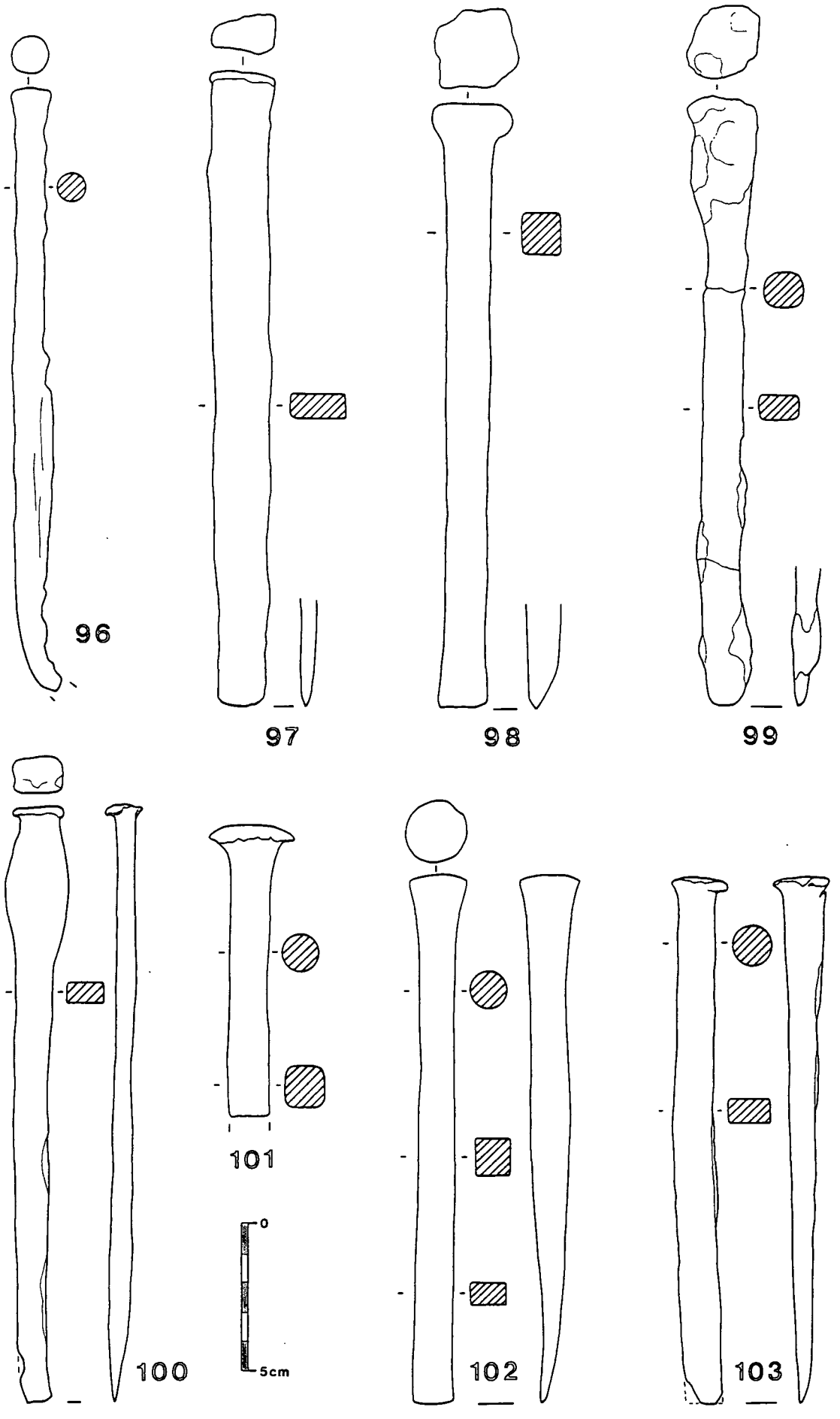


Figure A14. Hot chisels (Nos 96-103). Scale 1:2

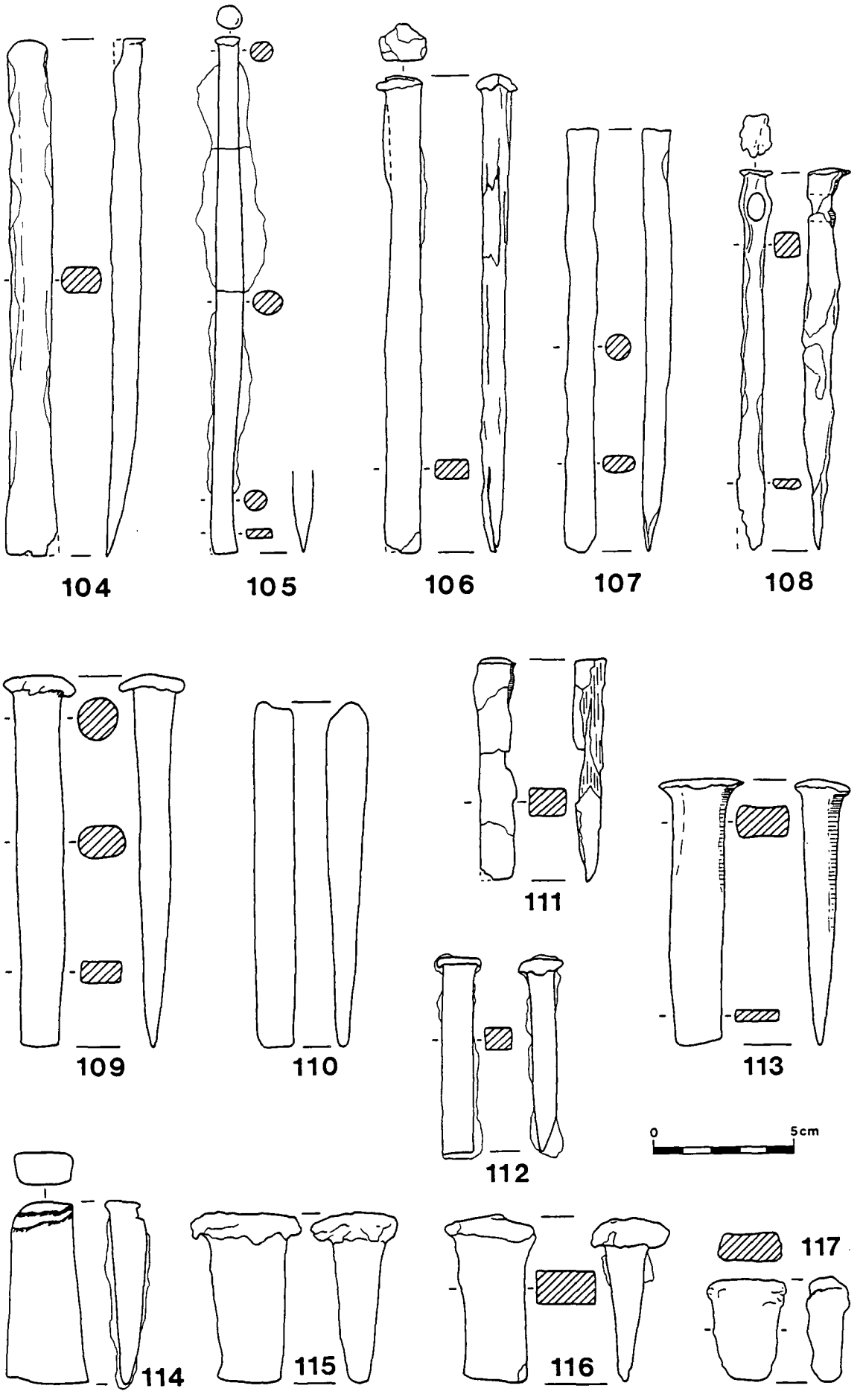


Figure A15. Chisels (Nos 104-112) and cold sets (Nos 113-117).
Scale 1:2

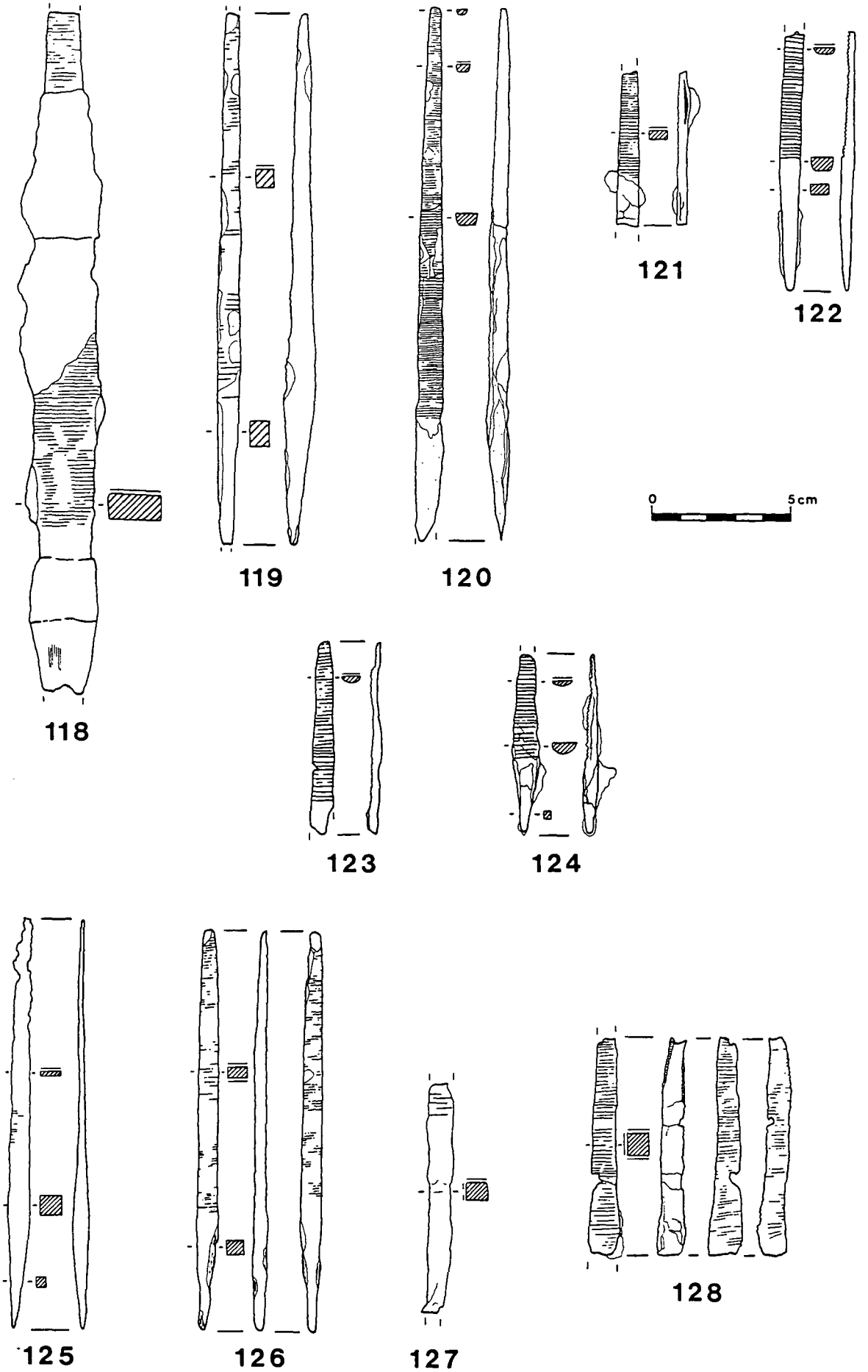


Figure A16. Files (Nos 118-128). Scale 1:2

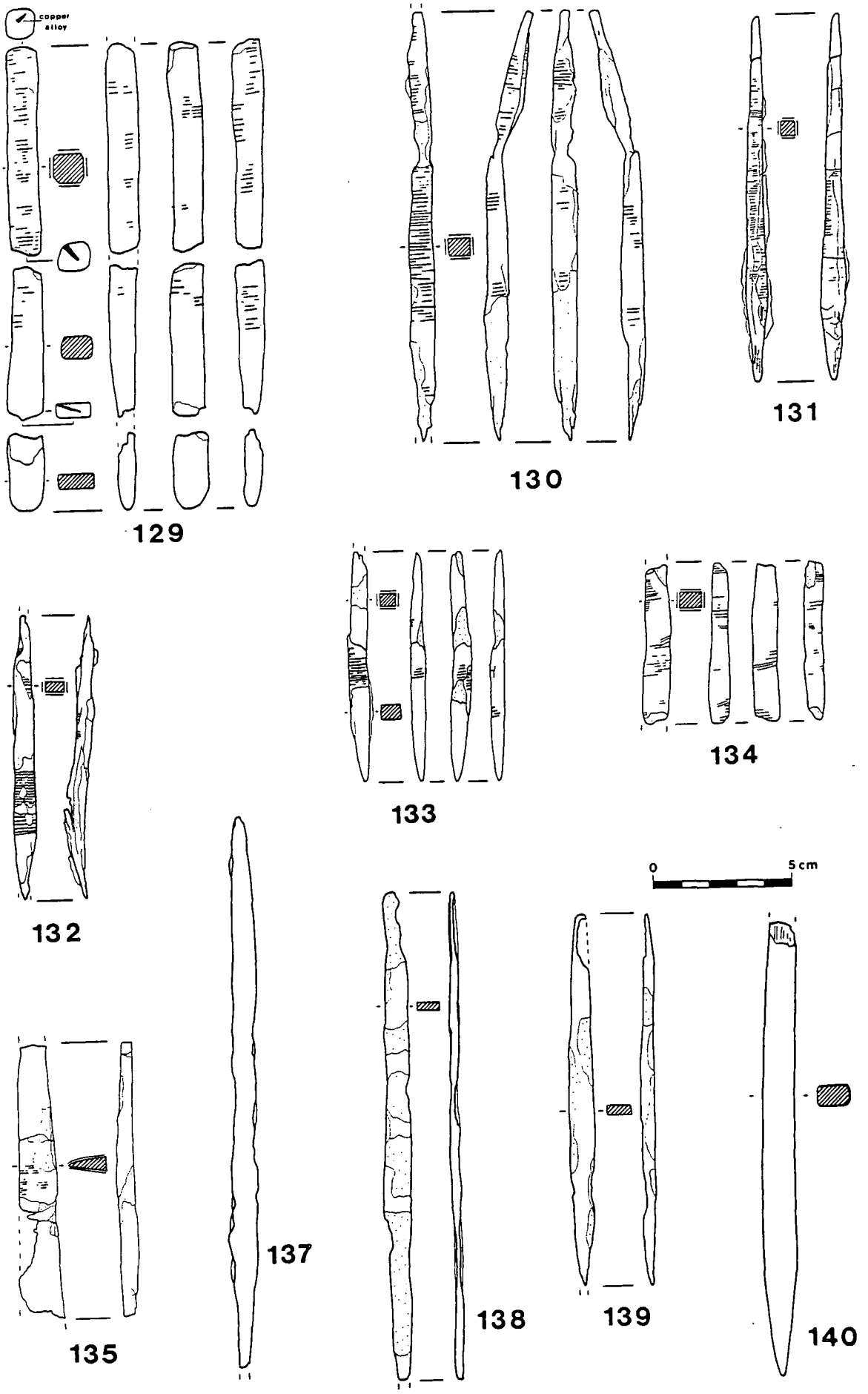


Figure A17. Files (Nos 129-135, 137-140). Scale 1:2

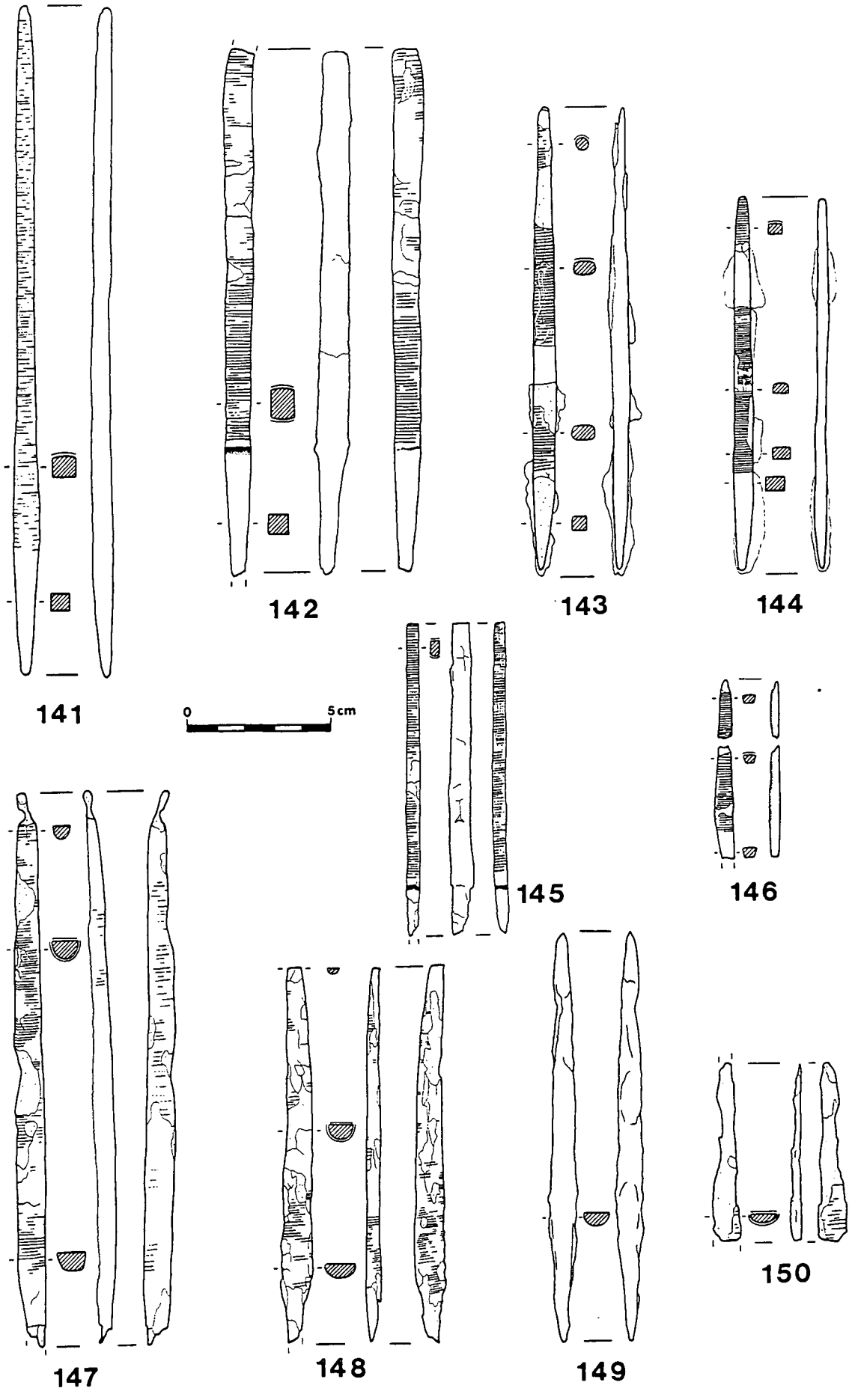


Figure A18. Files (Nos 141-150). Scale 1:2

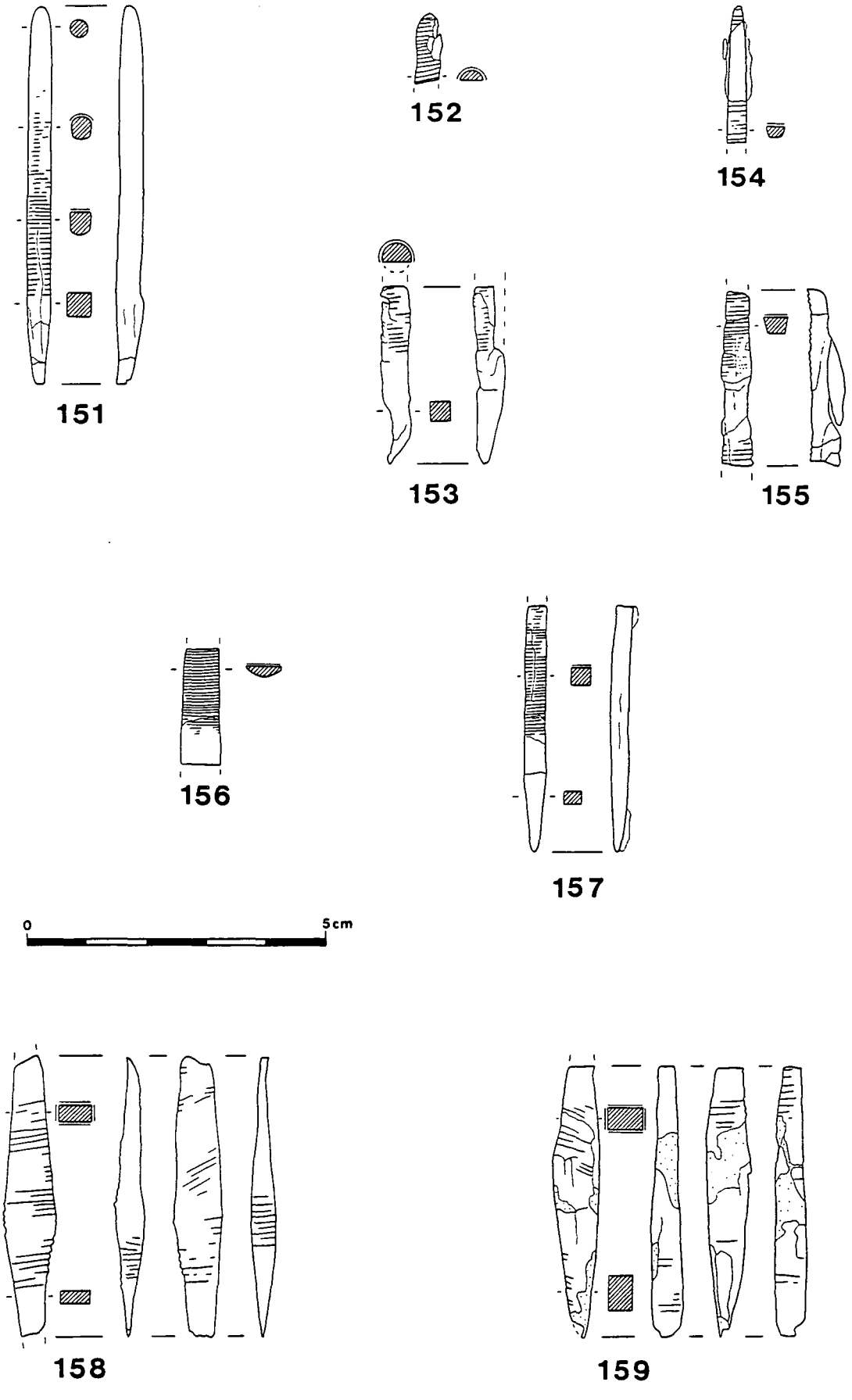


Figure A19. Files (Nos 151-159). Scale 1:1

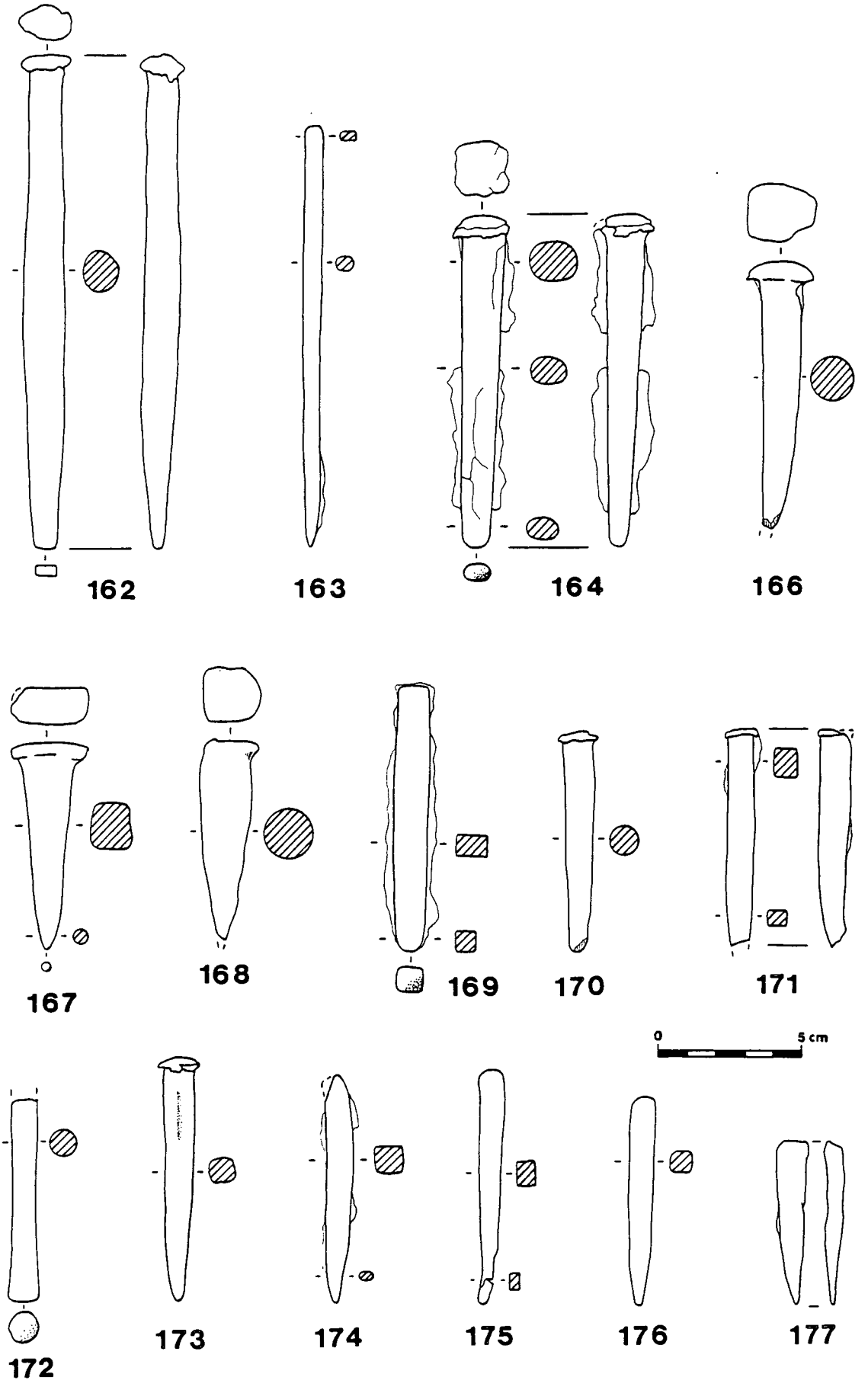


Figure A20. Punches (Nos 162-164, 166-177). Scale 1:2

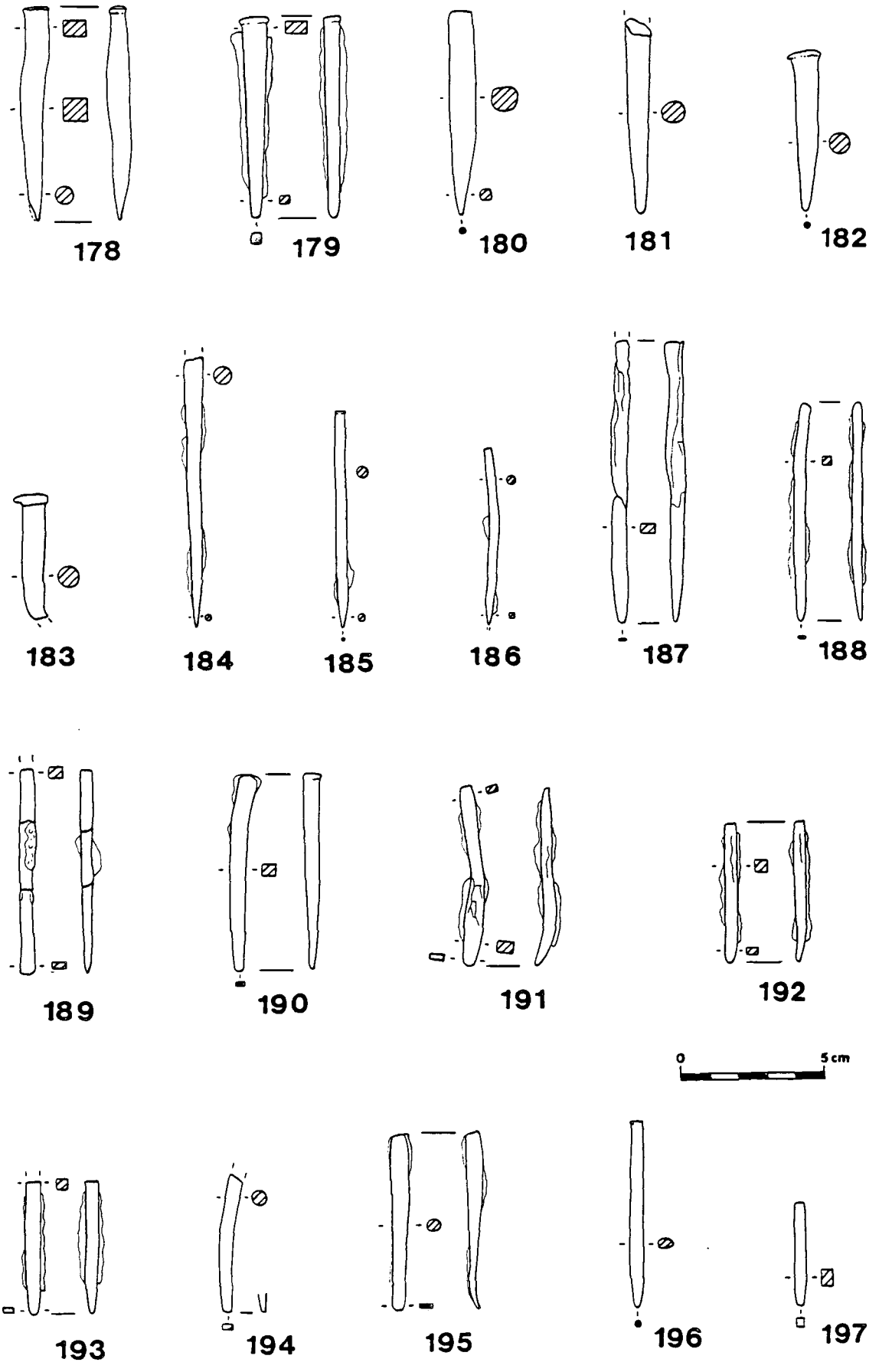


Figure A21. Punches (Nos 178-197). Scale 1:2

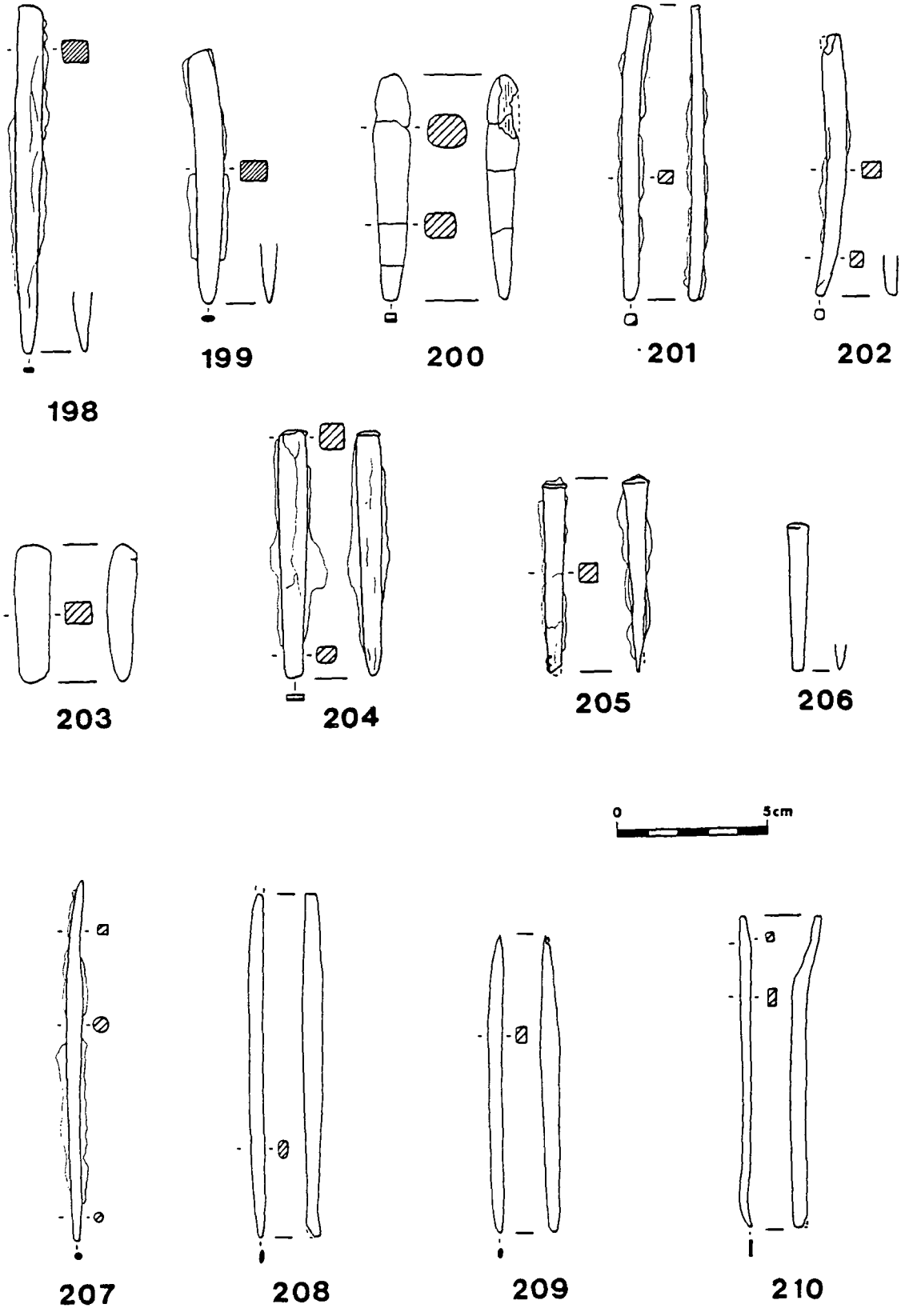


Figure A22. Punches, and possible chisels and gravers (Nos 198-210).
Scale 1:2

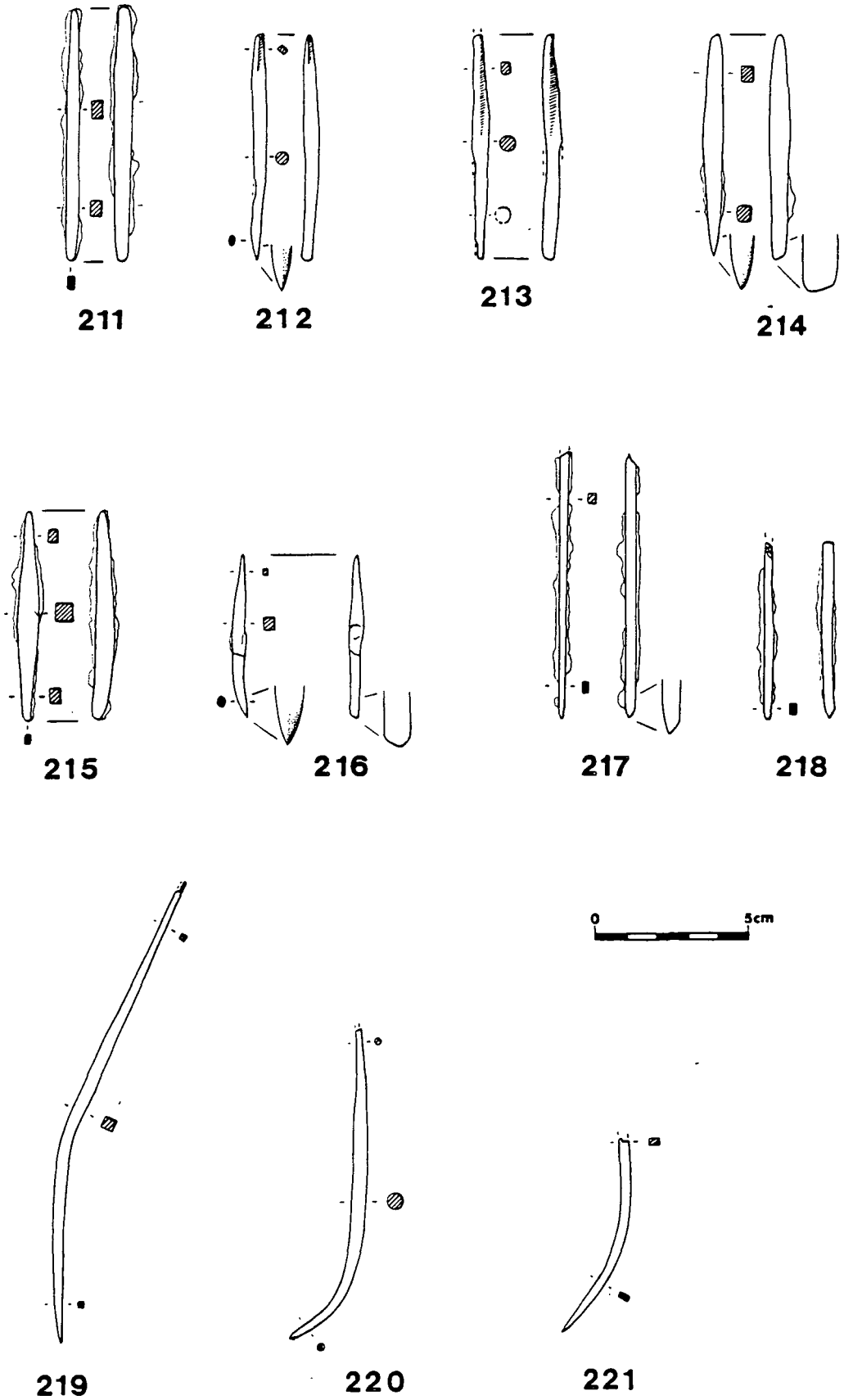


Figure A23. Possible gravers (Nos 211-218), and possible scorers or scribers (Nos 219-221).

Scale 1:2; Nos 212 and 216 (detail) 3:2, Nos 214 and 217 (detail) 1:1.

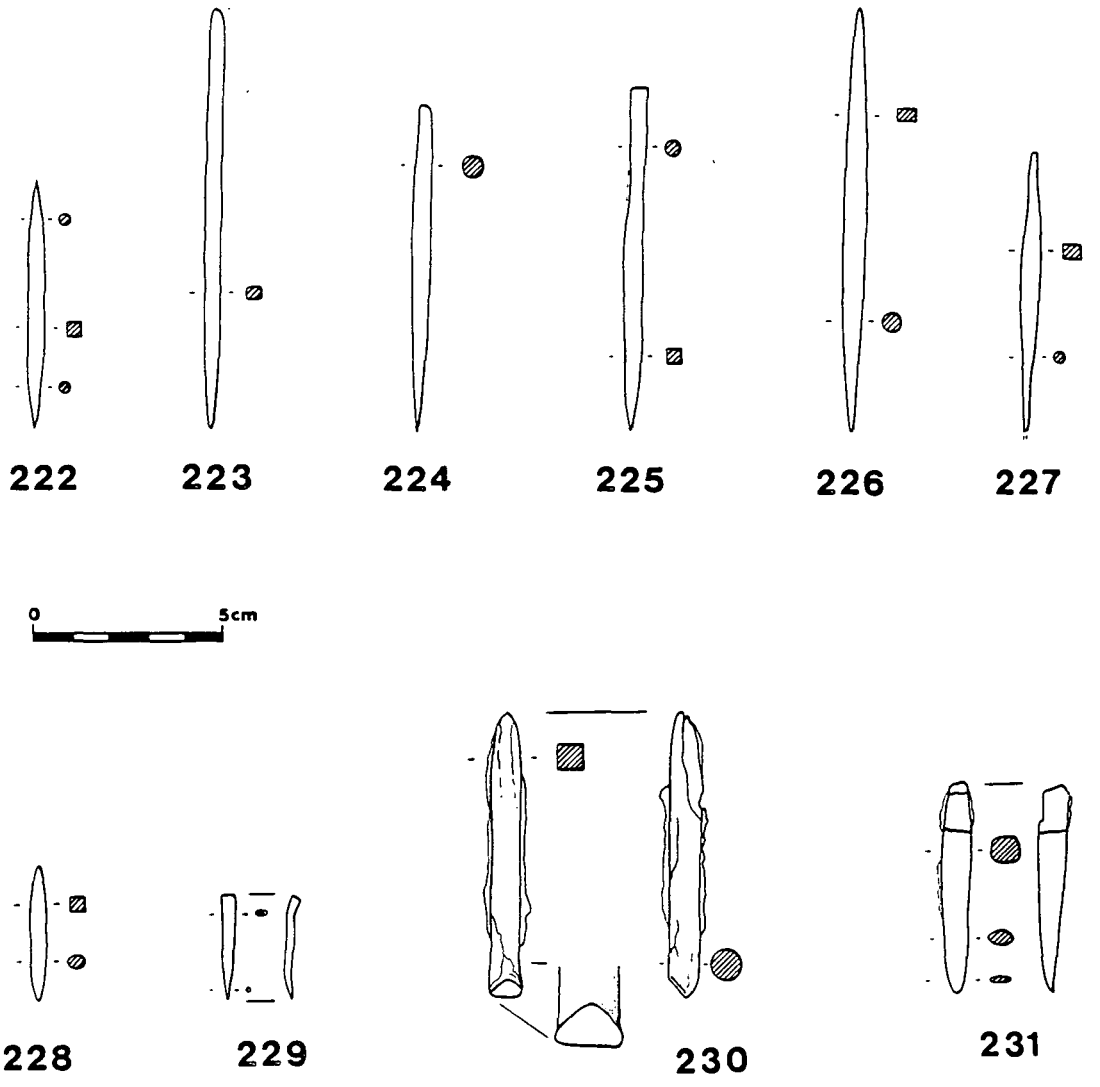


Figure A24. Possible scorers, scribers, and impressing tools (Nos 222-229), and scrapers and burnishers (Nos 230-231).

Scale 1:2; No. 230 (detail) 1:1.

APPENDIX B

CATALOGUE OF METALLOGRAPHIC EXAMINATIONS

Introduction

Each sample is accorded a sequential number S1-S69. The seven comparative tools (of less certain or non-metalworking function) are presented at the end of the sequence (S63-S69). Samples which derive from the assemblages studied by Ehrenreich (1985; 1986) for elemental composition are asterisked and the reference is given.

Each examination is illustrated (Plates B1-B51), where appropriate, with photomicrographs to show typical and/or unusual features, and diagrams to indicate sample position, inclusion distribution, carbon distribution, and hardness. Etchants used (see p. 83) are abbreviated in each entry as follows: **a**, nital; **b**, picral; **c**, hot alkaline sodium picrate; **d**, potassium metabisulphite. Unless otherwise stated, optical micrographs of metal sections were taken after etching with nital; residual metal structures in sampled flakes of corrosion products were not etched. SEM micrographs are secondary electron images taken after a light nital etch.

Details of examination methods are given in Chapter 2.5.3. Definitions of the principal terms applied are given in the glossary below (after Samuels 1980).

Glossary of metallurgical terms

α-Iron: or ferrite, existing below the A_1 critical temperature. Body-centred cubic crystal form.

Anneal: heat-treatment to remove stresses in the metal caused by work.

Austenite: the solid solution of gamma-iron and other elements, generally only existing above the A_3 critical temperature and below A_4. Face-centred cubic crystal form.

Austenitization range: between the A_1 and A_3 critical temperatures; the temperature range within which austenite forms on heating, and proeutectoid products form on cooling through this range.

A_1 (Lower Critical Temperature): the eutectoid transformation temperature, approximately 723°C.

A_2 temperature: magnetic transition.

A_3 (Upper Critical Temperature): austenite/gamma-iron upper transition temperature.

A_4 temperature: austenite/δ-ferrite transition.

Bainite: eutectoid transformation product formed by rapid cooling. Upper bainite (ferrite and a carbon dispersion) forms above *c.* 350°C. Lower bainite (ferrite and cementite plates) forms below *c.* 350°C.

Cementite: metastable iron carbide, Fe_3C.

Eutectoid composition: approximately 0.8% carbon.

Ferrite: see α-iron (δ-ferrite not applicable to the present study).

Gamma-iron: see austenite.

'Ghosting': segregation effects due to phosphorus.

Hyper-eutectoid: above 0.8% carbon.

Hypo-eutectoid: below 0.8% carbon.

Heat-treatment: any thermal process used specifically to alter or modify the microstructure (includes annealing, quenching, tempering)

Martensite: metastable phase, formed by diffusionless transformation when austenite is cooled very rapidly, at a rate faster than the critical cooling rate. Body-centred crystal form.

Neumann lines: deformation lines in ferrite which form along certain crystallographic planes as a result of cold work.

Nodular pearlite: radial growth of barely resolvable pearlite, formed by fairly rapid cooling (sometimes referred to as troostite).

Pearlite: eutectoid transformation product comprising alternate lamellae of ferrite and cementite.

Quench: very rapid cooling, by plunging the metal in water or other medium, which in an austenitized steel produces constituents such as martensite.

Temper: heat-treatment at a low temperature to reduce the brittleness and hardness of a quenched steel, and also to increase the toughness.

White lines: light-etching lines, due to impurities segregating during forging (the segregated elements are more resistant to etching and hence appear light in contrast to the adjacent area).

Widmanstätten ferrite: ferrite precipitated from austenite along specific crystallographic planes during fairly rapid cooling from elevated temperatures.

S1* (Plate B1, a-c) **POKER, No. 12** Hunsbury, Northants

Metal sample TS, mid-way along the side of the spatulate tip (Ehrenreich HNY65b).

Unetched Virtually free of inclusions (3 small ?glassy inclusions) surrounded by corrosion products (Plate B1b). Much corroded; granular carbides visible in the corrosion.

Etched [a] The section comprised coalescing pearlite and granular carbides, the carbon content c. 0.6% at one side of the section (poker edge, left in Plate B1a) increasing to c. 0.7% or 0.8% at the other side of the section.

Hardness Centre: 199 HV 0.2. Grain size: ASTM 5.

Comments The spheroidization of the carbide suggests severe reheating (but below A_1), as may be expected during use of a hearth tool.

Reference Ehrenreich 1985, 184, HNY, 65b.

S2* (Plate B1, d-e) **POKER, No. 25** Hunsbury, Northants

Metal sample LS, through the end of the spatulate tip (Ehrenreich HNY60a).

Unetched Very corroded; many islands of corrosion products within the metal. Abundant single-phase and duplex inclusions were aligned across the section.

Etched [a] Banded structure consisting of a broad ferrite band between broad low-carbon regions, the latter comprising grain-boundary pearlite (below 0.1%C). Two light-etching lines were present, one within a carburized band, the other at the edge of a carburized band (Plate B1e). Grains were equiaxed.

Hardness Ferrite band: 228 HV 0.2. Carburized band: 143 HV 0.2.

Grain size Ferrite band: ASTM 3. Carburized bands: ASTM 5.

Comments The light-etching lines suggest that the metal contained impurities which had segregated during piling, and these may have also caused the carbon to segregate to grain-boundaries and into bands. The relatively high hardness of the ferrite may be due to these impurities, or may relate to cold-work to (re)form the poker tip, (though this is not supported by the grain form, and would indicate little later use on a hearth).

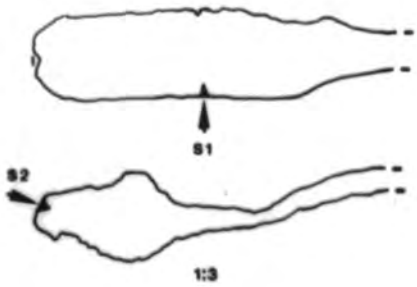
Reference Ehrenreich 1985, 182, 213, HNY60a.

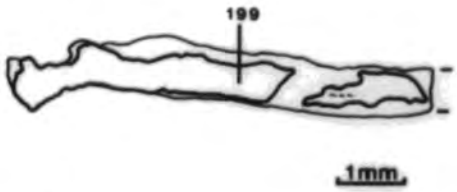
S3* (Plate B2, a-d) **POKER, No. 16** Hunsbury, Northants

Metal sample TS, mid-way along the side of the spatulate tip (Ehrenreich HNY61b).

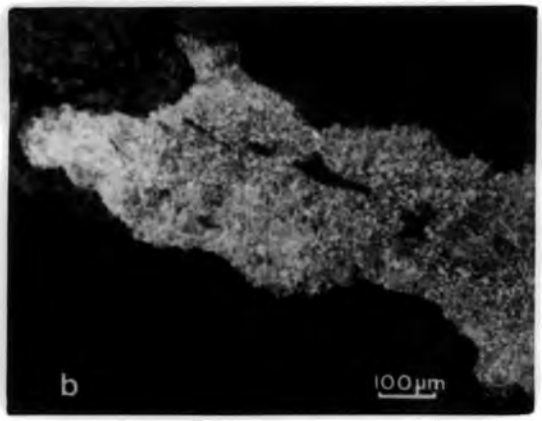
Unetched A few aligned duplex inclusions.

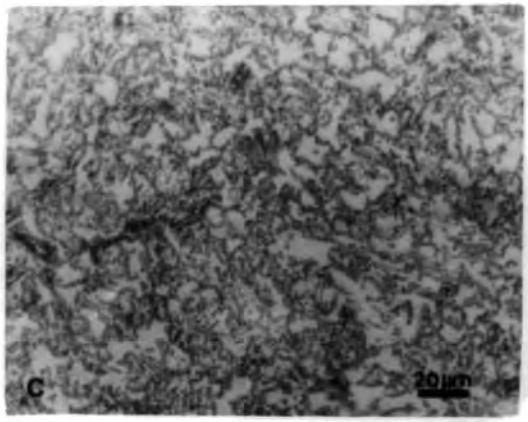
Etched [a] There was an even carbon gradation between the sides of the section (upper and lower surfaces of the poker, c. 0.2%C at the lower edge in Plate B2b, c. 0.4%C at the upper edge), and the centre of the blade which was c. eutectoid composition. The section comprised fine but coarsening pearlite, and cementite films were present at grain-boundaries and sub-grain boundaries (more noticeably in the

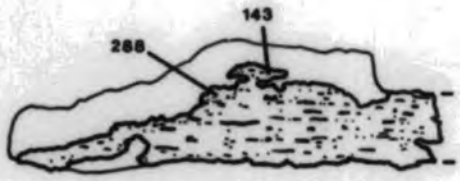




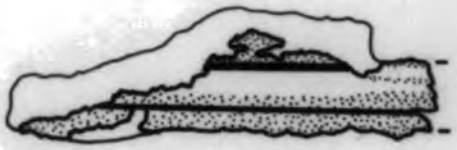
a

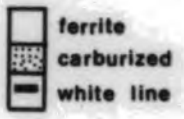






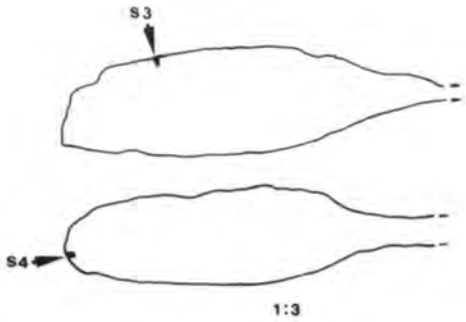
d

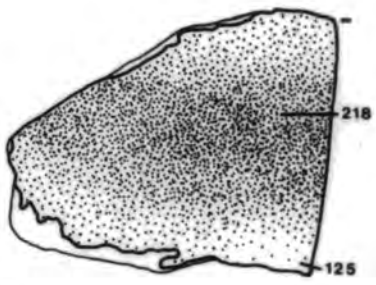


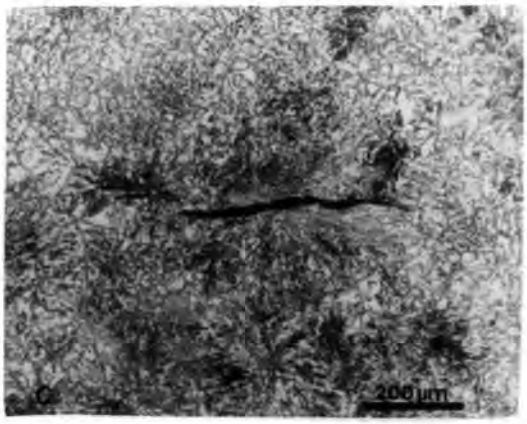


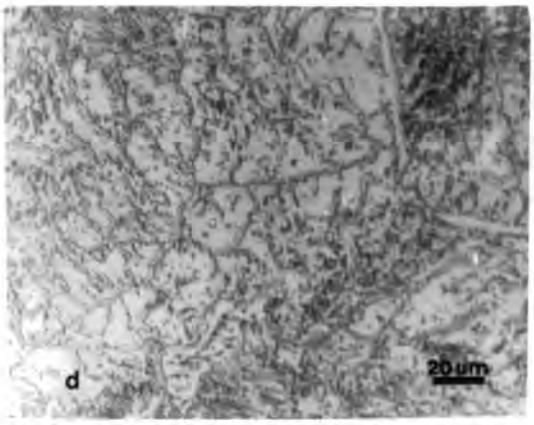
e

PLATE B1. Metallography of pokers No. 12 (S1) and No. 25 (S2).
(a) S1. Diagram of section: inclusion distribution and hardness (HV 0.2).
(b) S1. Centre of section: pearlite and slag stringers. (c) S1. Coarsened pearlite.
(d) S2. Diagram of section: inclusion distribution and hardness (HV 0.2).
(e) S2. Diagram showing structure.









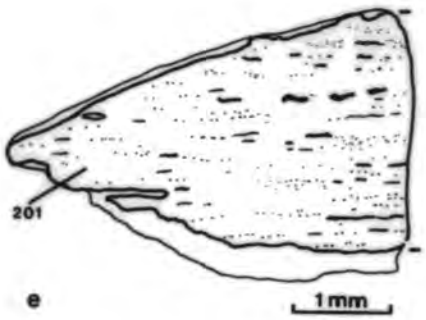


PLATE B2. Metallography of pokers No. 16 (S3) and No. 17 (S4).
(a) S3. Diagram of section: inclusion distribution. (b) S3. Diagram showing relative carbon distribution and hardness (HV 0.2). (c) S3. Eutectoid region: pearlite, carbide networks, slag stringer. (d) S3. Medium-carbon region: pearlite. (e) S4. Diagram of section: inclusion distribution and hardness (HV 0.2).

eutectoid area, Plate B2c).

Hardness — Eutectoid: 218 HV 0.2. Low-carbon: 125 HV 0.2. Grain size: ASTM 6

Comments — The carbon gradation could conceivably be the result of decarburization during use of the poker in a hearth; the gradation is not very pronounced and it seems more likely that the poker was forged from an unevenly carburized bloom. The veining suggests forging in the A_1-A_3 range - which may also account for the refined grain size. The coarsening of the pearlite may be due to heating below A_1.

Reference — Ehrenreich 1985, 183, 214, HNY61b.

S4* (Plate B2e) **POKER, No. 17** Hunsbury, Northants

Metal sample — LS, through the end of the spatulate tip (Ehrenreich HNY18b).

Unetched — Many alignments of multi-phased inclusion stringers and of fine particles.

Etched [a] — The section comprised equiaxed ferrite, mostly large-grained, and 'ghosting' was visible. Many Neumann lines were present.

Hardness — 201 HV 0.2. Grain size: ASTM 2 (at one edge ASTM 6).

Comments — The 'ghosting' and Neumann lines suggest that phosphoric ferrite had been cold-worked. High phosphorus was recorded by Ehrenreich (1985).

Reference — Ehrenreich 1985, 169, 212, HNY18b.

S5* (Plate B3, a-c) **POKER, No. 13** Hunsbury, Northants

Metal sample — TS, through the side of the spatulate tip (Ehrenreich HNY61a).

Unetched — Alignments of well-broken duplex inclusion stringers and fine particles.

Etched [a] — Banded structure comprising zones of almost solely ferrite, and carburized zones. The ferrite zones contained a very small amount of grain-boundary carbide. The carburized zones (c. 0.1-0.4%C) comprised ferrite and grain-boundary carbide in the lower-carbon regions, Widmanstätten ferrite and grain-boundary pearlite in the higher-carbon regions. Grains were slightly angular.

Hardness — Ferrite band: 184 HV 0.2. Carburized bands: 132 HV 0.2; 141 HV 0.2.

Grain size — Ferrite bands: ASTM 4. Carburized bands: ASTM 5-7.

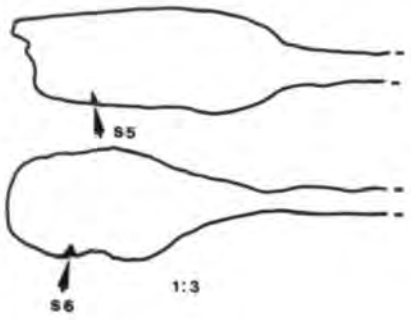
Comments — The banding suggests that the poker was forged from a bloom heterogeneous in carbon content and possibly also in elemental composition. The higher hardness in the ferrite bands suggests work-hardening, perhaps from reforming of the tool.

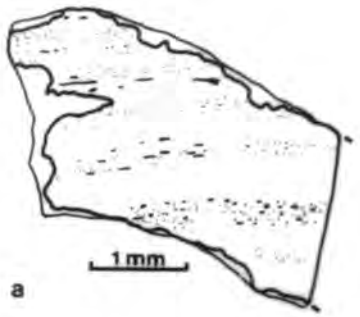
Reference — Ehrenreich 1985, 183, 213, HNY61a.

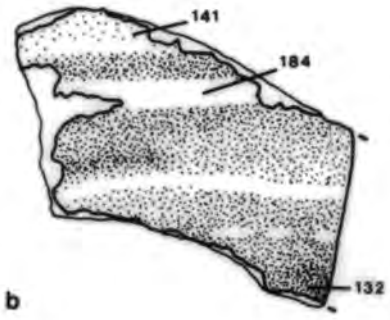
S6* (Plates B3, d-e, and B4, a-b) **POKER, No. 19** Hunsbury, Northants

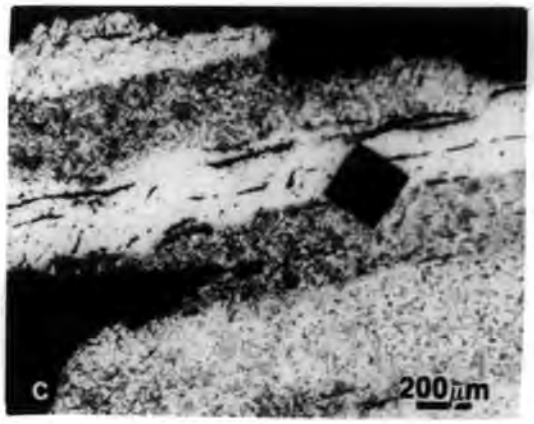
Metal sample — TS, through the side of the spatulate tip (Ehrenreich HNY65a).

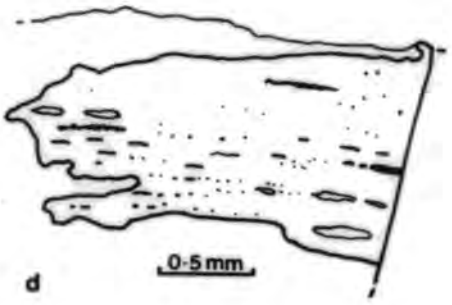
Unetched — Many alignments of multi-phase, and ?glassy inclusions. Stringers were well-broken and most were surrounded by corrosion (with nodular carbides surviving).











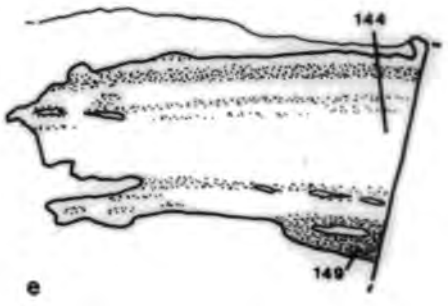
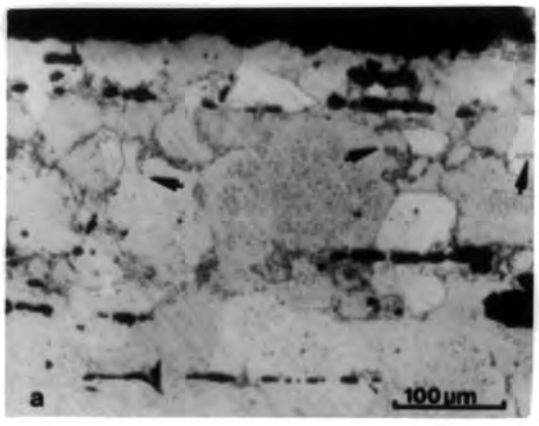
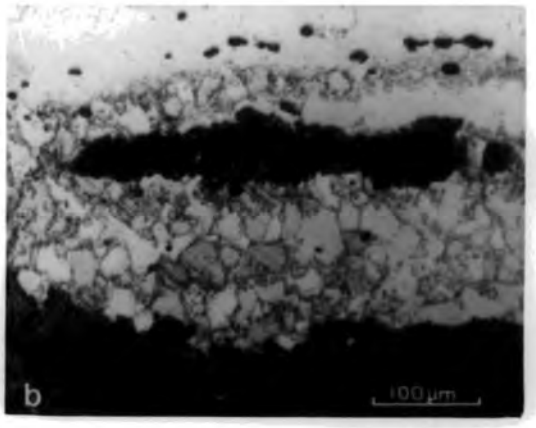
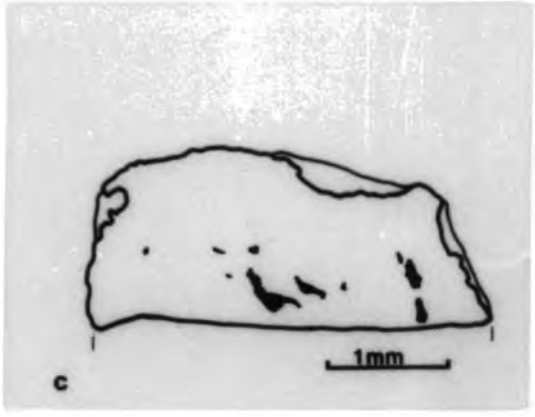
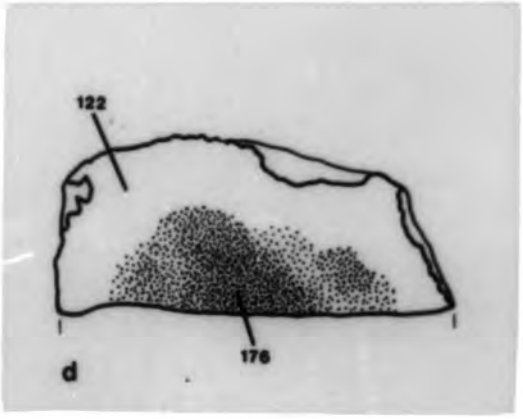


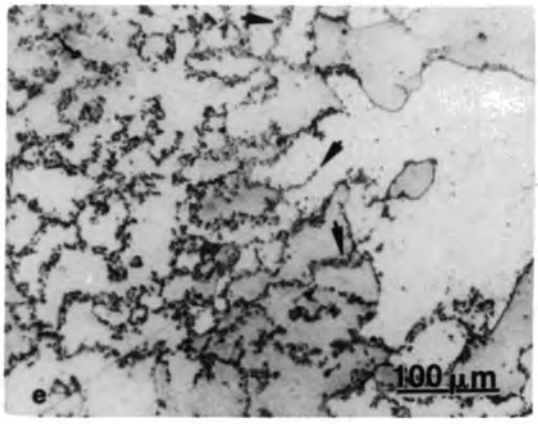
PLATE B3. Metallography of pokers No. 13 (S5) and No. 19 (S6).
(a) S5. Diagram of section: inclusion distribution. (b) S5. Diagram showing relative carbon distribution and hardness (HV 0.2). (c) S5. Banded structure at top of section (the hardness indent is from Ehrenreich's analysis). (d) S6. Diagram of section: inclusion distribution (outer corroded layers ignored). (e) S6. Diagram showing relative carbon distribution and hardness (HV 0.2).











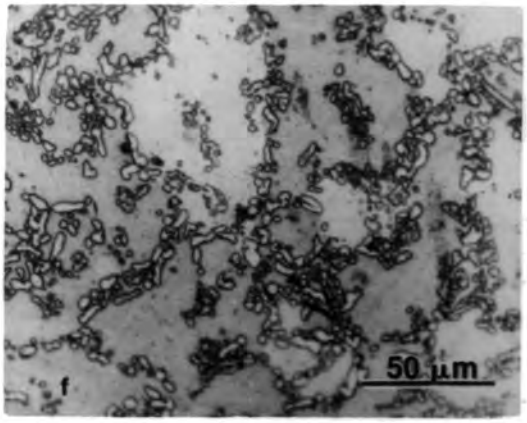


PLATE B4. Metallography of poker No. 19 (S6) and anvil No. 47 (S7).
(a) S6. Carburized band, some former grain-boundaries arrowed. (b) S6. Small-grained carburized band at edge of section. Nodular carbides at grain-boundaries and in corrosion products around slag and section. (c) S7. Diagram of section: inclusion distribution.
(d) S7. Diagram showing relative carbon distribution and hardness (HV 0.2).
(e) S7. Centre of section. (f) S7. Detail of carbides.

Etched [a]	Banded structure of ferrite, and low-carbon regions. The latter comprised granular carbide which outlined the present grain-boundaries and the former grain-boundaries, suggesting that recrystallization with grain growth had taken place (Plate B4a). The maximum carbon content was c. 0.1% in a band at the edge of the section (lowest in Plate B3e). Grains were equiaxed.
Hardness	Ferrite: 144 HV 0.2. Carburized band: 149 HV 0.2.
Grain size	Ferrite band: ASTM 3 (max.). Carburized band: ASTM 6 (min.).
Comments	The banding presumably resulted from the forging of an heterogeneous bloom. The spheroidization of the carbide and the recrystallization effects suggest that the poker had been reheated to a moderate temperature (below A_1) and this may have occurred during use in a hearth, or possibly during hot-forging.
Reference	Ehrenreich 1985, 184, 214, HNY65a.

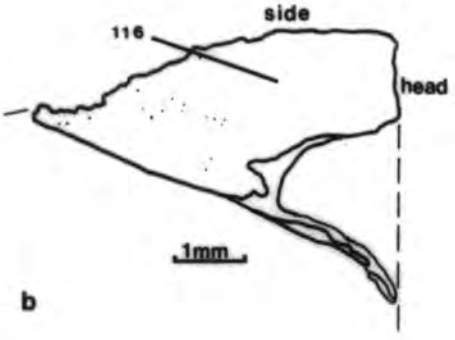
S7* (Plate B4, c-f) **ANVIL, No. 47** Barbury Castle, Wilts

Metal sample	From the edge of the burr on the head. (Ehrenreich BC7a).
Unetched	A few large glassy inclusions.
Etched [a]	At the centre of the section was a carburized region, c. 0.3%C max., comprising spheroidized carbides (Plate B4, e-f) which outlined the present grain-boundaries and some former grain-boundaries (arrowed in Plate B4e). Grain growth had occurred during recrystallization. At the edges of the section was ferrite with 'ghosting' effects. Grains were equiaxed.
Hardness	Ferrite: 122 HV 0.2. Carburized region: 176 HV 0.2.
Grain size	Ferrite: ASTM 4-5. Carburized region: ASTM 4-6.
Comments	This part of the anvil had probably been forged from an unevenly carburized bloom; the 'ghosting' suggesting that phosphorus was present, which may have caused segregation of the carbon; [Ehrenreich (1985) records medium P]. Spheroidization and recrystallization may have occurred during forging of the anvil.
Reference	Ehrenreich 1985, 130, 208, BC7a

S8 (Plate B5a) **?BENCH ANVIL, No. 54** Fiskerton, Lincs

Metal sample	TS, 5mm from the tip of the stem. See also S9.
Unetched	Severely corroded; many corrosion islands. Abundant, large multi-phase inclusions.
Etched [a]	Equiaxed ferrite.
Hardness	174 HV 0.2; 165 HV 5. Grain size: ASTM 2-4 (few complete grains).
SEM-EDXA	Phosphorus was sought but not detected.
Comments	The higher hardness of this section compared with the head (S9) suggests that the ferrite was rather impure.

a



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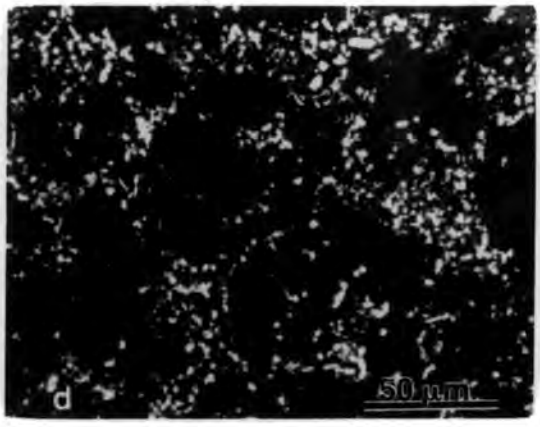


d

e

PLATE B5. Metallography of bench anvil No. 54 (S8 & S9) and top-swage No. 55 (S10). (a) S8. Diagram of section: inclusion distribution (for clarity, ignoring those in the corrosion products) and hardness (HV 0.2). (b) S9. Diagram of section: inclusion distribution and hardness (HV 0.2). (c) S9. Ferrite with Neumann lines. (d) S10. Nodular carbides (white) within corrosion matrix (dark). (e) S10. Lamellar carbide (white) within corrosion matrix (dark).

S9 (Plate B5, b-c) **?BENCH ANVIL, No. 54** Fiskerton, Lincs

Metal sample LS, through the head, incorporating part of the head and the side. See also S8.

Unetched A very small amount of ?single-phase inclusions.

Etched [a] Equiaxed ferrite, with some Neumann lines (Plate B5c).

Hardness 116 HV 0.2; 105 HV 5. Grain size: ASTM 2-3.

SEM-EDXA Phosphorus was sought but not detected.

Comments The Neumann lines indicate cold-work, but the low hardness suggests that the ferrite was very clean and in the almost annealed condition (cf. S8)
Both ends of the tool (S8 and S9) comprised essentially annealed ferrite but were likely to be of different elemental composition (and thus different hardnesses).

S10 (Plate B5, d-e) **TOP-SWAGE, No. 55** Fiskerton, Lincs

Corrosion flakes (1) A detached flake of corrosion products. (2) A flake of corrosion products removed 13mm from the functional tip of the tool.

Unetched Sample 1 revealed abundant grain-boundary nodular carbides (white in Plate B5d) in the corrosion matrix. Sample 2 revealed fine lamellar carbide (Plate B5e), the appearance of which suggested that it originally comprised fine pearlite. The carbon content may have been moderate to high, especially at the region of sample 2.

Comments The fine pearlite carbide (2) suggests that the tool had been fast air-cooled, though this sample may not have been typical of the microstructure at the very tip of the tool. The spheroidized carbide (1) suggests that a reheating cycle had occurred, but conclusions are limited owing to unknown position of the sample.

S11* (Plate B6) **HAMMER, No. 61** Hunsbury, Northants

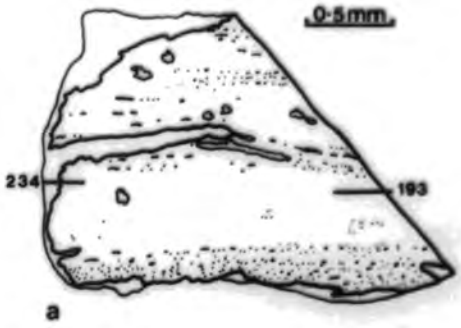
Metal sample LS, at an angle through the front edge of the complete (rectangular) face, comprising part of the face and part of the side of the hammer (Ehrenreich HNY70a).

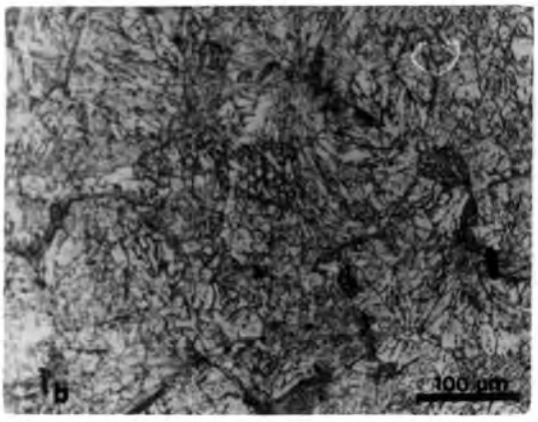
Unetched Much internal corrosion. Longitudinal alignments of fine particles and well-broken duplex stringers.

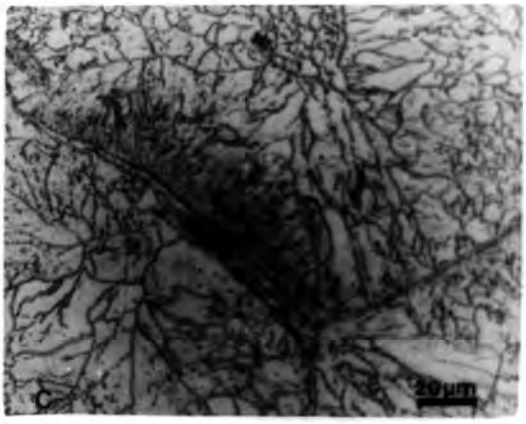
Etched [a, d] Networks of very fine cementite films, within which the microstructure was either irresolvable or comprising fine dark particles, possibly carbide precipitates. Some of these particles were aligned as short rows. The matrix appeared blocky in some regions (Plate B6d). Cementite films delineated the grain-boundaries and were present at sub-grain boundaries. Bainite was suggested from intersecting plates (Plate 6e) and grain-boundary ferrite plates with precipitates (Plate B6, c-d).

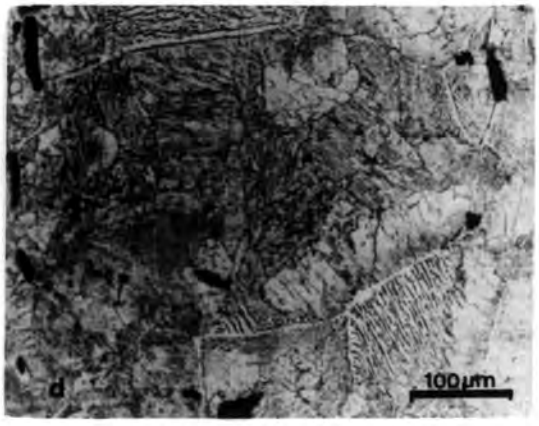
Hardness Bainite: 234 HV 0.2. Matrix: 193 HV 0.2. Grain size: ASTM 3.

Comments The hammer face was quenched, forming bainite at least, but it had probably then been reheated which severely over-tempered the original structure. The orientated carbon/carbide particles may have precipitated from lath martensite during the









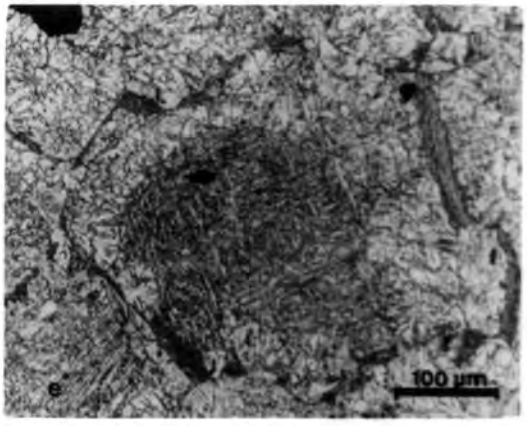


PLATE B6. Metallography of hammer No. 61 (S11).
(a) Diagram of section: inclusion distribution and hardness (HV 0.2). (b) Network of cementite films. (c) Detail of cementite films, and bainite. (d) Bainite.
(e) Bainite: visible at grain-boundaries, and as intersecting ferrite plates.

reheating, or may be part of the bainite, though the original structure may have comprised bainite alone.

Reference — Ehrenreich 1985, 186, 214, HNY70a.

S12 (Plate B7) — **HAMMER, No. 62** — Fiskerton, Lincs

Metal sample — LS through the rectangular face. See also S13, S14 and S15.

Unetched — Duplex inclusions, aligned as 3 arcs at the centre of the section, plus lines running towards the face (left in Plate B7b)

Etched [a, a+b] — Across the section was martensite with a small amount of grain-boundary nodular pearlite and traces of feathery grain-boundary ferrite - probably bainite (Plate B7e). The nodular pearlite was concentrated along some of the inclusion lines. There were several light-etching lines (Plate B7, c-d) associated fine particles.

Hardness — Martensite: **face** 834, 800 HV 0.2; 873 HV 0.5; 795, 781, 752, 677 HV 5; **within the section** 606 HV 0.2; 812, 588 HV 5.

Grain size — Martensite: at centre ASTM 4-5; elsewhere ASTM 3-4.

Comments — The alignments of inclusions and associated light-etching lines indicate welding, the orientation of which suggest the folding over of metal at the hammer face, probably to thicken and form the face. The high hardness suggests a medium-high carbon content, perhaps about 0.5%C or 0.6%C. The hammer face was severely quenched from the fully austenitized condition.

S13 (Plate B8) — **HAMMER, No. 62** — Fiskerton, Lincs

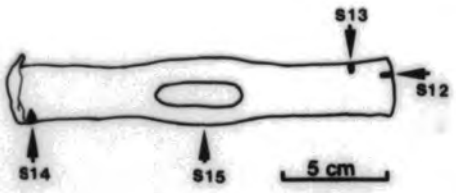
Metal sample — TS, 20mm from the tip of the rectangular face. This second sample from the face (cf. S12) was taken to investigate the unusual inclusion alignments, and the possibility that steel may have been welded-on at the face. (See also S14 & S15.)

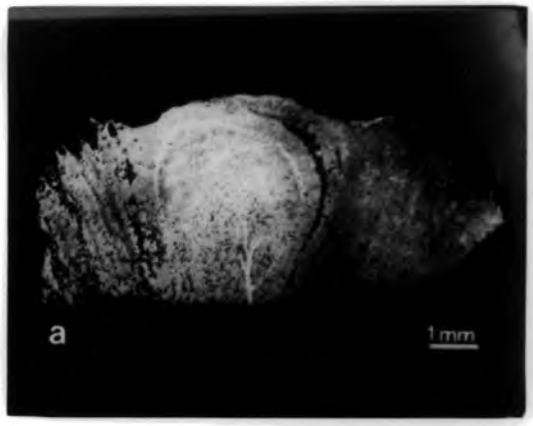
Unetched — At one side of the section there were several alignments of angular multi-phased inclusions and of fine particles.

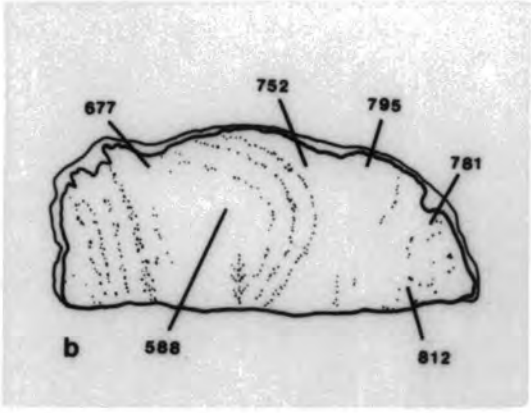
Etched [a, a+b, d] — Two-thirds of the section (left and centre in Plate B8a) comprised massed nodular pearlite with some lath martensite (light etching areas, left and centre in Plate B 8a). Through the centre of this region was a light-etching (weld) line. At the side of the section (right in Plate B8a) were several light-etching lines associated with fine particles. Here the structure consisted of irresolvable pearlite and grain-boundary ferrite; carbon segregation (or decarburization) had occurred within some of the light-etching lines (Plate B8, e-f). The carbon content varied from low/medium to high.

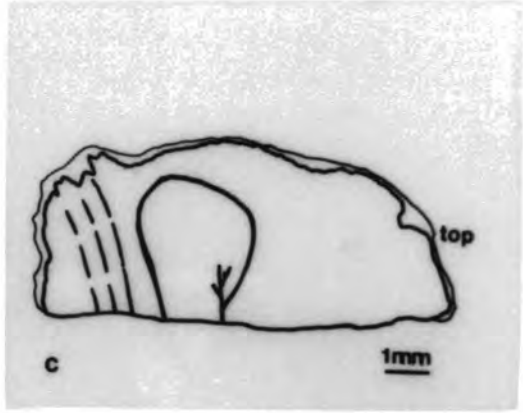
Hardness — Martensite: 986 HV 0.2; 1003 HV 0.5; nodular pearlite 338 HV 0.2; 396 HV 5; irresolvable pearlite 239 HV 5; irresolvable pearlite + ferrite (1:1) 178 HV 5.

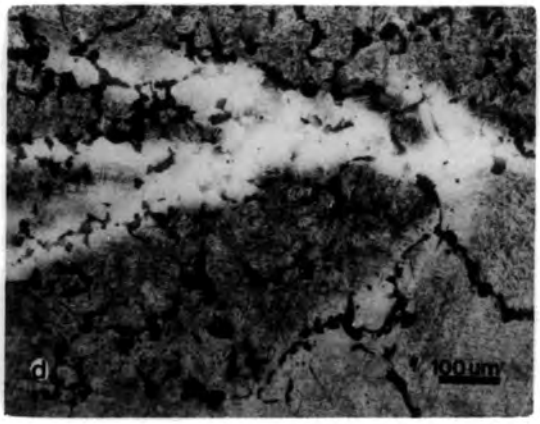
SEM-EDXA — Ferrite band in Plate B8f revealed a high concentration of arsenic.











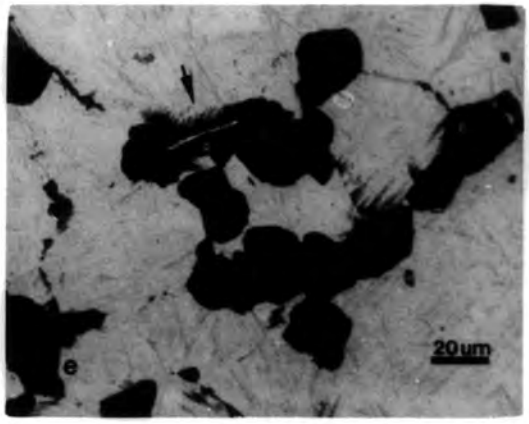
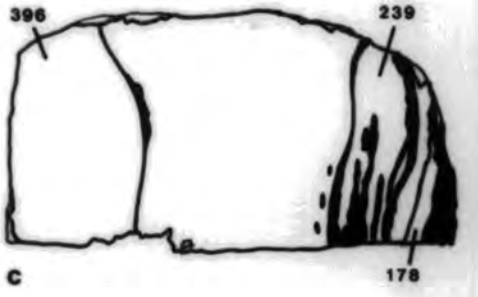
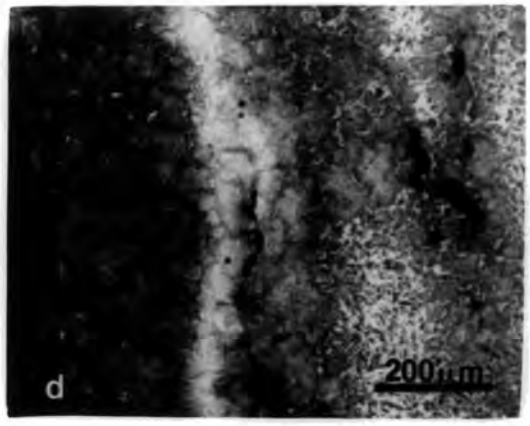
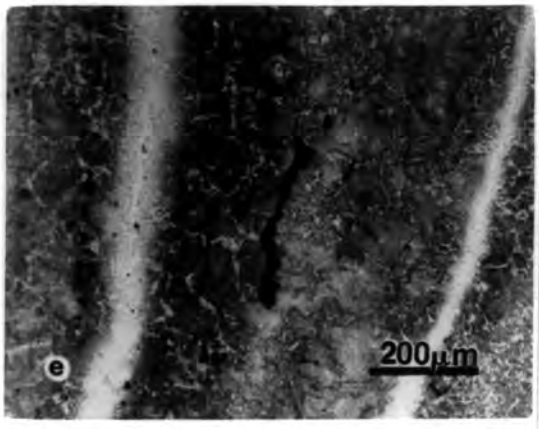


PLATE B7. Metallography of hammer No. 62 (S12).
(a) Whole section. (b) Diagram of section: inclusion distribution and hardness (HV 5). (c) Diagram showing weld lines. (d) Inside edge of section: martensite, nodular pearlite, and a branched light-etching segregation line. (e) Martensite, nodular pearlite, ?bainite (arrowed).







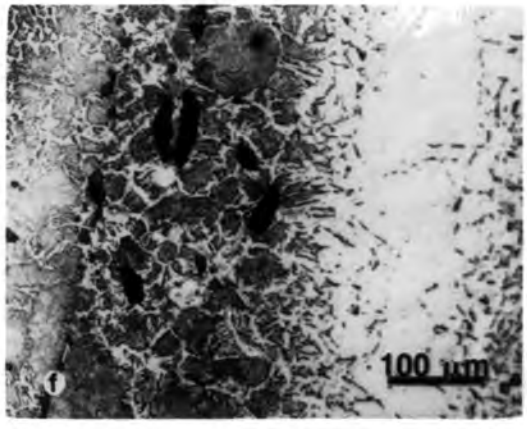


PLATE 88. Metallography of hammer No. 62 (S13).
(a) Whole section. (b) Diagram of section: inclusion distribution. (c) Diagram showing light-etching weld lines and hardness (HV 5). (d) Light-etching weld line at side of section. (e) Light-etching weld lines exhibiting decarburization. (f) Light etching weld lines, the one on the right much decarburized.

Comments — The light-etching lines with associated particles indicate welding, and some segregation of carbon away from the weld had occurred within these lines. The presence of arsenic could account for the different microstructures associated with the welds and the carbon segregation (contra decarburization). The inclusion alignments were consistent with those in S12, suggesting that the metal had been folded over at the tip of the face only, and confirmed that no additional metal had been welded on to form the face. The microstructures were typical of a slack-quench, which was to be expected considering the distance of this sample from the hammer face (cf. S12).

S14 (Plate B9, a-c) **HAMMER, No. 62** Fiskerton, Lincs

Metal sample — TS, 6mm from the 'square' face, behind the burr. See also S12, S13, S15.

Unetched — Clusters of large, angular, glassy inclusions.

Etched [a, a+b] — One half of the section revealed massed nodular pearlite, with some martensite (Plate B9c) at the edge (side of the hammer, apex of section in Plate B9a). At the other side of the section was irresolvable pearlite, very fine pearlite, and some grain-boundary ferrite and bainite. There was some zoning of the microstructures, which may be due to variable carbon content (e.g. low to medium carbon).

Hardness — Martensite 630 HV 0.2; martensite + nodular pearlite 474 HV 5; nodular + irresolvable pearlite 299 HV 5; fine pearlite + ferrite 250-262 HV 5.

Comments — The hammer face had been quenched, the microstructures suggesting a mild quench (though may not be typical of the structure at the original face). The heterogeneity and low hardness may account for the much burred condition of the hammer face.

S15 (Plate B9, d-f) **HAMMER, No. 62** Fiskerton, Lincs

Corrosion flakes — Samples were taken from inside the eye and from the side of the hammer adjacent to the eye. See also metal sections S12, S13 and S14 from the faces.

Unetched — Fine lamellar cementite was visible within the corrosion matrix (Plate B9, d-f), which SEM confirmed to be residual pearlite.

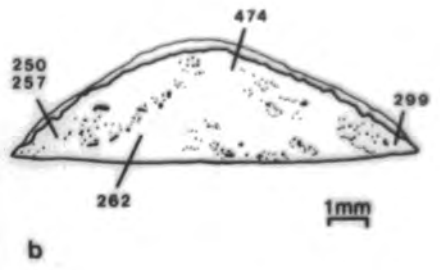
Comments — The presence of pearlite indicates that the eye of the hammer had been air-cooled. Both faces of the hammer had been quenched (S12 + S13, S14) which suggests that the eye was intentionally left unquenched, and thus less brittle and tougher.

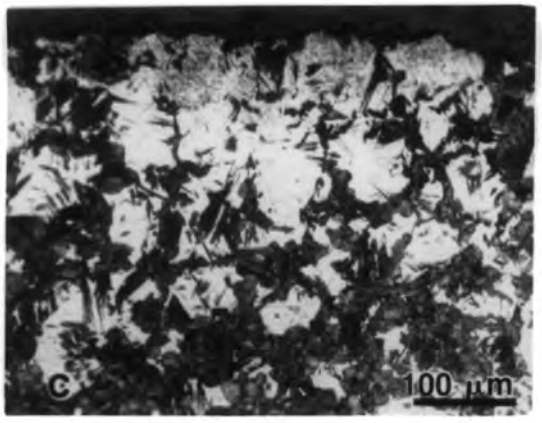
S16* (Plate B10, a-d) **HAMMER, No. 63** Bigbury, Kent

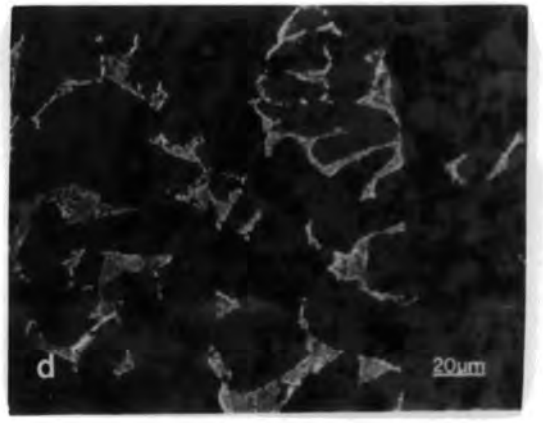
Metal sample — LS, through the rectangular face (Ehrenreich B3b).

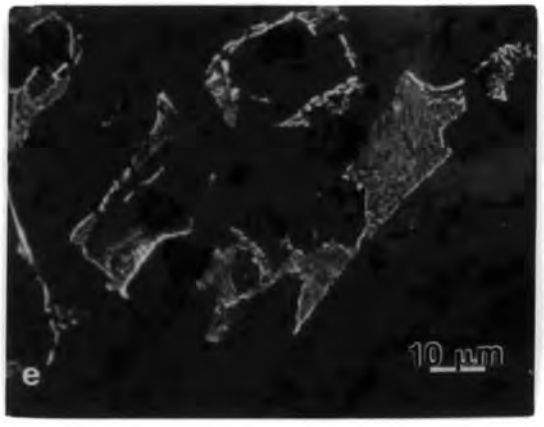
Unetched — Angular glassy inclusions. Much corroded.

Etched [a] — The section comprised extremely fine spheroidized carbides, with some grain-









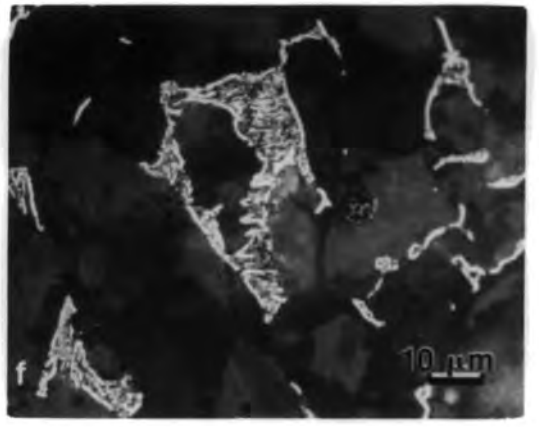
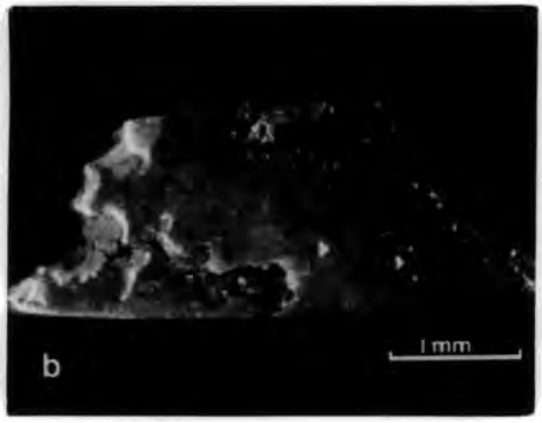
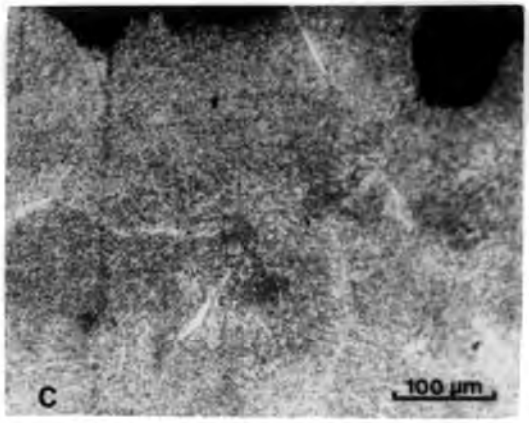
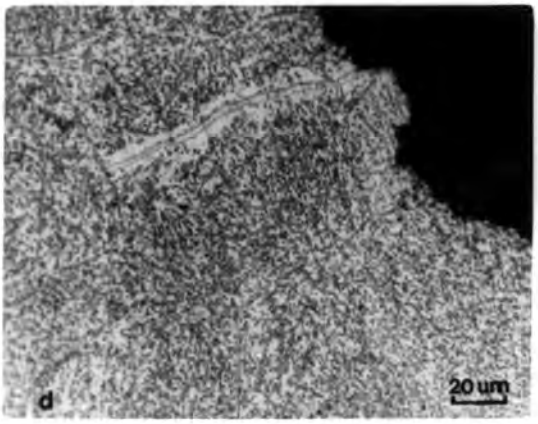


PLATE B9. Metallography of hammer No. 62 (S14 and S15).
(a) S14. Whole section. (b) S14. Diagram of section: inclusion distribution and hardness (HV 5). (c) S14. Apex of section: martensite (pale) and pearlite. (d-f) S15. Pearlite carbides (white) within corrosion matrix (grey).

a







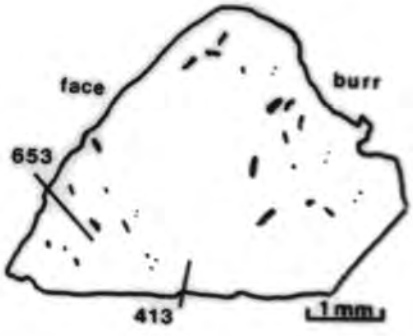


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PLATE B10. Metallography of hammers No. 63 (S16) and No. 68 (S22).
(a) S16. Diagram of section: inclusion distribution and hardness (HV 0.2).
(b) S16. Whole section (hardness indents are those of Ehrenreich 1985).
(c) S16. Spheroidized carbide at edge of section. (d) S16. Detail of spheroidized carbide. (e) S22. Diagram of section: hardness (HV 0.5).

boundaries delineated by fine granular carbide. A few of the interstitial carbide particles appeared to be aligned. Perhaps about eutectoid composition.

Hardness 171 HV 0.2. Grain size: ASTM 3.

Comments The homogeneous carbon composition suggests that a (?well-worked) carburized bloom was employed. The microstructure and large grain size suggests that the hammer face had been reheated to a moderate temperature (below A_1) for a sufficiently long period that all the former microstructure spheroidized. The small size of the carbide suggests that the original structure may have been extremely fine.

Reference Ehrenreich 1985, 124, 207, 83b.

S17 (Plate B11) **HAMMER, No. 66** Ham Hill, Somerset

Metal sample Round face. TS, behind the burr, 4mm from the extant face, incorporating part of the top and the side of the hammer. (See also S18 [LS], and S19).

Unetched Curved alignments of a small number of rounded, duplex dendritic inclusions.

Etched [a] Fairly evenly carburized, c. 0.2-0.3 %C; the microstructure comprising coarse pearlite with Widmanstätten ferrite. There were 3 curved light-etching bands with associated inclusions. On longer etching, these bands stained dark yellow and pearlite was visible. There appeared to be slight decarburization within the bands, particularly in the one shown lowest in Plate B11c.

Hardness Ferrite + pearlite: large grains at centre 155 HV 0.2; small grains 182 HV 0.2; apex of section 236 HV 0.2. Grain size: ASTM ?4.

Comments The light-etching lines with associated inclusions suggest segregation enrichment from welding (presumably arsenic segregation, see SEM-EDXA in S18). The face was air-cooled from the austenitized condition.

S18 (Plate B12, a-c) **HAMMER, No. 66** Ham Hill, Somerset

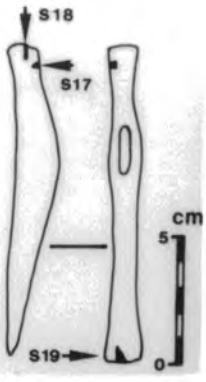
Metal sample Round face. LS, through the face, plus some of the burr. See also S17 (TS), & S19.

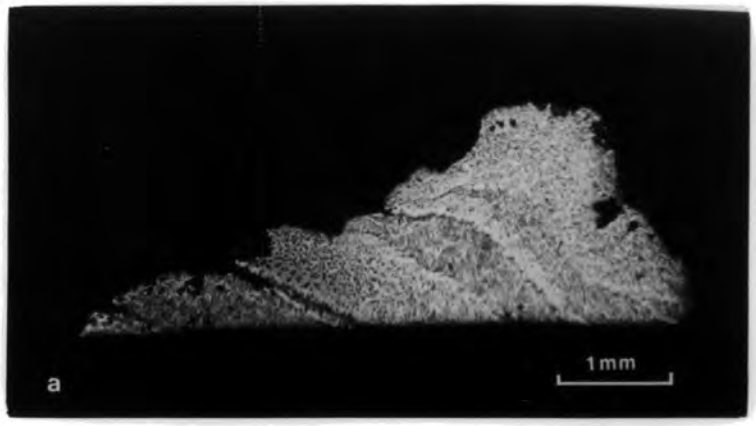
Unetched There were 3 main inclusion lines. The outer comprised small, rounded, glassy inclusions. The central line (Plate B12, a-c) comprised large duplex inclusions and a corrosion/stress line linked the inclusions. The inner line comprised small, angular, glassy inclusions. Some pearlite cementite survived in the corrosion layers adjacent to the metal.

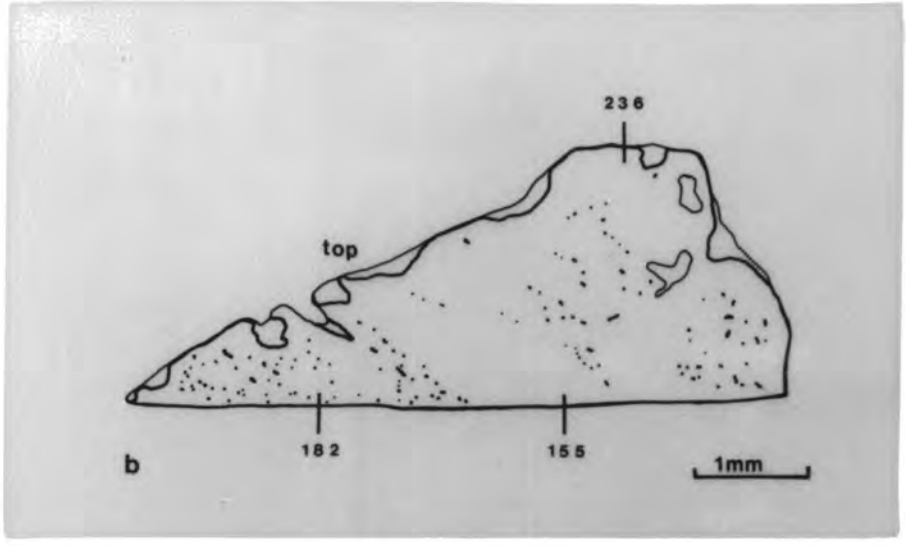
Etched [a] The carbon content was low, and comprised pearlite and Widmanstätten ferrite. There were 3 curved light-etching lines which were parallel to the main inclusions, and fine inclusion particles were present within or just to one side of the lines. The grains in the burr of the face were much deformed (Plate B12c).

Hardness Ferrite + pearlite: 220 HV 0.2; at burr 262 HV 0.2. Grain size: ASTM 4.

SEM-EDXA Arsenic (c. 0.95 - 1.25%) was detected within the two light-etching lines examined







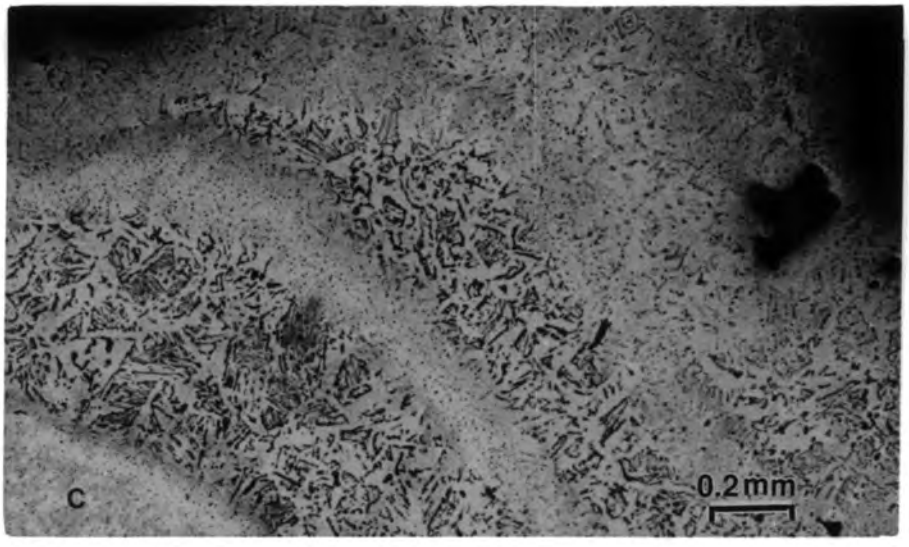
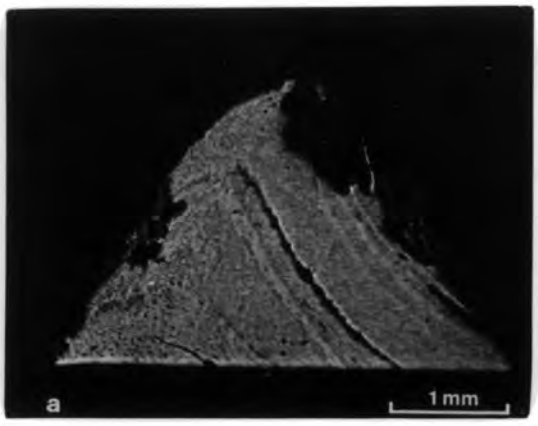
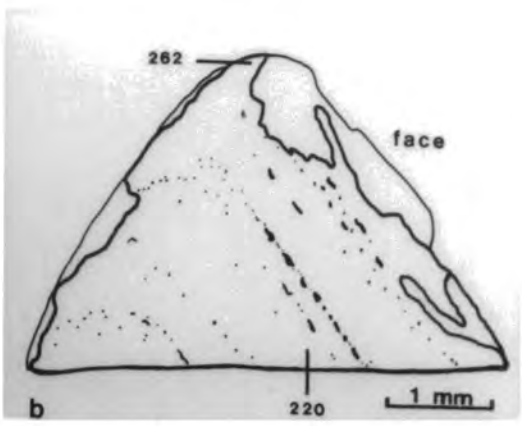
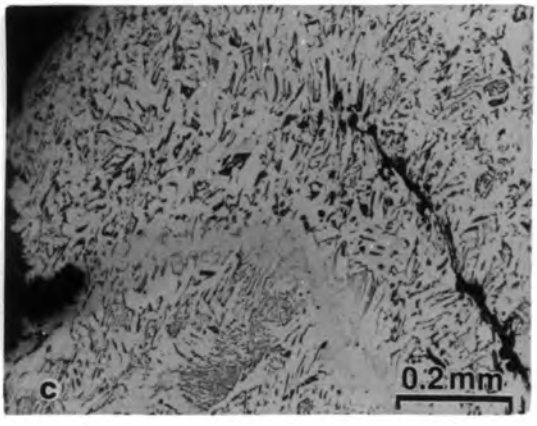
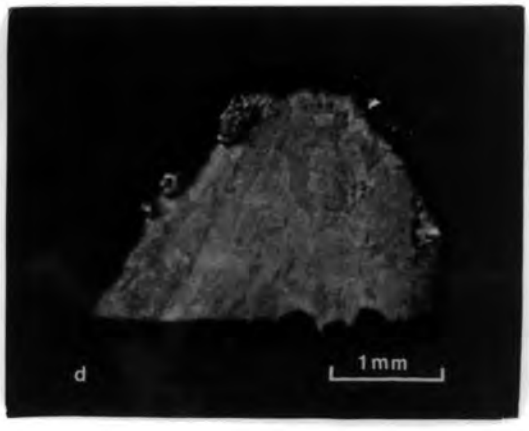


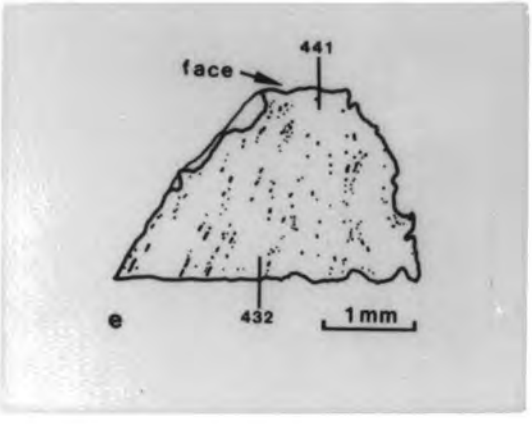
PLATE B11. Metallography of hammer No. 66 (S17).
(a) Whole section. (b) Diagram of section: inclusion distribution and hardness (HV 0.2). (c) Pearlite and Widmanstätten ferrite. Three light-etching weld lines run from top left to centre bottom.











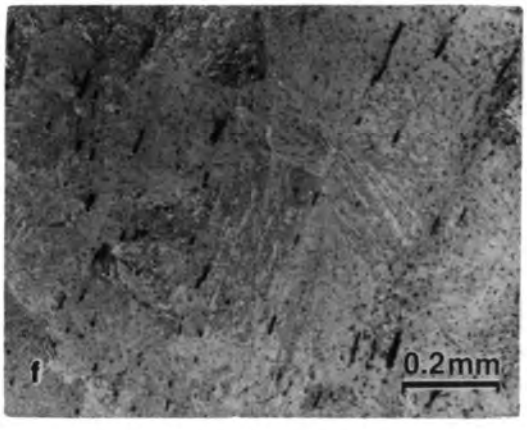


PLATE B12. Metallography of hammer No. 66 (S18 and S19).
(a) S18. Whole section. (b) S18. Diagram of section: inclusion distribution and hardness (HV 0.2). (c) S18. Deformed grains at top left, above weld line. (d) S19. Whole section. (e) S19. Diagram of inclusion distribution and hardness (HV 0.2). (f) S19. Martensite and slag stringers.

whereas none was detected between the lines.

Comments — Like S17 (TS), the structure suggest fold-welding, attested by arsenic enrichment. Again the structures indicate rapid air-cooling from the austenitized condition.

S19 (Plate B12, d-f) — HAMMER, No. 66 — Ham Hill, Somerset

Metal sample — Rectangular face: LS, centrally through the face.

Unetched — Small, well-broken, glassy inclusions.

Etched [a] — Across the section was lath martensite, perhaps with retained austenite, with a very small amount of grain-boundary feathery ferrite, probably bainite. A few short, quench or corrosion cracks were present.

Hardness — Ferrite + pearlite: at face 441 HV 0.2; 420 HV 0.5, 453 HV 1; within section 432 HV 0.2. Grain size: ASTM 4.

Comments — This face was severely quenched from the fully austenitized state. The low hardness suggests a low-medium carbon content.

The two faces of this hammer had been treated differently; the rectangular face (S19) was quench-hardened whereas the round face (S17 and S18) was air-cooled. A functional difference between the two faces is therefore indicated.

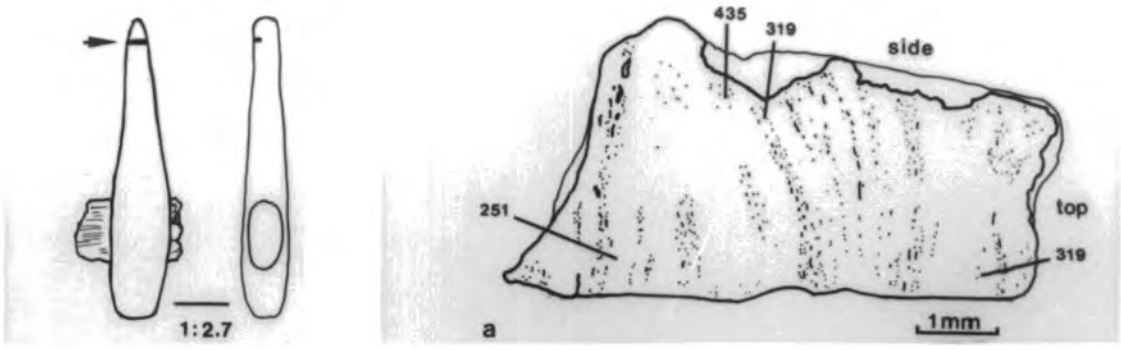
S20 (Plate B13) — HAMMER, No. 67 — Whitcombe, Dorset

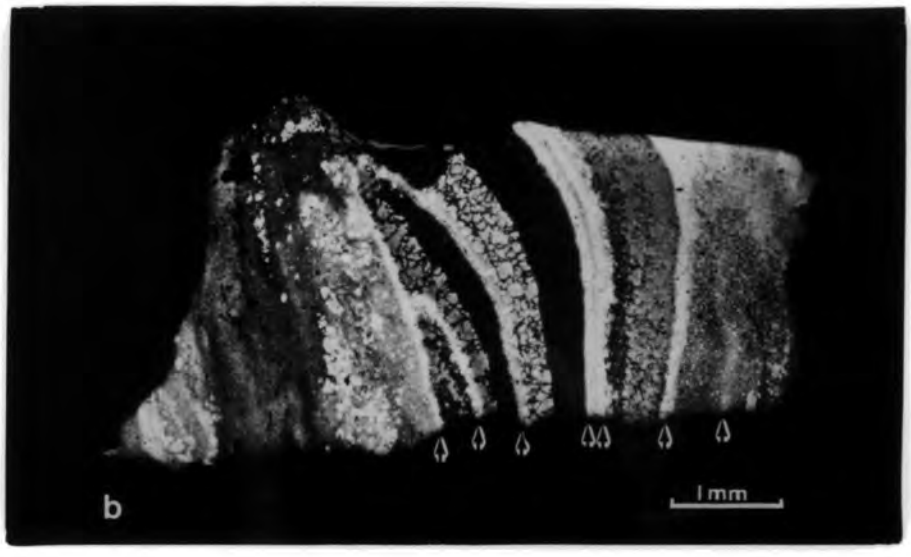
Metal sample — TS, 8mm from the rectangular face. The face was too corroded and fragile to permit longitudinal sampling.

Unetched — Fine particles and elongated angular inclusions were aligned across the section; some were duplex though the majority were single-phased.

Etched [a, a+b, d] — One side of the section (left in Plate B13b) comprised nodular pearlite, irresolvable pearlite, some martensite, and a small amount of grain-boundary ferrite. There was some zoning to the structure. The central third of the section comprised curved parallel bands forming 2 sets of 2 alternating microstructures; (1) martensite (marked M in Plate B13c) with grain-boundary nodular pearlite and some bainite and (2) massed nodular pearlite (darkest in Plate B13, b-c). Light-etching lines (arrowed in Plate B13b) were present at the edges of some of the bands, the microstructure continuous beneath. The other side of the section (right of the double light-etching line in Plate B13b) comprised martensite and grain-boundary nodular pearlite in roughly equal proportions, and 2 further light-etching lines.

Over the whole section there were roughly equal volume fractions of martensite and nodular pearlite, a lesser proportion of irresolvable pearlite, and a small amount of grain-boundary ferrite and of bainite. The fine inclusion particles were aligned along the light-etching lines, whereas the larger inclusions were present (and aligned) within bands of all constituents.





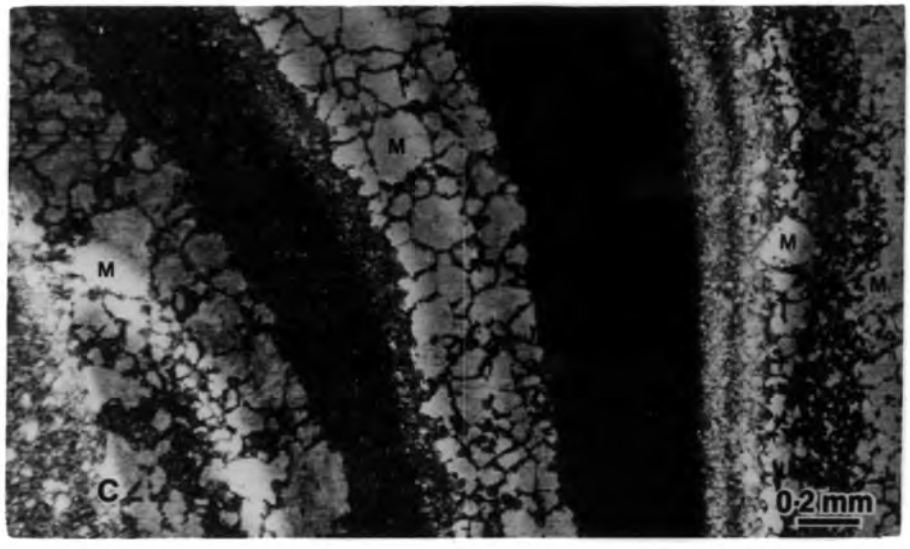


PLATE B13. Metallography of hammer No. 67 (S20).
(a) Diagram of section: inclusion distribution and hardness (HV 5). (b) Whole section. Light-etching segregation (weld) lines arrowed. (c) Centre of section showing nodular pearlite (dark), martensite (M), and light-etching segregation lines.

Hardness — **Martensite:** at side of hammer (top edge in Plate B13, a-b) 441, 463, 469, 488, 518, 547, 550 HV 0.2. Martensite band + grain-boundary pearlite: 435 HV 5. Martensite + irresolvable pearlite: 278 HV 0.2; 319 HV 5. **Nodular pearlite** band: 245 HV 0.2; 319 HV 5. **Irresolvable pearlite:** 208 HV 0.2; 251 HV 5.

SEM-EDXA — Arsenic was detected in all 3 of the light-etching lines examined, at concentrations c. 0.2%, 0.5%, 0.7%, and in the central pearlite band at c. 0.1%.

Comments — The hammer face had probably been piled from medium-carbon steel containing a high arsenic (the arsenic partly segregating to the weld lines). The face was quenched from the fully austenitized state, though probably not severely quenched. The presence of arsenic within a martensite band (and possibly therefore throughout the section), as well as in the light-etching lines, may alone account for the variable austenite transformation products although other variations in chemical composition also may have contributed.

S21* (Plate B14) — **HAMMER, No. 68** — Bigbury, Kent

Metal sample — LS, through the rectangular face (Ehrenreich B13a). See also S21 and S23.

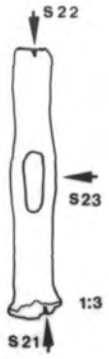
Unetched — At one side of the section (right in Plate B14b) there were alignments of fine inclusion particles and multi-phased stringers. Elsewhere the inclusions were clustered, glassy or multi-phased.

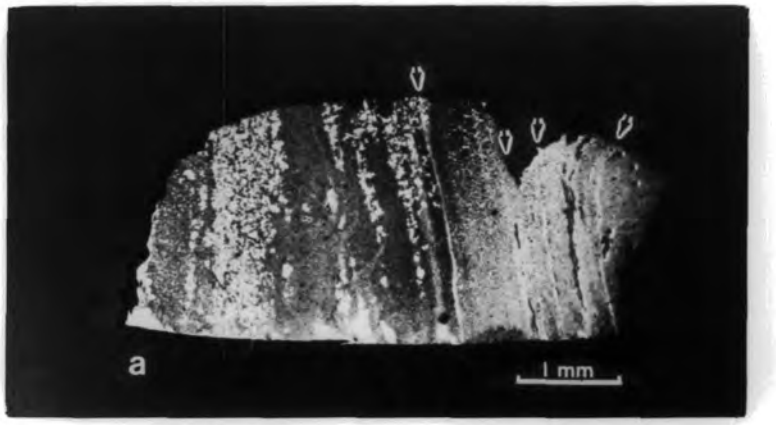
Etched [a, c] — One half of the section (left in Plate B14a) comprised martensite (light-etching in Plate B7a) with nodular pearlite, which together formed discontinuous bands orientated towards the hammer face. The other side of the section was low in carbon and the transformation products were slightly angular (almost spiky) and comprised a light-etching lathy constituent, probably martensite, and a darker-etching constituent, probably pearlite (Plate B14c). Etching with alkaline picral did not appreciably darken either constituent. The grains were much deformed, particularly at the edge of the section (the burr of the hammer face). There were 4 light-etching lines (arrowed in Plate B14a), and the microstructure was continuous beneath. The carbon content was probably medium/high at the left side of the section decreasing to below 0.1%C at the other side.

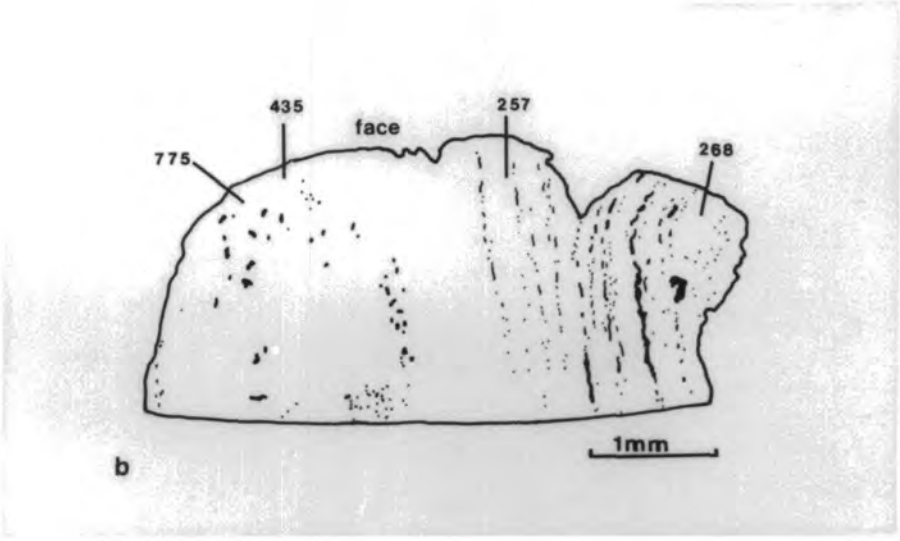
Hardness — Martensite: 632 HV 0.2; 775 HV 0.5; nodular pearlite: 435 HV 0.5; irresolvable pearlite 257 HV 0.5; ferrite + other constituents, low-carbon 268 HV 0.5.

Comments — The zoning of the microstructures, and the light-etching lines, suggest that the metal had been much piled, and folded over to form the face. The microstructures were typical of a mild quench. The form of the angular transformation products at the low-carbon region may be the result of incomplete austenitization, though work-hardening probably had had an effect.

Reference — Ehrenreich 1985, 127, 207, B13a.







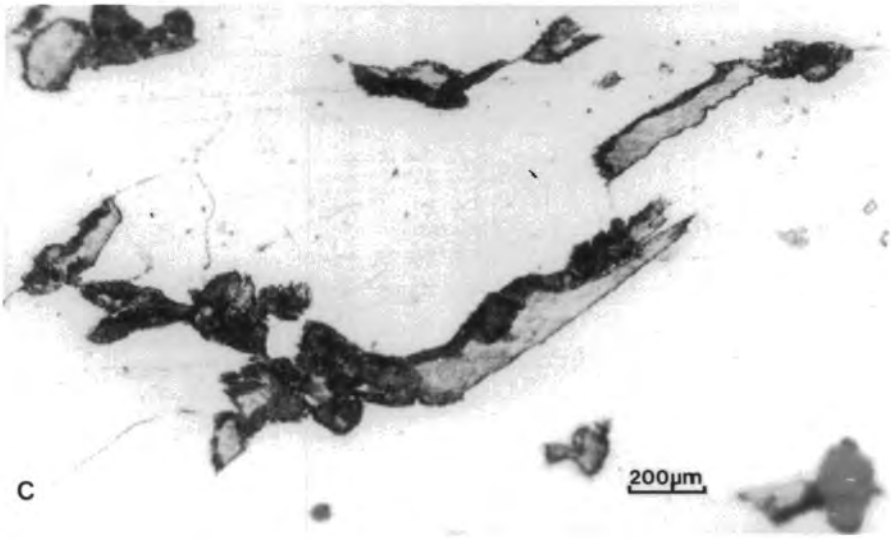


PLATE B14. Metallography of hammer No. 68 (S21).
(a) Whole section. Light-etching lines arrowed. (b) Diagram of section: inclusion distribution and hardness (HV 0.5). (c) Low-carbon region: ferrite (white), ?martensite (pale), irresolvable ?pearlite (dark).

S22 (Plates B10e and B15, a-b) **HAMMER, No. 68** Bigbury, Kent

Metal sample LS, though the burr of the flat square face. The original sample (Ehrenreich B13b) is now almost polished out; another sample was taken (VF) adjacent to the original cut, and this description if of that sample. See also S22 and S23.

Unetched Small amount of angular, glassy inclusions forming two groups.

Etched [a] Massed nodular pearlite with a few grains of martensite (c. 5% of the total) and a very small amount of grain-boundary ferrite. (Plate B15, a-b).

Hardness Martensite: 653 HV 0.2. Nodular pearlite: 413 HV 0.2; 391 HV 0.5.

Comments The hammer face had been quenched from the fully austenitized state, the microstructures suggesting a mild or slack quench. ?Medium carbon content.

Reference Original sample: Ehrenreich 1985, 128, 207, B13b.

S23 (Plate B15, c-d) **HAMMER, No. 68** Bigbury, Kent

Metal sample TS through the outer part of the eye. See also S21 and S22).

Unetched A small amount of clustered, glassy or multi-phased inclusions.

Etched [a] Homogenous structure of very fine pearlite, some irresolvable at x500; c. 0.3 - 0.4%C. The ferrite is slightly spiky in places, elsewhere it is more rounded.

Hardness 198 HV 0.2. Grain size: ASTM 8.

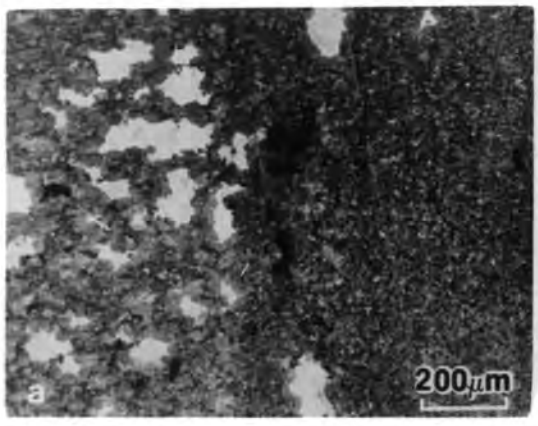
Comments Fairly rapidly cooled. The rounded ferrite boundaries may indicate partial austenitization during the final heat. The two faces of the hammer (S21 and S22) had been quenched whereas the eye was not quenched; thus it seems possible that the eye was left deliberately in the unquenched condition, probably to enhance toughness there. Conceivably the faces were heated independently, which could have resulted in partial austenitization near the eye. The fineness of the pearlite may be due to rapid cooling when the faces were quenched.

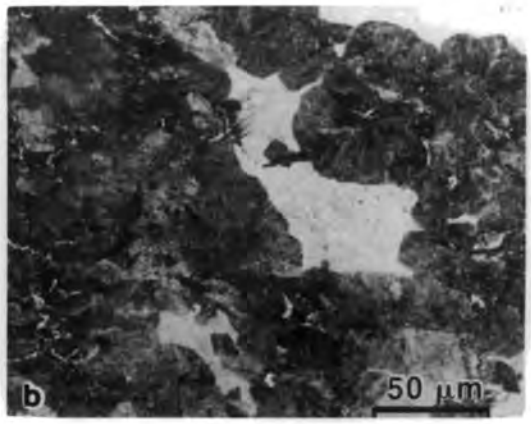
S24 (Plates B16 and B17) **HAMMER, No. 71** Fiskerton, Lincs

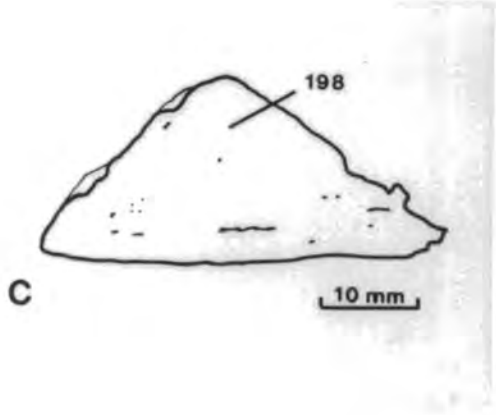
Metal sample TS, 5mm from the tip of the ball face. See also S25 and S26.

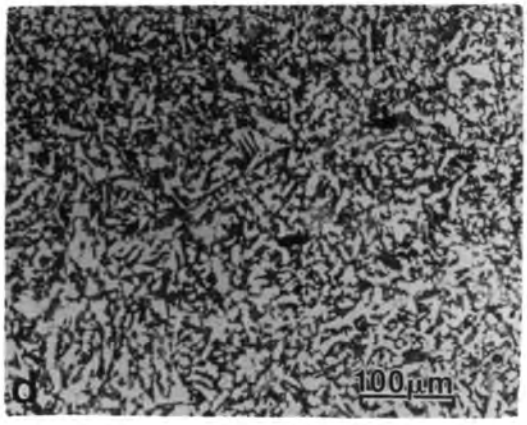
Unetched Clusters of angular single-phase and duplex inclusions.

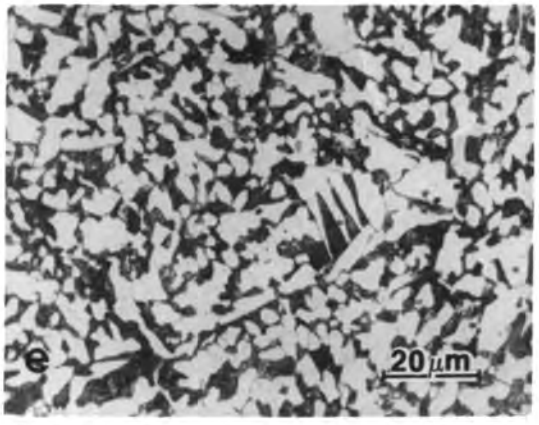
Etched [a, a+b, c] At one side of the section (light-etching zone, left in Plate B16b) was a very low carbon zone which comprised ferrite, a light-etching acicular constituent, and a dark-etching constituent. The greater part of the section (right in Plate B16a) was slightly higher in carbon content (but nevertheless low overall, below 0.3%C), with ferrite, and acicular transformation products similar to those seen in the lower-carbon region, but with a greater proportion of the dark-etching constituent. Some of the dark-etching constituent was also acicular. In some spikes both constituents were present (visible in Plate B16a), but neither was resolvable at X1000. The transformation products were in roughly equal proportion and there was











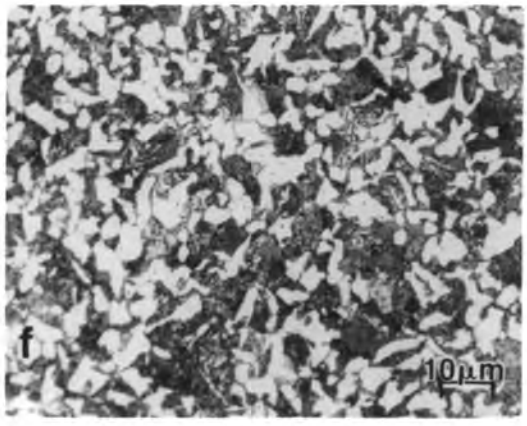
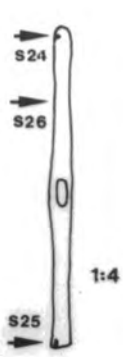
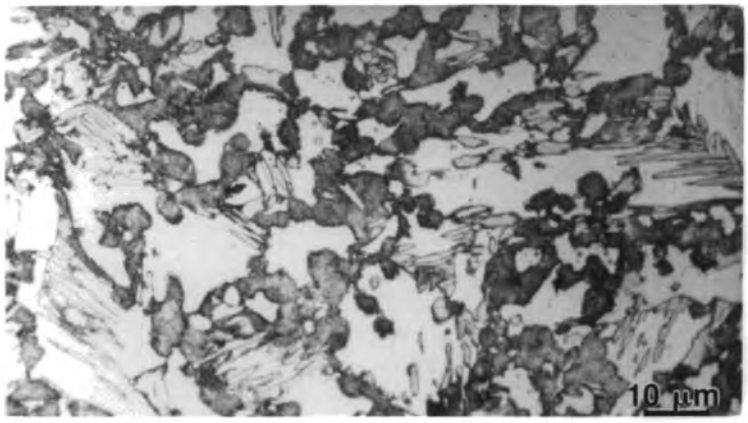


PLATE B15. Metallography of hammer No. 68 (S22 and S23).
(a) S22. Centre of section; nodular pearlite (dark), martensite (pale).
(b) S22. Detail of [a]. (c) S23. Diagram of section: inclusion distribution and hardness (HV 0.2). (d) S23. Pearlite (dark) and ferrite (pale). (e) S23. Detail of [d] showing both rounded and angular ferrite. The pearlite is barely resolvable.
(f) S23. Ferrite with rounded boundaries, and resolvable pearlite.





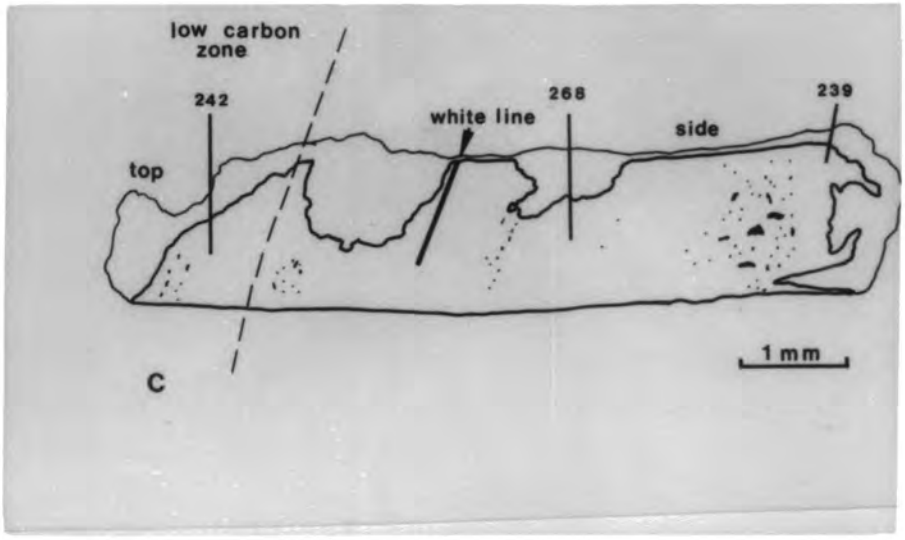
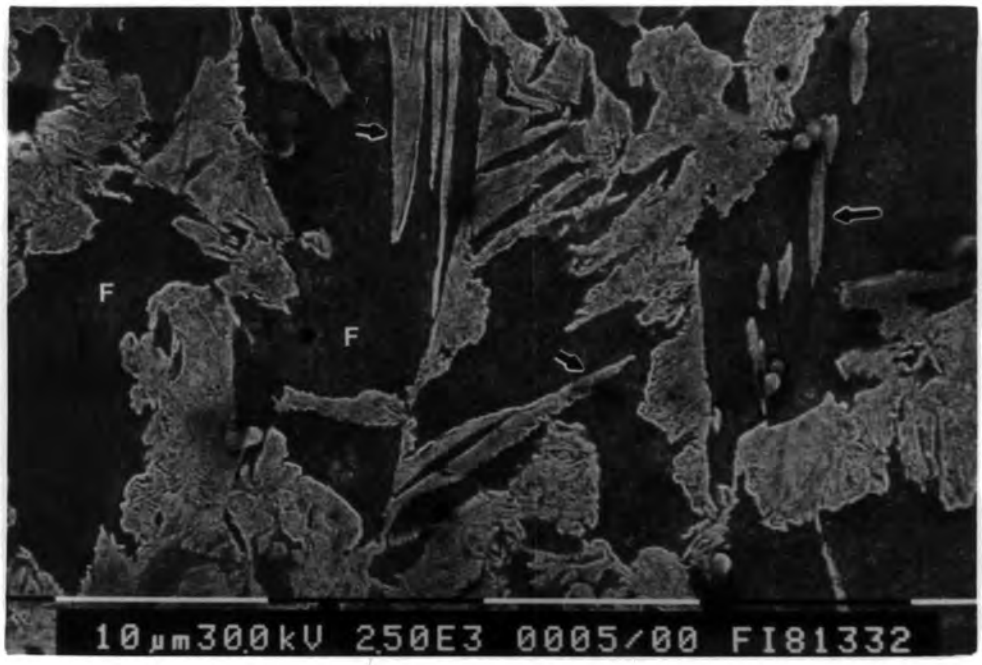


PLATE B16. Metallography of hammer No. 71 (S24).
(a) Detail of higher-carbon zone; ferrite (white), acicular light-etching constituent probably martensite, and irresolvable pearlite (dark). (b) Whole section.
(c) Diagram of section: inclusion distribution and hardness (HV 5).



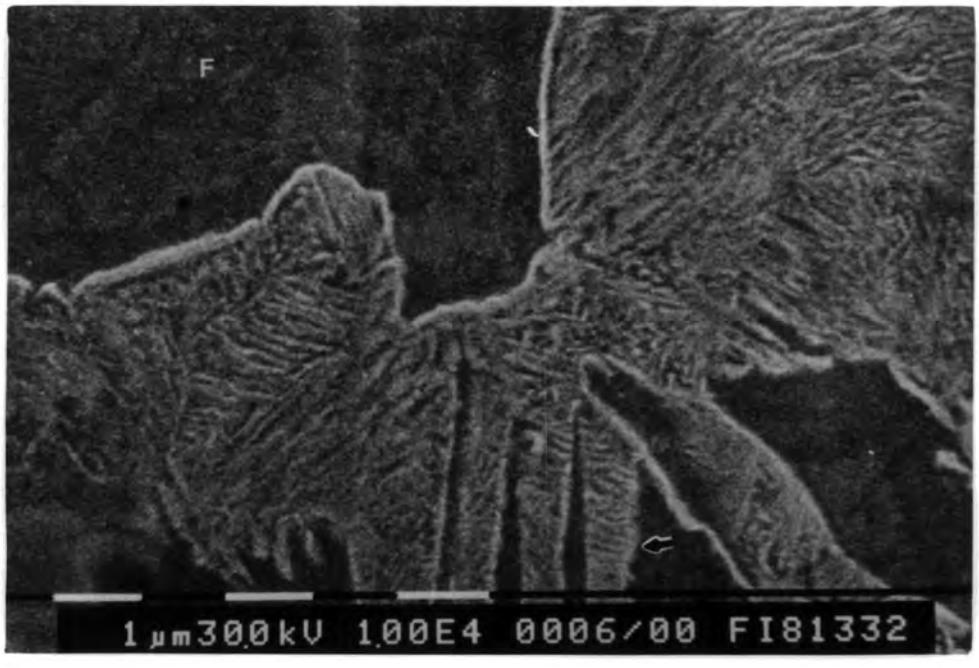


PLATE B17. Metallography of hammer No. 71 (S24).
SEM micrographs showing spiky martensite (light), very fine pearlite (light), ferrite (dark). (a) Spikes of martensite are visible at centre top. (b) Detail of same area (top centre of a). Pearlite lamellae are clearly visible at centre and top right.

some zoning (denser concentration at centre and right in Plate B16b). A short light-etching line was present, without associated inclusions, and the microstructure was continuous beneath. Deformed grains were not seen. Etching with hot alkaline picral revealed no free carbide and only appreciably stained the constituent which was darker-etching under nital.

SEM — The acicular light-etching constituent (arrowed, centre top in Plate B17a, centre bottom in Plate B17b) was partly resolved; there was some alignment in the structure, although none revealed sufficient to be certain of the phase. The other constituent (the darker-etching constituent under nital) comprised fine wavy lamellae, and this was assumed to be pearlite (see especially top right in Plate B17b). This constituent forms the more-rounded fronts adjacent to ferrite (F) in Plate B17a.

Hardness — **Lower-carbon** zone: ferrite 283 HV 0.2; all constituents 242 HV 5.

Higher-carbon zone: all constituents 314 HV 0.2; 312 HV 0.2; 268 HV 5, 239 HV 5.

Grain size — Lower-carbon zone: ASTM 5. Higher-carbon zone: ASTM 7.

SEM-EDXA — Phosphorus was detected in the lower-carbon zone only.

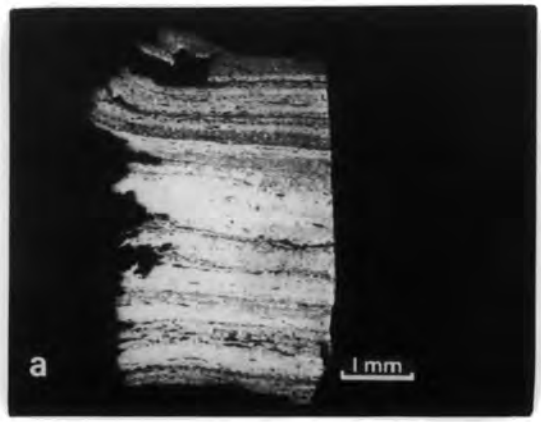
Comments — The presence of phosphorus may account for the variable carbon and microstructural distribution. The light-etching constituent was considered most likely to be martensite, although lower bainite with pearlite, or transitional forms of transformation products are a possibility. The spiky morphology may have resulted from incomplete austenitization (the austenite, concentrated in carbon, forming along crystallographic planes and later transforming to martensite upon quenching). Alternatively, the austenite may have been partly transformed before quenching.

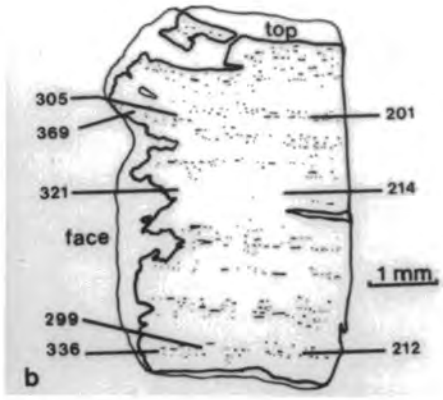
S25 (Plate B18, a-e) **HAMMER, No. 71** Fiskerton, Lincs

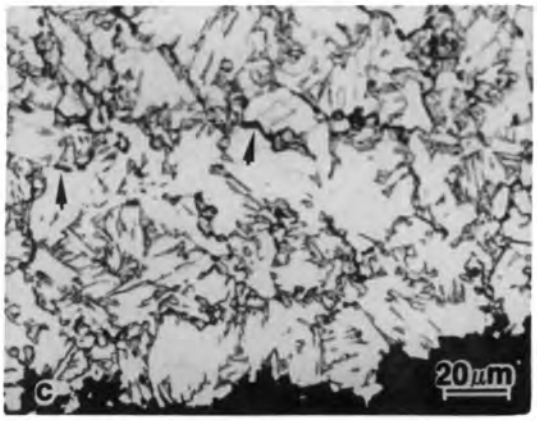
Metal sample — LS, through the rectangular face. See also S24 and S26.

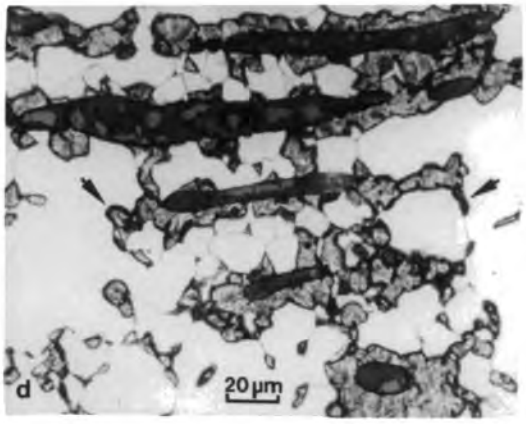
Unetched — Single-phase and duplex particles and stringers were aligned across the section.

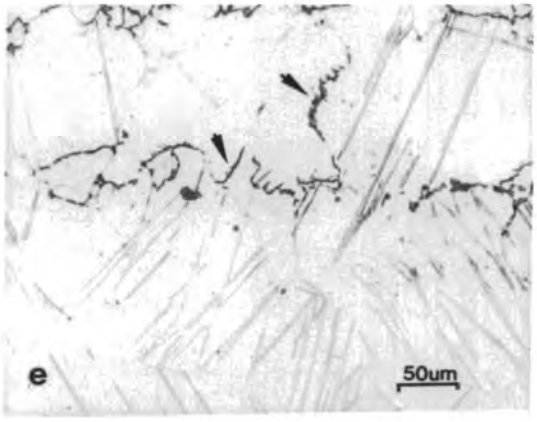
Etched [a, a+b, c] — Much banded structure of ferrite bands alternating with low-carbon bands (Plate B18a). At the centre of the section was a broad band in which numerous Neumann lines were present (Plate B18e). Neumann lines were also present in other ferrite bands and also at the edges of some of the carburized bands. `Ghosting' was visible in the ferrite. The carburized bands comprised a small amount of martensite, visible as grain-boundary spikes (Plate B18, c-e), intragranular plates (Plate B18c), and more rounded forms (Plate B18d). Plate B18c shows a carburized band with ferrite (white), spiky martensite (pale), and a small amount of irresolvable pearlite (dark, arrowed) at the edges of some of the martensite. Plate B18d shows the martensite with a lath-like structure, surrounding duplex stringers. Some dark-etching irresolvable pearlite was associated with the martensite











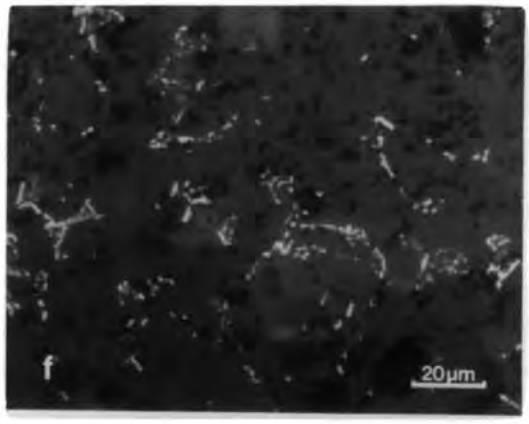


PLATE B18. Metallography of hammer No. 71 (S25 and S26).
(a) S25. Whole section: face at left. Light-etching bands = ferrite. (b) S25. Diagram of section: inclusion distribution and hardness (HV 5). (c) S25. Carburized band at edge of section. (d) S25. Martensite around an inclusion. (e) S25. Ferrite with Neumann lines. The grain-boundary spiky martensite of an adjacent carburized band is arrowed. (f) S26. Carbides (white) within corrosion matrix.

(arrowed). The grains at the hammer face (left in Plate B18a) were much distorted; ferrite grains revealed sub-grain strain lines, and the hardness was high in the burr at the hammer face (compare hardness values in Plate B18b). Etching with hot alkaline picral revealed no free carbides nor was the acicular martensite stained.

Hardness — **Ferrite:** (central band) 330 HV 0.2; 321, 214 HV 5. **Carburized band:** martensite 420, 412 HV 0.05; all constituents (upper band in Plate B15b) 369, 305, 201 HV 5; (lower band in Plate B15b) 375 HV 0.2; 336, 299, 212 HV 5.

Grain size — Ferrite bands ASTM 1-2; carburized bands ASTM 5-7.

SEM-EDXA — Phosphorus was detected in the central ferrite band but not in an adjacent carburized band.

Comments — The hammer face showed evidence of considerable work-hardening through use (high hardness, distorted grains, Neumann lines). The presence of phosphorus was probably responsible for the banding effects, causing segregation of carbon into bands and grain boundaries, during piling and forging. Veining visible in stressed grains suggests that the hammer had been forged in the A_1-A_3 range. The acicular form of the martensite suggests that the hammer face had been partly austenitized before rapid quenching from the A_1-A_3 range (but see comments on the other face, S24). In this section (S25), the martensite was lathy (cf. S24), and there was a lesser proportion of the dark-etching irresolvable pearlite, but the carbon content in the carburized bands was possibly similar to that in the lower-carbon zone of S24 (i.e. very low).

S26 (Plate B18, f) — **HAMMER, No. 71** — Fiskerton, Lincs

Corrosion flakes — Flakes of corrosion products from the eye (where there was no metal core) and 40-50mm from each face (where metal survived in the core). See also S24 and S25.

Unetched — Cementite from pearlite survived within the corrosion matrix.

Comments — The presence of residual pearlite indicates air-cooling, suggesting therefore that the central part of this hammer was left in the unhardened and tougher condition, whereas the faces (S24 and S26) were quenched. Selective hardening of the faces is therefore indicated.

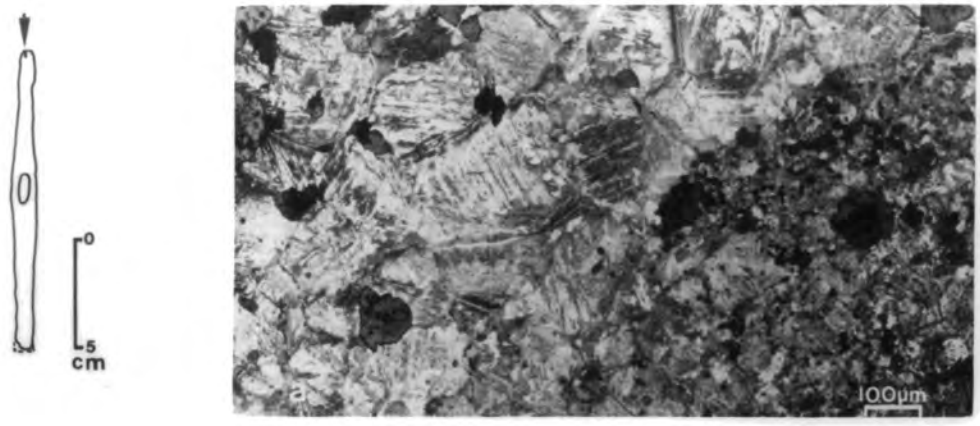
S27* (Plate B19) — **HAMMER, No. 72** — Hunsbury, Northants

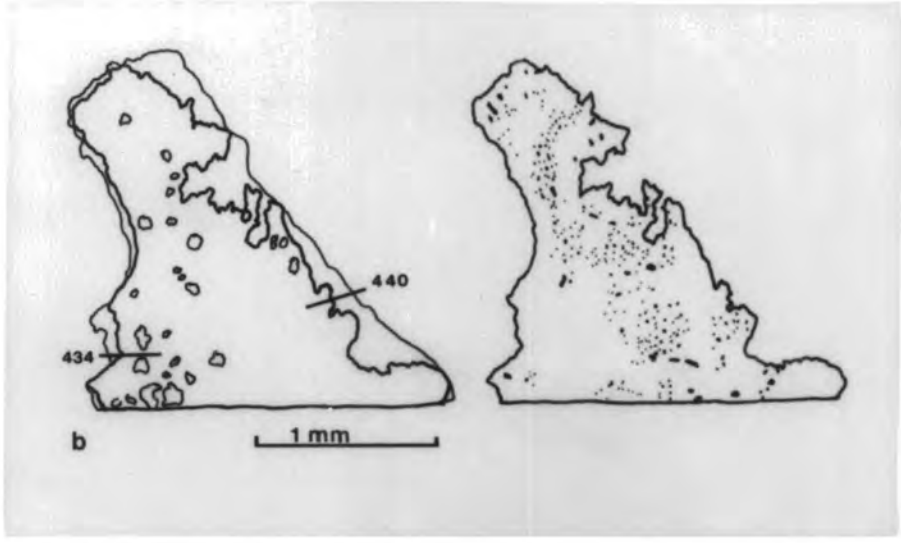
Metal sample — LS, at an angle through the edge of the ball-face, where the face was already damaged (flaked) (Ehrenreich HNY70b).

Unetched — Internal corrosion. Many single-phase (some ?glassy) and duplex inclusions.

Etched [a, d] — Across the section was lath martensite, grain-boundary nodular pearlite, and bainite.

Hardness — Martensite: 484 HV 0.2; 434 HV 0.5. Martensite + pearlite 450 HV 0.2; 440 HV 0.5.





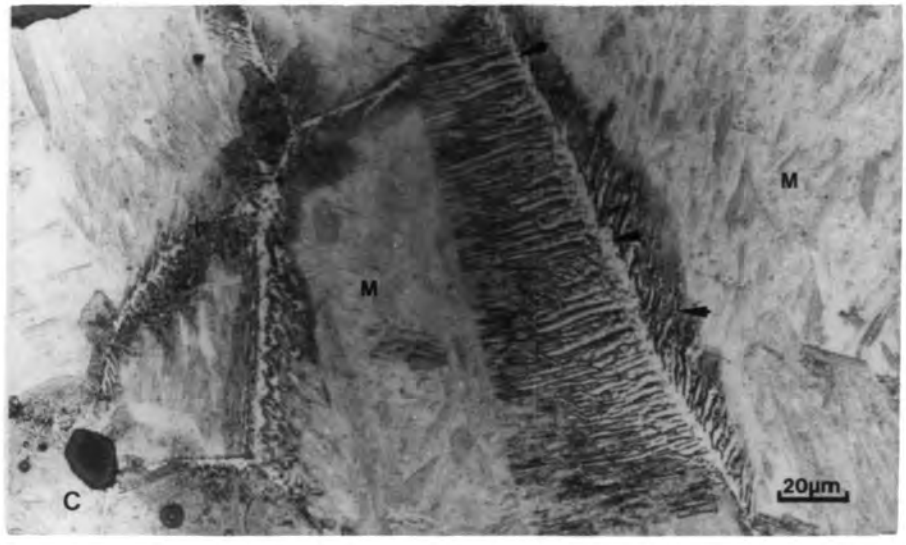


PLATE B19. Metallography of hammer No. 72 (S27).
(a) Centre of section: large-grained martensite (with bainite) at left, small-grained at right. (b) Diagrams of section. Left: hardness (HV 0.5). Right: inclusion distribution (corrosion ignored). (c) Martensite (M), bainite (carbon precipitates arrowed).

Grain size — At one side of the section (left in Plate B19b) ASTM 3; elsewhere ASTM 4-5.

Comments — The hammer face had been quenched from the fully austenitized state, the microstructures typical of a slack quench. The hardness suggests a medium-carbon content. The variation in grain size may be due to uneven chemival composition.

Reference — Ehrenreich 1985, 186, 214, HNY70b.

S28 (Plate B20) HAMMER, No. 73 Bredon Hill, Glos

Metal sample — TS, 4mm from the tip of the rectangular face. See also S29.

Unetched [a] — Abundant, rounded inclusions were concentrated at one side of the section, most of which were multi-phased, though some were glassy. Also one very long stringer.

Etched — One side of the section (right, Plate B20, a-c), where there were less inclusions, the structure was martensitic with some grain-boundary nodular pearlite and a very small amount of feathery grain-boundary ferrite - probably bainite (Plate B20d). The remainder of the section comprised a blocky matrix and bainite (Plate B20e).

Hardness — Martensite: 589 HV 0.2; 542 HV 0.5; 423 HV 5. Bainite: 157 HV 0.2; 162 HV 5.

Grain size — ASTM 6.

Comments — The difference in the microstructure between the two regions appears to be related to the presence of inclusions. On the basis of hardness, the martensitic region may have been low-medium carbon content, whereas the region of high inclusion content was probably very low in carbon. The hammer face was quenched from the fully austenitized state, the structure and hardness suggesting rapid quenching.

S29 (Plate B21) HAMMER, No. 73 Bredon Hill, Glos

Metal sample — TS, 4.5mm from the tip of the ball-face. See also S28.

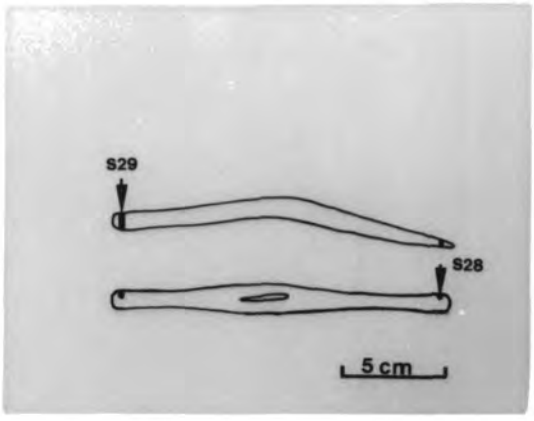
Unetched — Very many rounded and angular, multi-phase and glassy inclusions.

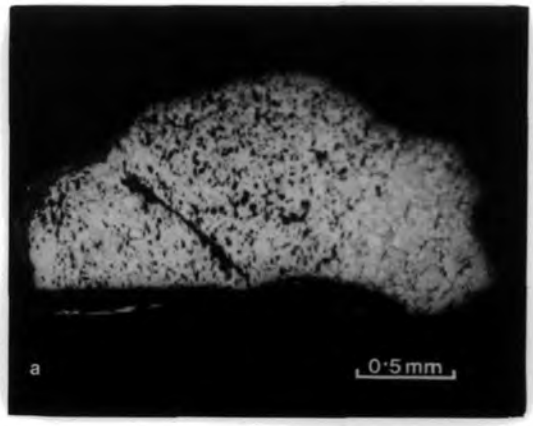
Etched [a] — Both sides of the section (left and right in Plate B21, a-b) revealed martensite with nodular pearlite, and traces feathery grain-boundary ferrite - probably bainite (Plate B21b). The central area (two-thirds of the section) comprised blocky ferrite and a network of bainite (Plate B21, c-d) with a few martensite grains and some irresolvable matrix. Plate B21c shows the typical structure. In Plate B21e the ferrite plates are clearly visible where they intersect; in Plate B21f there are particles of carbon or carbide alongside the ferrite plates.

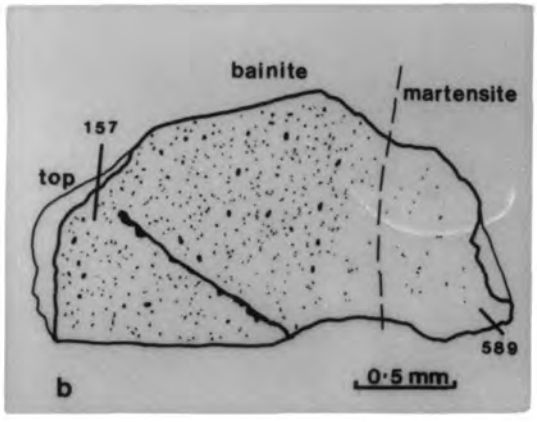
Hardness — **Martensite region:** 507 HV 0.2; 524 HV 0.5; 336 HV 5. **Bainite region:** overall 188 HV 5; martensite 549, 470, and 394 HV 0.2; bainite (as in Plate B21f) 242 HV 0.2; matrix, ?bainite 263 and 241 HV 0.2; matrix, ?ferrite 138, 149, and 153 HV 0.2.

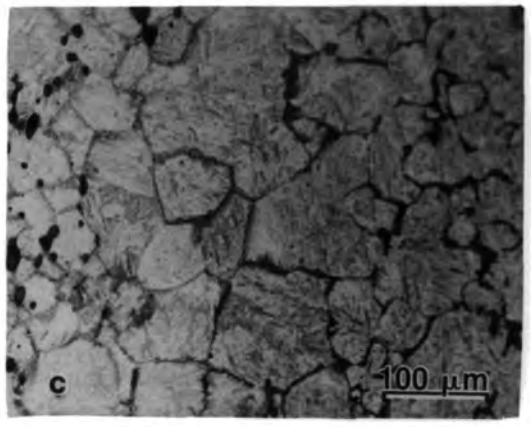
Grain size — ASTM 3-4.

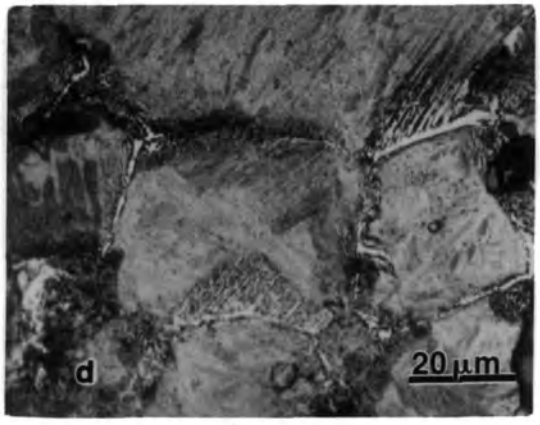
Comments — The low hardness of the martensite suggests a low-medium carbon content. The structure at the central zone (blocky ferrite + bainite) may be a transition form











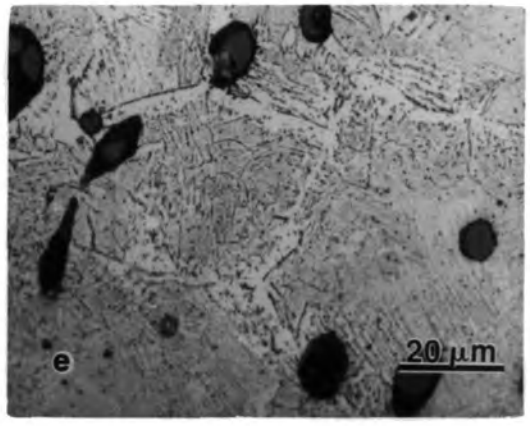
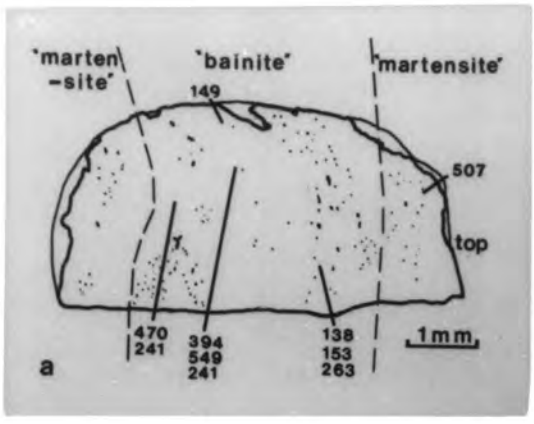
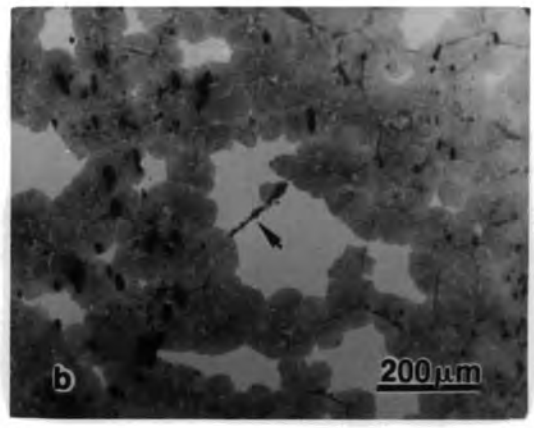
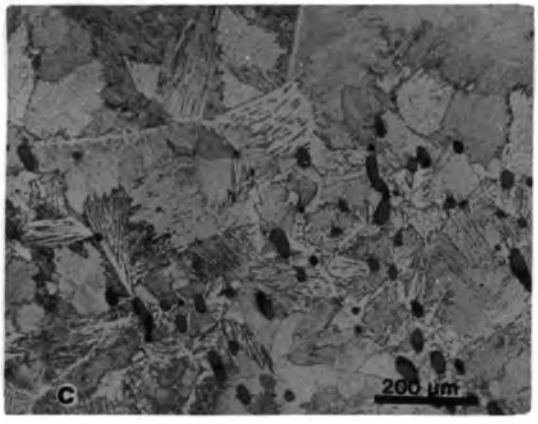
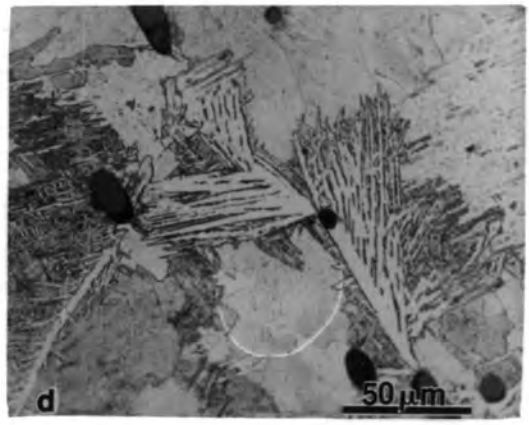


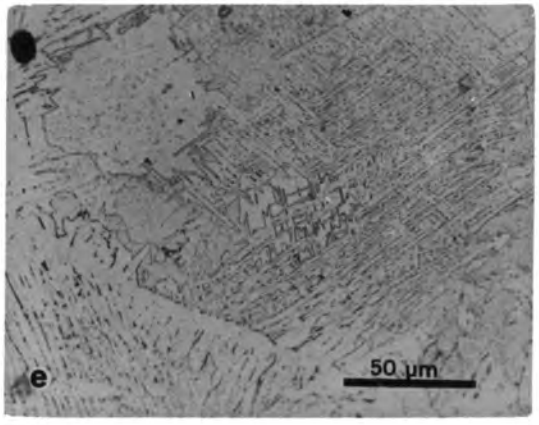
PLATE B20. Metallography of hammer No. 73 (S28).
(a) Whole section. (b) Diagram of section: inclusion distribution and hardness (HV 0.2). (c) Right side of section: martensite with grain-boundary pearlite.
(d) Martensitic region: grain-boundary ferrite, probably bainite. (e) Bainite region: grain-boundary ferrite with carbon dispersion, multi-phase slag.











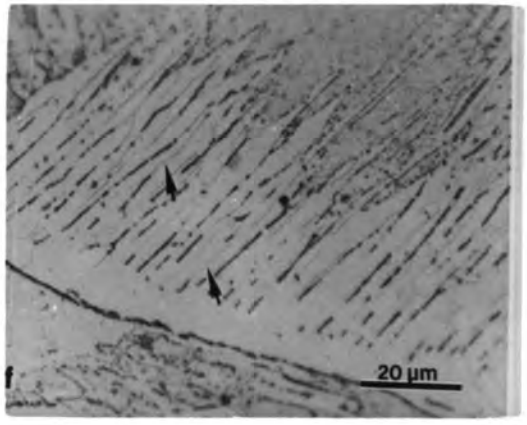


PLATE B21. Metallography of hammer No. 73 (S29).

(a) Diagram of section: inclusion distribution and hardness (HV 0.2).

(b) Edge of section: martensite (pale), nodular pearlite, ?bainite (dark, arrowed).

(c) Blocky ferrite and bainite. (d) Detail of [c]. (e) Intersecting ferrite plates.

(f) Ferrite plates (some edges arrowed) with carbon dispersion (fine black lines & particles).

of ferrite/bainite present in massive form. The hammer was quenched from the fully austenitized state, the structure indicating a mild quench.

Both sections from this hammer (S28 and S29) exhibited similar austenite transformation products which suggested a relatively similar carbon content and elemental composition at both faces. Additionally, both were probably quenched under the same conditions, possibly simultaneously. The condition of the hammer did not permit a sample to be taken from the eye region, nor for the easy removal of corrosion products for examination of remanent metal structures.

S30 (Plates B22 and B23) HAMMER, No. 76 Ham Hill, Somerset

Metal sample Round face: TS, 2mm from the extant face. See also S31 and S32.

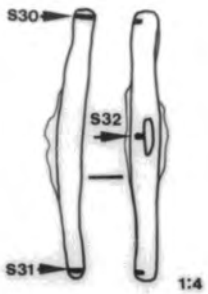
Unetched Two bands of dendritic, multi-phased inclusions; some small glassy inclusions.

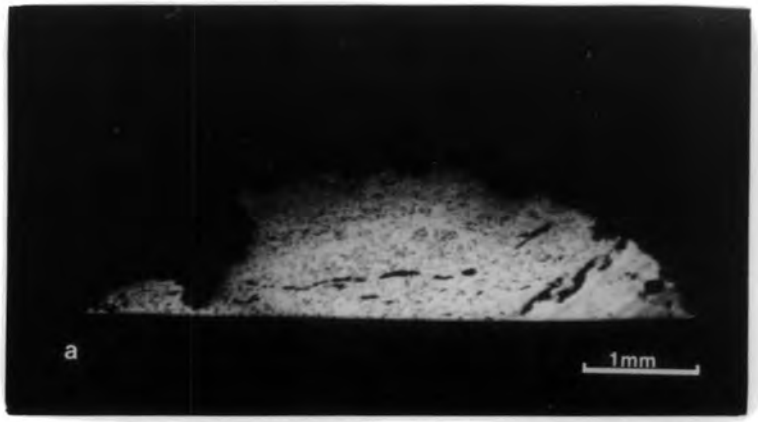
Etched [a] Very low carbon content, below 0.1%C. At one side of the section was a ferrite zone with abundant Neumann lines (Plate B22b). At the other side of the section was ferrite, acicular light-etching transformation products, and a small amount of a dark-etching constituent (some of which had a feathery appearance at the edges). Grains were equiaxed. Numerous dark granules, possibly carbide precipitations, were present in the ferrite (Plate B23, a-b). The transformation products were similar to those seen in the sections from the other face (S31) and the eye (S32).

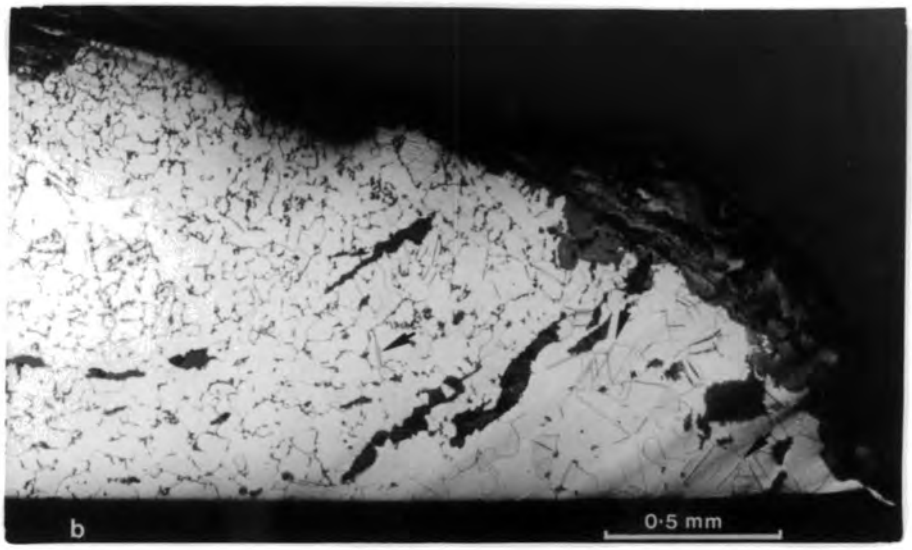
SEM The section was examined by SEM in an attempt to resolve the nature of the transformation products. The spiky constituent had very little internal structure (e.g. the spikes at the centre in Plate B23b); the `feathery' constituent had a slight lamellar appearance (e.g. centre left [P] in Plate B23a, below the spike). In the ferrite [F] were abundant precipitations (visible in Plate B23, a-b as short white plates). Surrounding the transformation products were precipitate-free zones (dark outlines around the constituents) which were probably due to re-absorption of carbide into the austenite (N. Ridley pers. comm.)

Hardness Centre of section: ferrite 185 HV 0.2. Grain size: ASTM 5-6.

Comments The spikiness of some of the transformation products may be attributable to incomplete austenitization, the austenite growing along crystallographic planes and later transforming upon quenching. The lighter-etching constituent was possibly martensite; the other was probably pearlite. Some of the acicular constituents could possibly be lower bainite. However, in consideration of the microstructure at the other face of the hammer (S31), where there were areas of lathy martensite, then martensite and pearlite would seem to be the most likely constituents present. The Neumann lines indicate cold deformation, presumably during use of the hammer.







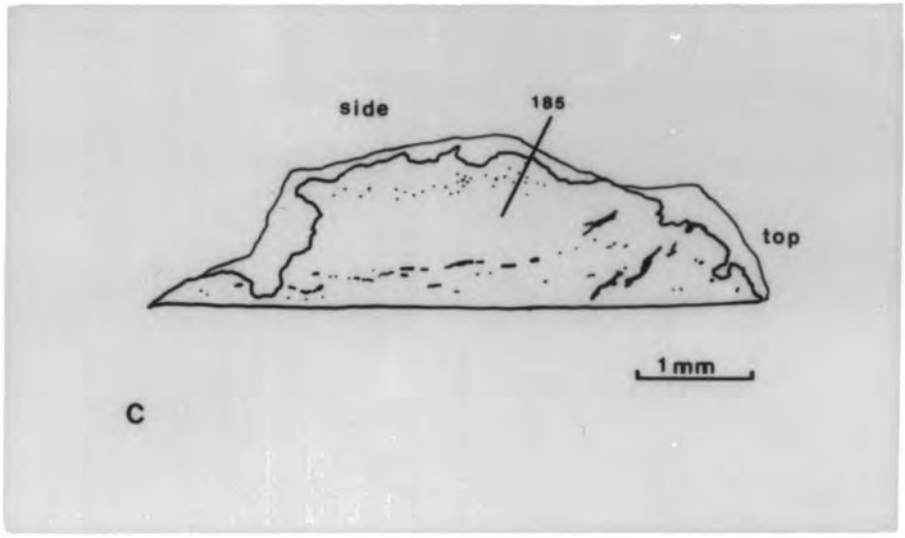
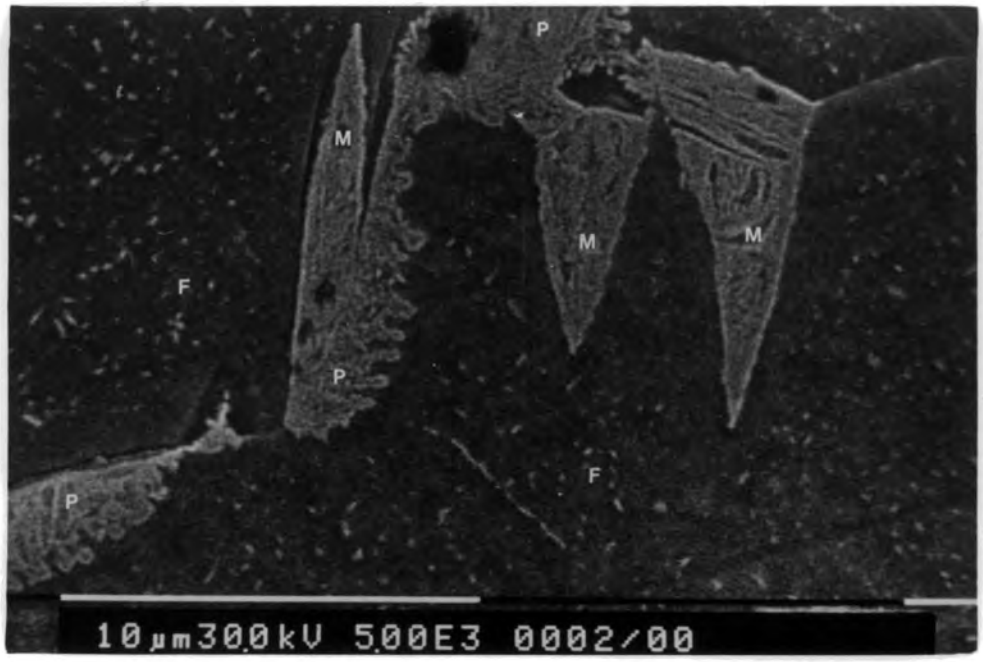


PLATE B22. Metallography of hammer No. 76 (S30).
(a) Whole section. (b) Half of section: left, carburized region; right, ferrite with Neumann bands (some arrowed). (c) Diagram of section: inclusion distribution and hardness (HV 0.2).



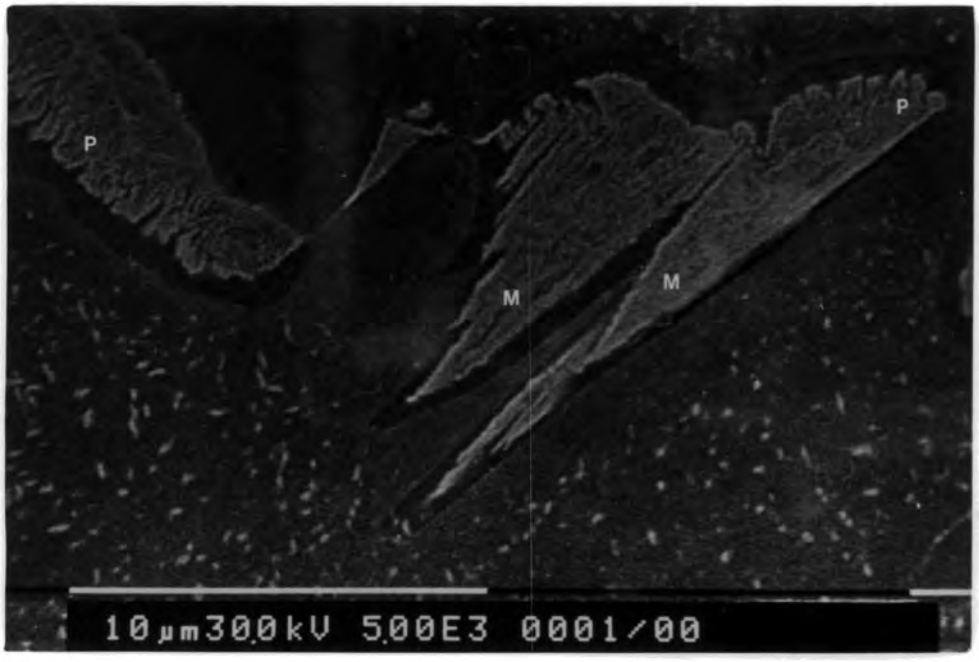


PLATE B23. Metallography of hammer No. 76 (S30).
SEM micrographs showing spiky ?martensite (light), ?pearlite (light, with irregular boundaries), ferrite (dark) with inclusions (white dots).
(a) Three ?martensite spikes, delineated from the ?pearlite.
(b) Spikes of ?martensite at centre; ?pearlite at centre left & top right.

S31 (Plate B24, a-c) **HAMMER, No. 76** Ham Hill, Somerset

Metal sample — Rectangular face: TS 3mm from extant face. Corroded layers detached during sampling; 2 pieces were mounted (Plate B24a, right and lower). See also S30 and S32.

Unetched — Small amount of rounded ?glassy inclusions, most of which appear to be unaligned, except within the carburized bands.

Etched [a] — Much banded: 6 bands of ferrite alternated with bands of very low carbon content (below 0.1%C). At one side of the section (the underside of the hammer, bottom in Plate B24a), there was a slightly broader band of higher carbon content (but nevertheless low-carbon), and this band extended into the fragment of corrosion products which had been detached during sampling. The carburized bands comprised ferrite, and spiky martensite of distinctly lathy appearance (Plate B24c) with some dark-etching irresolvable ?pearlite at its edges - microstructures similar to those seen in the other 2 sections (S30 and S32) from this hammer. Where the carbon content was lowest, the martensite was more spiky. There was no evidence of deformed grains, though some veining was present.

Hardness — Ferrite (near face) 142 HV 0.2. Higher-C region: ferrite + martensite 214 HV 0.2.

Grain size — ASTM 6-9; in general there was a gradation across the section, with the grains at the carburized bands smaller than those in the ferrite banding.

SEM-EDXA — Ferrite band: c. 1% arsenic. Carburized band: no elemental enrichment.

Comments — The banding suggests much fold-welding, resulting in arsenic enrichment and carbon segregation. Like the other face (S30), this face was also partly austenitized and then quenched.

S32 (Plate B24, d-f) **HAMMER, No. 76** Ham Hill, Somerset

Metal sample — Eye: TS, from the underside of the eye. See also S30 and S31.

Unetched — Groups and loose alignments of multi-phased dendritic inclusions.

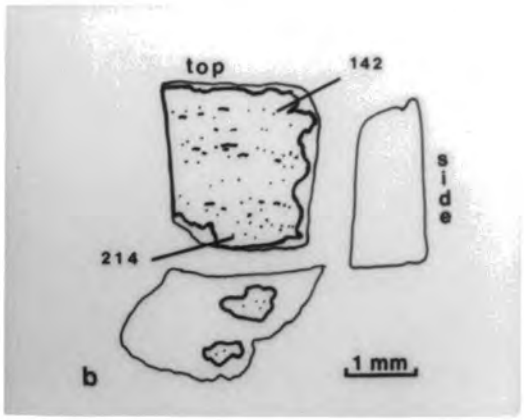
Etched [a] — Banded structure comprising 2 broad ferrite bands and 2 broad carburized regions, the latter of very low-carbon (below 0.1%C). The carburized regions revealed a small amount of light-etching spiky ?martensite with dark-etching irresolvable ?pearlite, some of which had a feathery appearance (Plate B24f). These transformation products were similar to those seen in the other 2 sections from this hammer (see S30). The ferrite grains revealed some veining (Plate B24f).

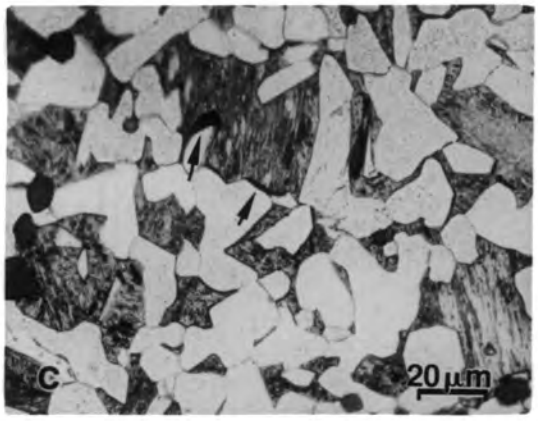
Hardness — Carburized band: ferrite 151 HV 0.2; 189 HV 1. Ferrite band: 148 HV 0.2.

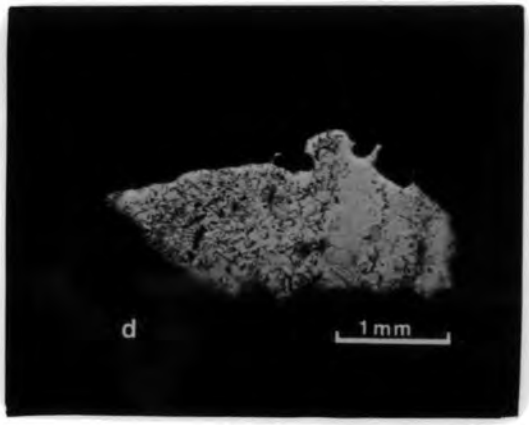
Grain size — ASTM 3-5; larger grains only in the ferrite bands.

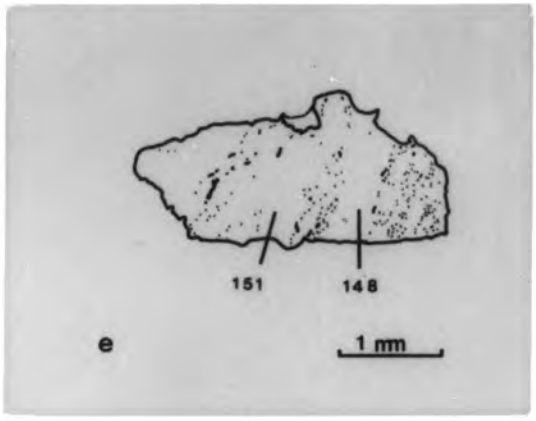
SEM-EDXA — Carburized band: c. 0.15 % arsenic. Ferrite band: c. 0.5% arsenic.

Comments — Like S31, the banding seems to be due to arsenic, which had caused segregation of the carbon. The hammer eye, like the two faces of this hammer (S30 and S31), had been quenched from the partly austenitized condition.









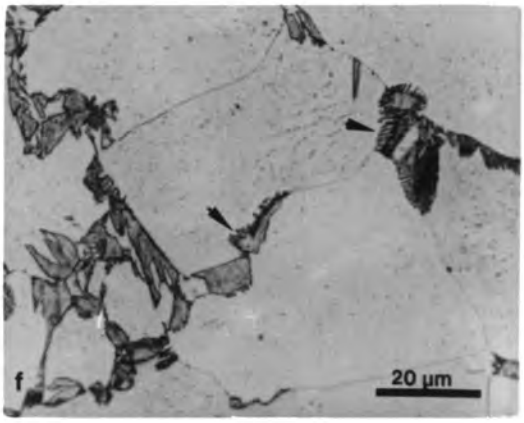


PLATE B24. Metallography of hammer No. 76 (S31 and S32).
(a) S31. Whole section. (b) S31. Diagram of section: inclusion distribution and hardness (HV 0.2). (c) S31. Ferrite, martensite, pearlite (arrowed). (d) S32. Whole section. (e) S32. Inclusion distribution and hardness (HV 0.2). (f) S32. Ferrite with veining, spiky transformation product (?martensite), feathery constituent (?pearlite).

The 3 sections from this hammer (S31-S32) were similar in carbon-content and microstructure, and all had been quenched. This suggests that the whole hammerhead was quenched, without selective heat-treatment of the faces.

S33 (Plate B25, a-b) **HAMMER, No. 77** Bredon Hill, Glos

Metal sample: TS, 4mm from the extant rounded (rectangular) face, through the side of the hammer. See also S34.

Unetched: A very small amount of single-phase and duplex inclusions. Carbides were visible within the corrosion layers.

Etched [a, a+b]: Fairly homogeneous across the section but of lower carbon content at one region; the range c. 0.2 to 0.4% C. Fine nodular carbide was present, some outlining former grain boundaries, and some as intragranular carbide. There were traces of acicular ferrite.

Hardness: Higher-carbon regions: 136, 137 HV 0.2; 111 HV 5. Grain size: ASTM 7.

Comments: The hammer face had been reheated to a moderate temperature (below A_1) causing spheroidization and recrystallization to occur. The small size of the carbide suggests that the former microstructure was of fine morphology.

S34 (Plate B25, c-e) **HAMMER, No. 77** Bredon Hill, Glos

Metal sample: TS, 3mm from the extant rectangular face. See also S33.

Unetched: A few well-broken and narrow inclusion stringers; multi-phased, one diagonal alignment. Some carbides were visible in the corrosion layers.

Etched [a, a+b]: Fine nodular carbides outlined some of the grain-boundaries and were present with in the grains. The carbon content was uniform across the section, c. 0.5 - 0.6%C.

Hardness: 155 HV 0.2, 168 HV 0.2; 157 HV 5. Grain size: ASTM 6.

Comments: Like the section from the other face (S33), the former structure had spheroidized as a result of reheating, and had probably been a fine structure originally.

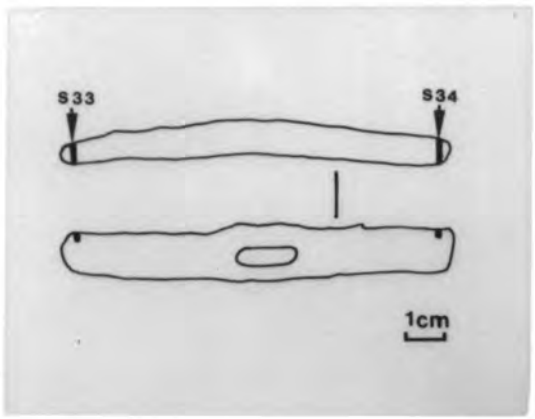
S35 (Plate B26) **HAMMER, No. 84** Glastonbury, Somerset

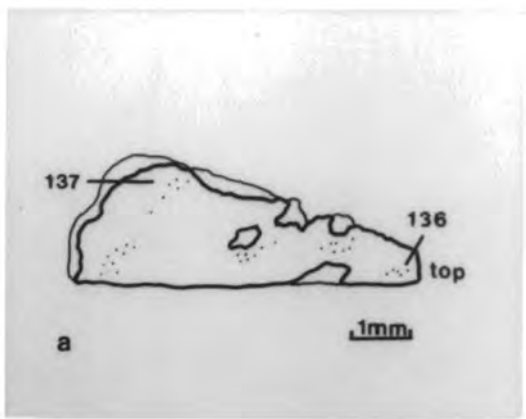
Metal sample: TS, 3mm from the extant face of the longer thinner arm, behind the burr, incorporating part of the front and part of the side of the hammer. The condition of the hammer permitted only the one sample to be taken.

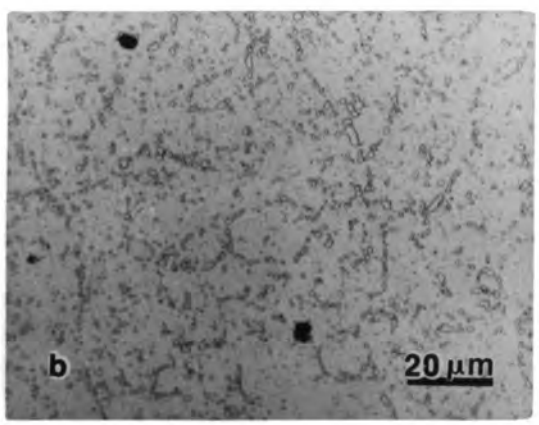
Unetched: Essentially no inclusions; there were only 3 tiny particles (even on repolishing).

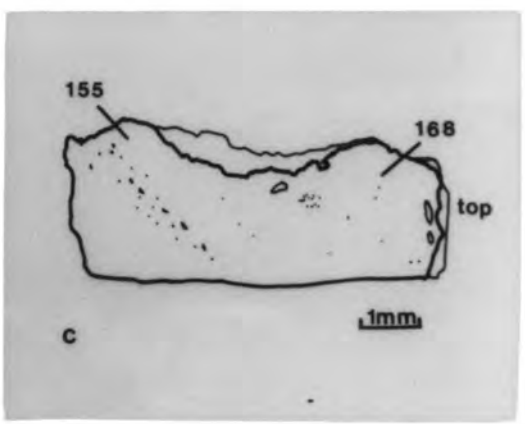
Etched [a]: Homogeneous structure which etched rapidly and darkly, comprising networks of cementite films, visible in Plate B26c as dark lines, and arrowed in Plate B26d. Within the networks was degenerate pearlite cementite (some of which was continuous with the free [grain-boundary] cementite).

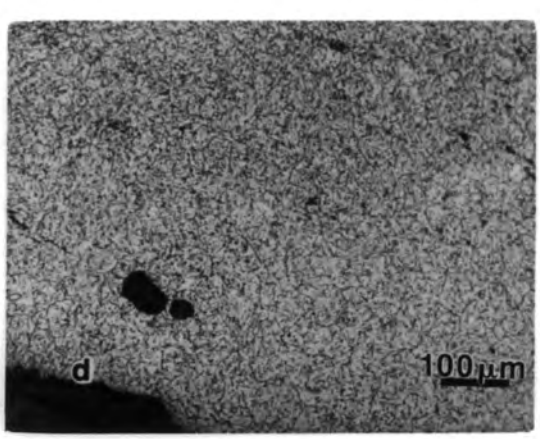
Hardness: At side of section: 198 HV 0.2. At apex: 207 HV 0.2. Grain size: ASTM 4.











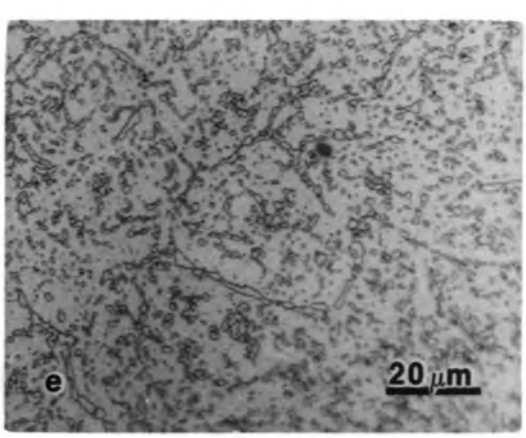
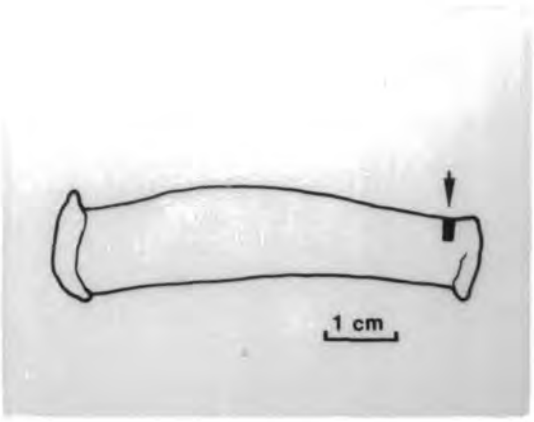
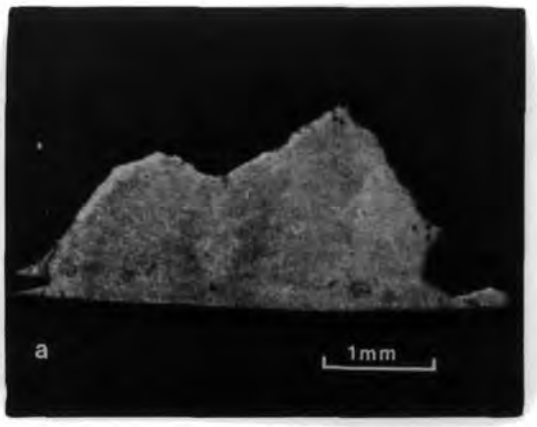
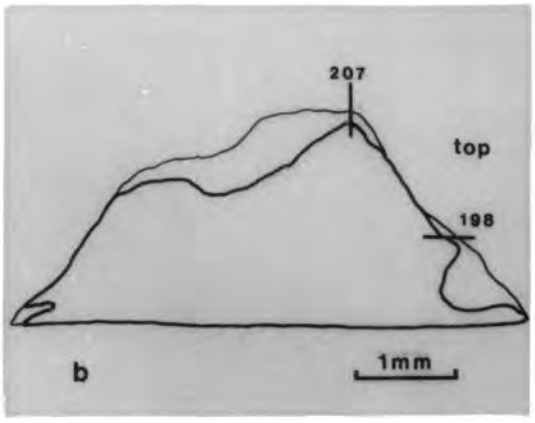


PLATE B25. Metallography of hammer No. 77 (S33 and S34).
(a) S33. Diagram of section: inclusion distribution and hardness (HV 0.2).
(b) S33. Spheroidized carbide. (c) S34. Slag distribution and hardness (HV 0.2).
(d) S34. Carbide. (e) S34. Detail of carbide.







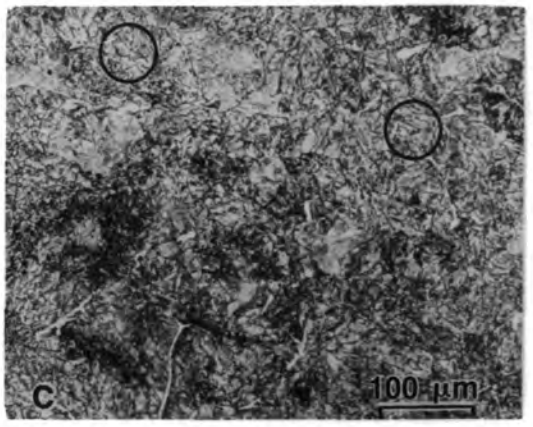


PLATE B26. Metallography of hammer No. 84 (S35).
(a) Whole section. (b) Diagram of section: hardness (HV 0.2). (c) Centre of section: degenerate pearlite, the free (grain-boundary) cementite is dark (some circled).
(d) Degenerate pearlite, free cementite arrowed.

Comments The degeneracy of the pearlite suggests that the carbon content was low-medium (perhaps about 0.5%C max.) and had been rapidly cooled. (See also discussion on degenerate pearlite in S56.)

S36 (Plate B27) **HAMMER, No. 86** Bredon Hill, Glos

Metal sample TS, 5mm from the extant burred face, from the underside corner of the hammer.

Unetched A few glassy and duplex inclusions.

Etched [a, d] The section comprised lath martensite with grain-boundary nodular pearlite, with some feathery grain-boundary ferrite (?bainite). At one corner of the section (bottom right in Plate B27, a-b) there were curved light-etching lines without associated inclusions, some bainite, and the matrix appeared blocky (Plate B27c).

Hardness **Martensite:** side 477 HV 0.2; 485 HV 0.5; apex 493 HV 0.5; upper centre 480 HV 5; near white lines 408 HV 0.2. **Bainite:** 211 HV 0.2. Grain size: ASTM 5.

Comments The segregation lines at one corner of the section suggest variable elemental composition, which could account for the bainitic microstructure. The hammer face was probably of low-medium carbon content as judged by the moderate hardness. The face was quenched from the fully austenitized condition, the microstructures suggesting a mild quench (although this may be because the sample was taken well back from the original hammer face).

S37 (Plate B28) **HAMMER, No. 89** Bredon Hill, Glos

Metal sample TS, 5mm from the tip of the unburred face, through the side of the hammer.

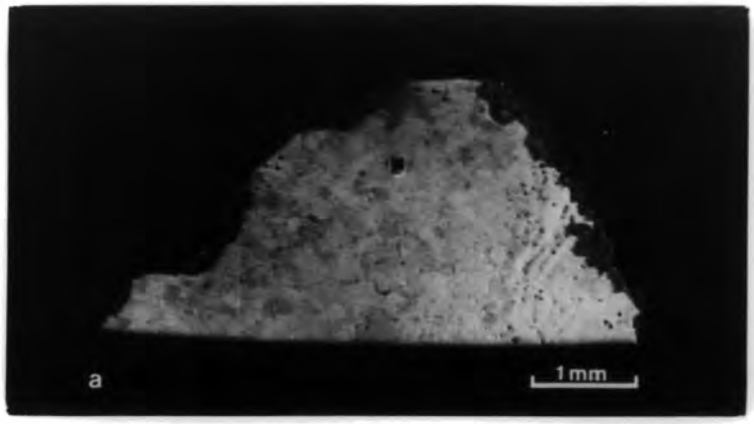
Unetched Many inclusions, many of which were aligned. At one side of the section was a broad band of large, angular, glassy inclusions (left in Plate B8b). Vertically across the centre were 2 narrow bands of small, rounded, multi-phase inclusions.

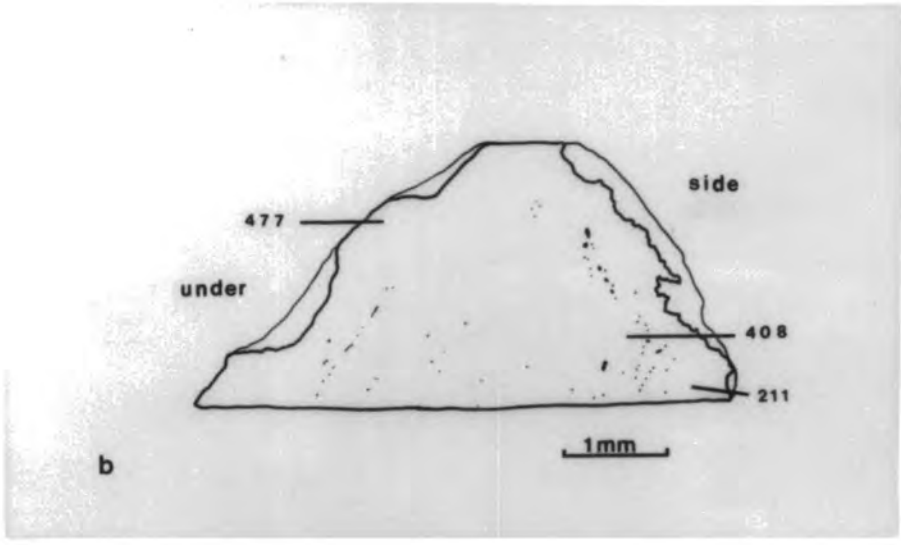
Etched [a] Even carbon gradation across the section, from essentially carbon-free at the top of the hammer (left in Plate B28, a-b) to c. 0.7%C at the underside (right in Plate B28, a-c). At the low-carbon region there was a very small amount of grain-boundary pearlite with ferrite. Elsewhere there was very fine, barely resolvable pearlite, with Widmanstätten ferrite. The pearlite etched unevenly; near the fine inclusions (centre) the pearlite etched darkly, and light-etching parallel lines were visible close by (Plate B8c).

Hardness Low-carbon region: 130 HV 0.2; 142 HV 5. High-carbon region: 234 HV 0.2; 236 HV 5.

Grain size Low-carbon region: ASTM 7/8. High-carbon region: ASTM 6.

Comments The alignments of fine inclusions and differentially etching pearlite suggests welding (i.e. pile-forging) at that region. The hammer face was finally fast air-cooled from the fully austenitized condition.





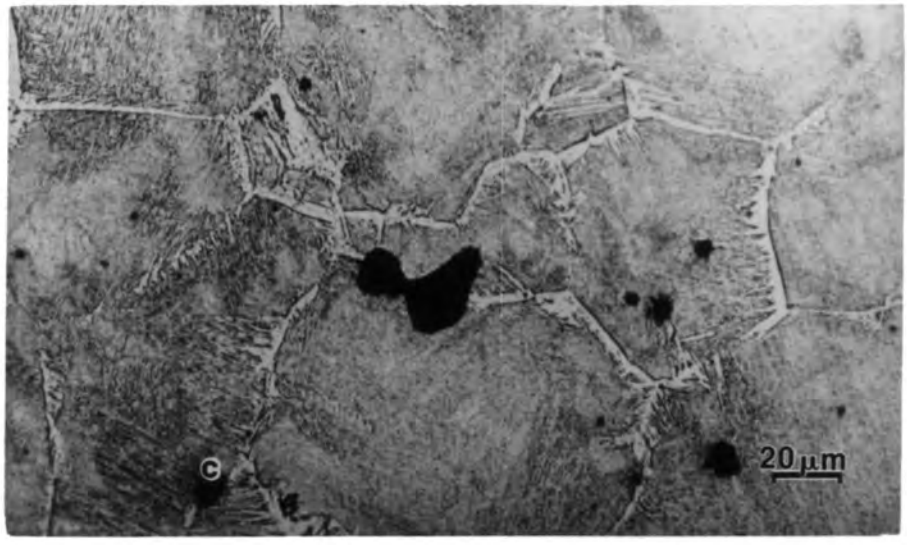
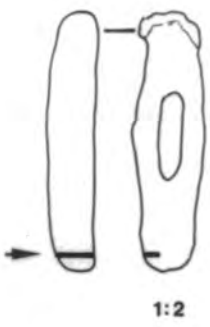
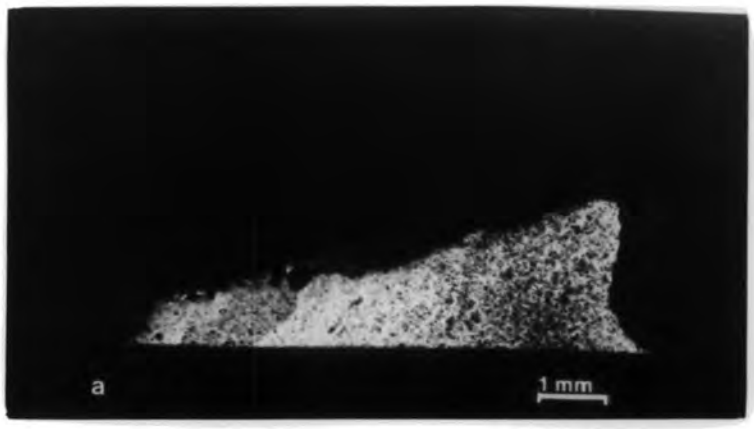
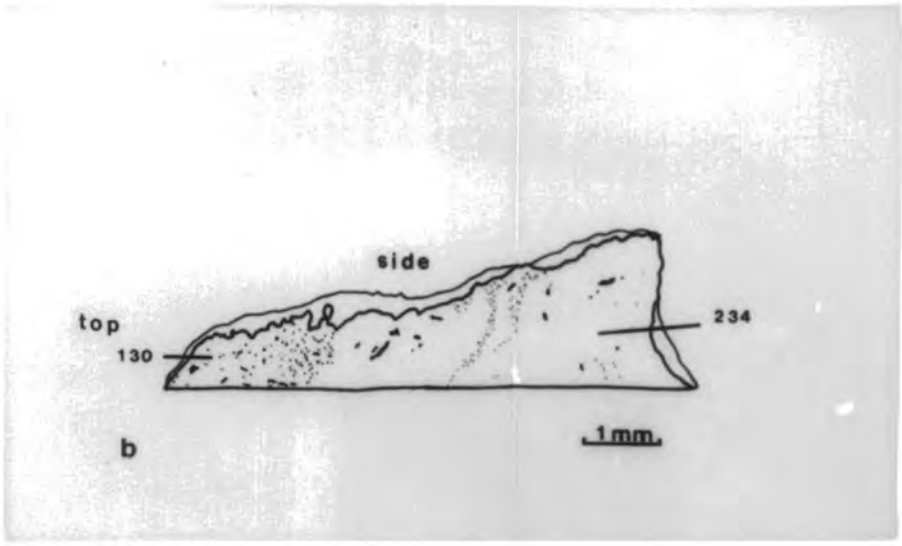


PLATE B27. Metallography of hammer No. 86 (S36).
(a) Whole section. (b) Diagram of section: inclusion distribution and hardness (HV 0.2).
(c) Feathery grain-boundary ferrite, ?bainite.







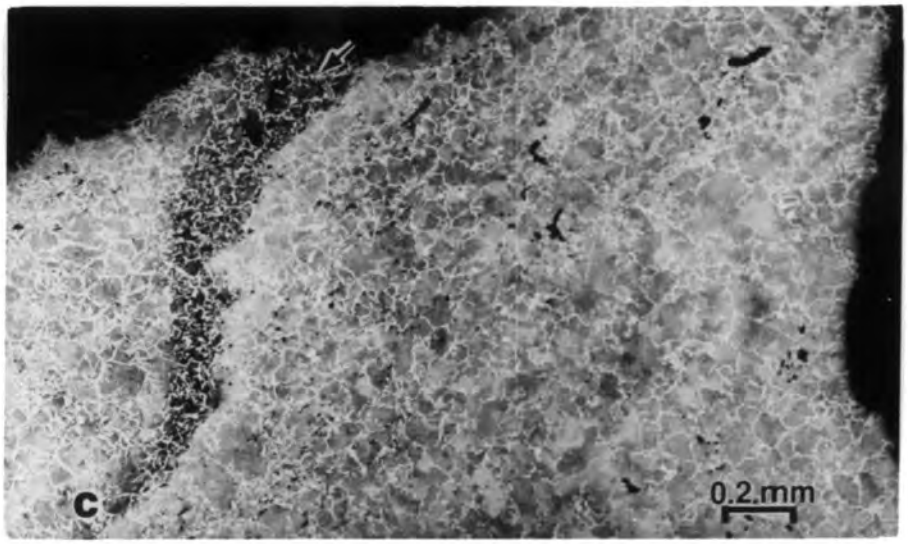


PLATE B28. Metallography of hammer No. 89 (S37).
(a) Whole section. (b) Diagram of section: inclusion distribution and hardness (HV 0.2). (c) Higher carbon region: pearlite with Widmanstätten ferrite. Dark-etching band of higher inclusion content runs down the section to the left (arrowed).

S38* **(Plate B29, a-c)** **HOT CHISEL OR SET, No. 108** Hunsbury, Northants

Metal sample LS, through the extant (corroded) corner of the cutting edge (Ehrenreich HNY20a). The cutting edge of the chisel is on the left in Plate B29, a-b.

Unetched Aligned duplex inclusions. Corroded along a stringer at one side (top edge in Plate B29, a-b [arrowed], and visible at bottom in Plate B29c).

Etched [a] The section comprised fine pearlite with Widmanstätten ferrite. The carbon content was c. 0.1-0.4%C at the centre of the section, but the extreme edges of the section were of much higher carbon content (Plate B29b). Plate B29c shows one carburized edge of the section (top edge in diagrams); the other edge of the section reached eutectoid composition.

Hardness 212 HV 0.2. Grain size: ASTM 4 at carburized edges, elsewhere ASTM 6.

Comments The very high carbon levels at both edges of the section suggests that the chisel had probably been surface carburized. However the cutting edge of the tool is now much corroded and surface layers have been lost, which makes this identification uncertain. The cutting edge was air-cooled from the fully austenitized condition.

Reference Ehrenreich 1985, 169, 212, HNY20a.

S39* **(Plates B29, d-f and B30, a-b)** **COLD SET, No. 113** Worthy Down, Hants

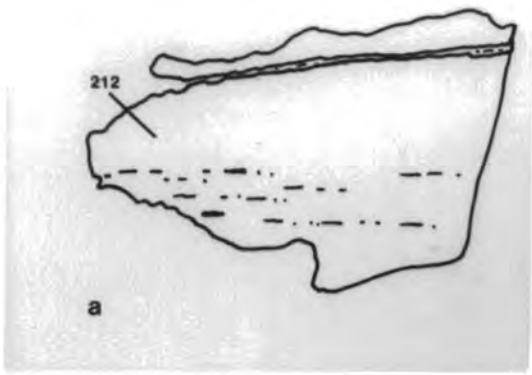
Metal sample LS, through the cutting edge, just off-centre (Ehrenreich WD11a). The cutting edge is on the left in Plate B29, d-e.

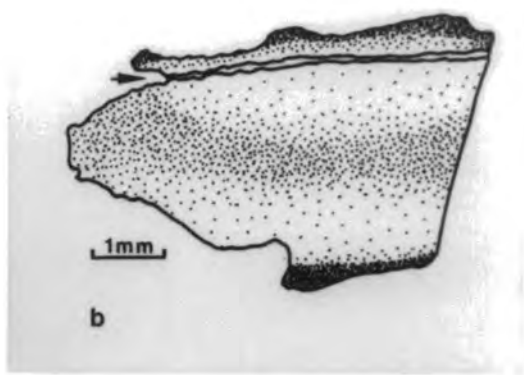
Unetched Aligned multi-phased slag inclusions (Plate B30b) and particles.

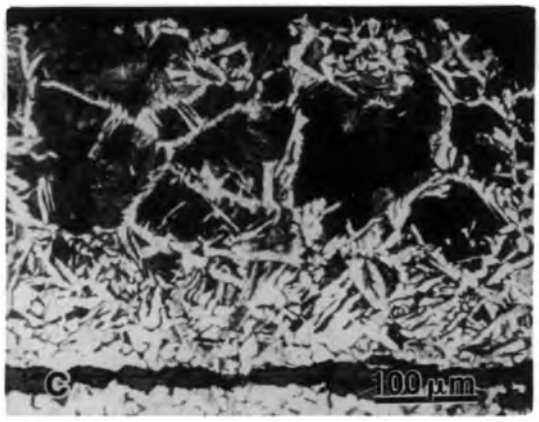
Etched [a] Banded structure comprising a central martensitic band which has some grain-boundary nodular pearlite, and feathery grain-boundary ferrite (probably bainite). At the sides of the section are lower-carbon ferritic regions, the carbon concentrated into narrow bands of spiky, and feathery, light-etching constituents which were irresolvable at magnifications up to X500. Possibly this is pearlite although the hardness is rather high, or perhaps a mixture of several high-temperature transformation products including martensite (?tempered) and bainite. 'Ghosting' was visible in the ferrite (arrowed in Plate B30a).

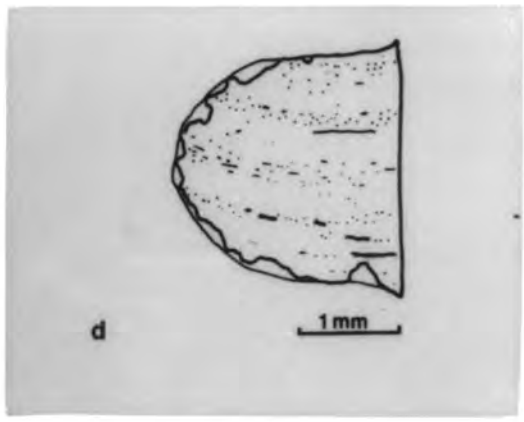
Hardness Martensite (band): 447 HV 0.2. Light-etching constituents: 476 HV 0.2. Ferrite: 262 HV 0.2. Grain size: ASTM 4-5.

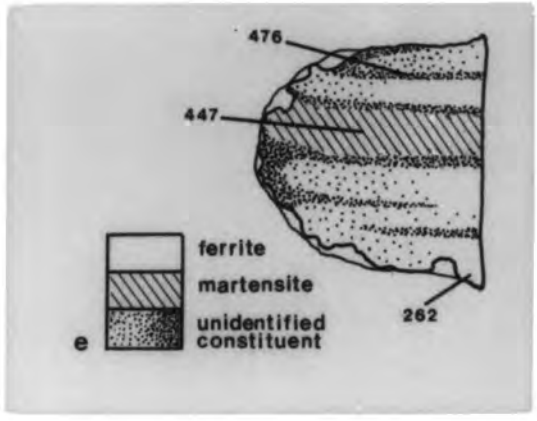
Comments The banding in the section suggests that the tool had been piled, possibly with the deliberate use of a central higher-carbon component to create a hard cutting edge. No evidence of welding was seen at the edges of the central martensitic band although this may have been obliterated by forging. The ghosting effects in the ferrite may be due to phosphorus (determined to be present in moderate levels by Ehrenreich 1985). The tool was quenched; there was no certain evidence for tempering in the central martensitic band, and the hardness was similar to that of











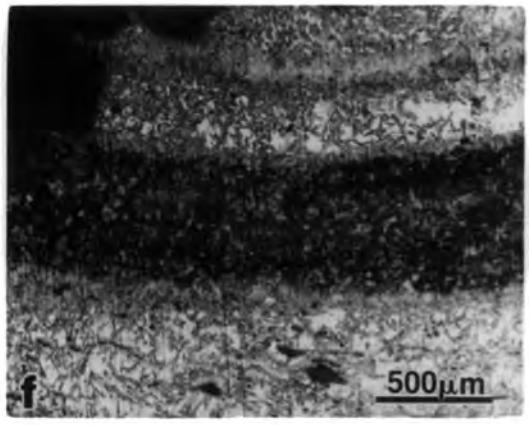
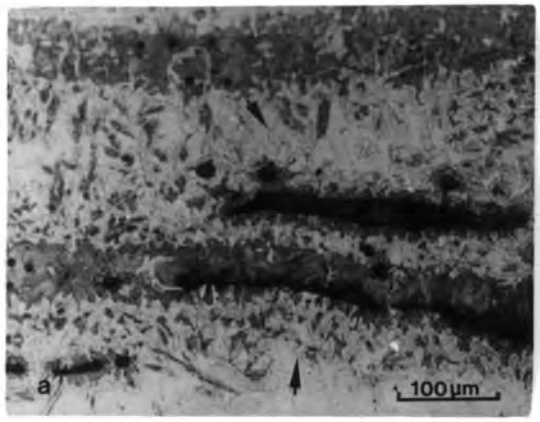
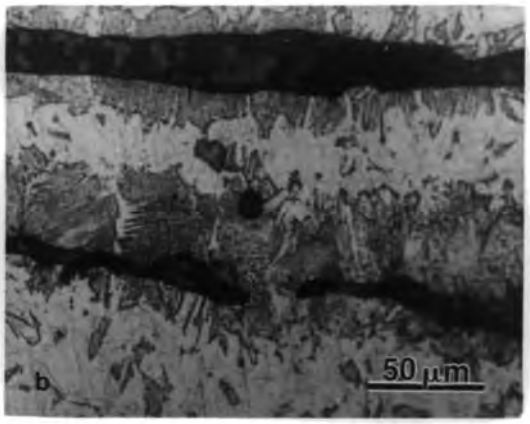
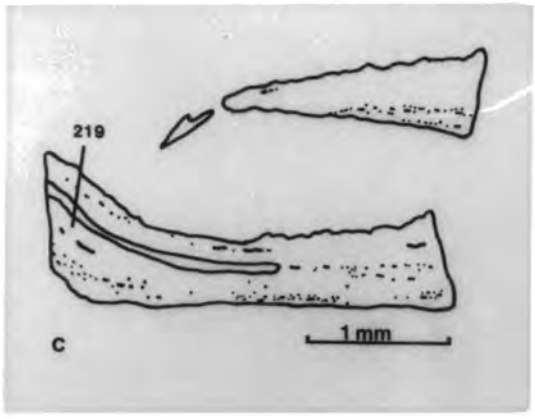
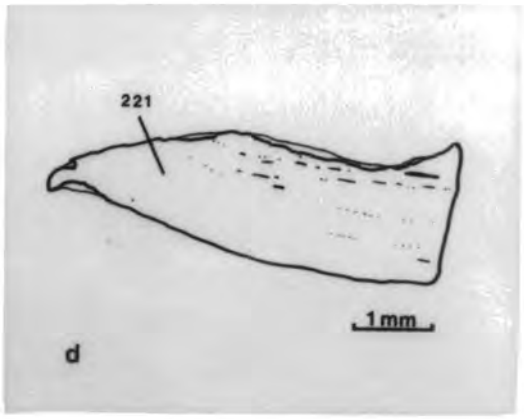


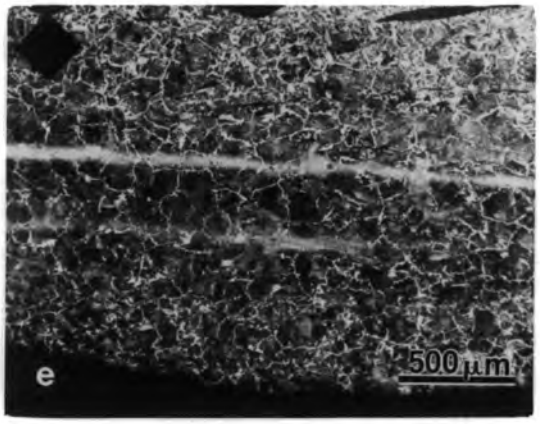
PLATE B29. Metallography of hot chisel/set No. 108 (S38) and cold set No. 113 (S39). (a) S38. Diagram of section: inclusion distribution and hardness (HV 0.2). (b) S38. Diagram showing relative carbon distribution. (c) S38. Carburized edge of section. (d) S39. Diagram of section: inclusion distribution. (e) S39. Diagram showing relative carbon distribution and hardness (HV 0.2). (f) S39. Part of section: central martensitic band (dark), low-carbon ferritic bands (pale).











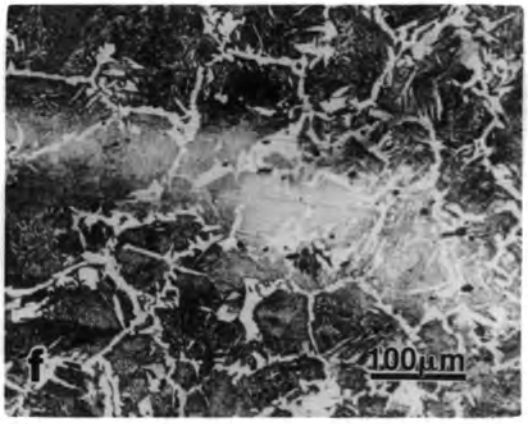


PLATE B30. Metallography of cold set No. 113 (S39), and hot chisels No. 95 (S40) and No. 91 (S41). (a) S39. Low-carbon band: ferrite (pale), ghosting (arrowed), light-etching constituent (grey), inclusion stringers. (b) S39. Detail of low-carbon region. (c) S40. Diagram of section: inclusion distribution and hardness (HV 0.2). (d) S41. Diagram of section: inclusion distribution and hardness (HV 0.2). (e) S41. Ferrite (white), pearlite (dark), weld lines. (f) S41. Weld line with inclusion particles.

the light-etching constituents in the outer ferritic regions. The hardness of the central martensitic band may indicate a low-medium carbon content.

Reference — Ehrenreich 1985, 199, 215, WD11a, fig. 3.9; Salter and Ehrenreich 1984, 157, fig. 10.9A.

S40☆ (Plate B30c) **HOT CHISEL, No. 95** Bigbury, Kent

Metal sample — LS through the cutting edge (Ehrenreich B6b). The sample was in 2 pieces; one fragment seems to have been inverted during mounting.

Unetched — Abundant, aligned, multi-phase and single-phase inclusion stringers and particles.

Etched [a] — Both fragments revealed ≈ equiaxed grains of ferrite, with a very small amount of grain-boundary pearlite and carbide. The carbon content was below 0.05%. Slight 'ghosting' effects were visible at one region.

Hardness — 219 HV 0.2. Grain size: ASTM 5.

Comments — The relatively high hardness and the 'ghosting' was presumably due to phosphorus (as determined by Ehrenreich 1985), and may also indicate work-hardening (though no deformed grains were seen). The chisel had been air-cooled.

Reference — Ehrenreich 1985, 125, 207, B6b.

S41☆ (Plate B30, d-f) **HOT CHISEL, No. 91** Hunsbury, Northants

Metal sample — LS, through the middle of the cutting edge (Ehrenreich HNY23b). The cutting edge of the chisel is on the left in Plate B30d.

Unetched — Aligned duplex inclusion stringers and fine particles.

Etched [a] — Across the section was fine pearlite and Widmanstätten ferrite; c. 0.4-0.6% C. There were two light-etching lines with associated inclusion particles at the centre of the section (Plate B30, e-f), the microstructure continuous beneath.

Hardness — 221 HV 0.2. Grain size: ASTM 4.

Comments — The alignments of inclusions and light-etching lines indicate welding (piling). The chisel had been air-cooled from the fully austenitized condition.

Reference — Ehrenreich 1985, 170, 212, HNY23b.

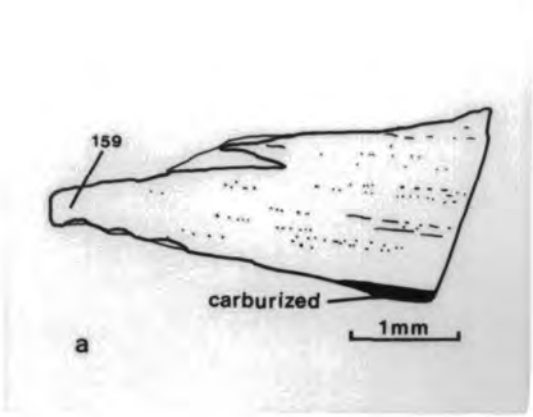
S42☆ (Plate B31, a-b) **HOT CHISEL, No. 94** Hunsbury, Northants

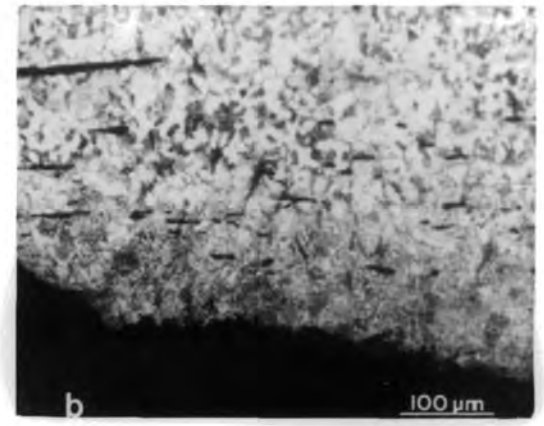
Metal sample — LS, at one side of the damaged cutting edge (Ehrenreich HNY18a). The cutting edge of the chisel is on the left in Plate B31a.

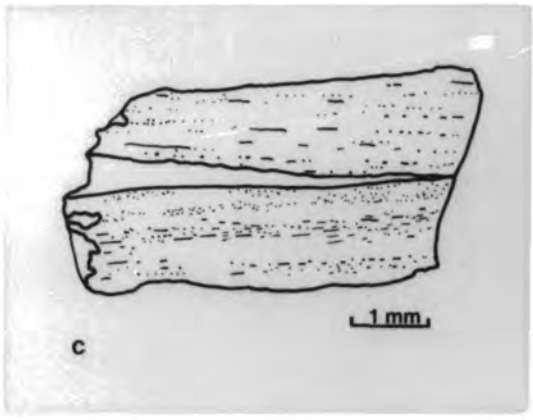
Unetched — Aligned, well-broken, duplex and ?glassy inclusions.

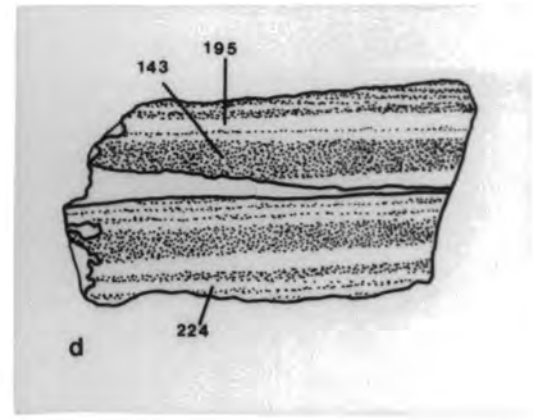
Etched [a] — Homogeneous structure of fine pearlite and ferrite; the carbon content c. 0.3%. At one side of the section (lower right-hand corner in Plate B31a) was a band of fine pearlite, where the carbon content was c. 0.7% (Plate B31b, lower half).

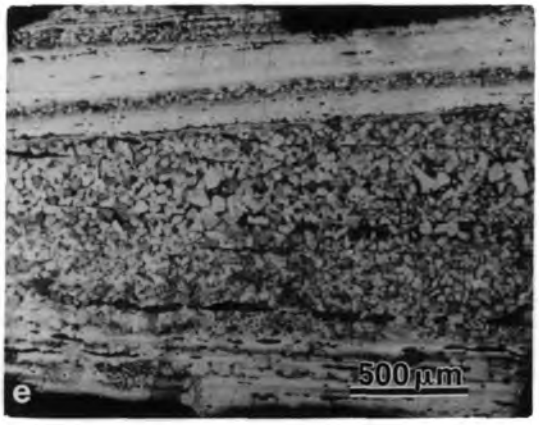
Hardness — 159 HV 0.2. Grain size: ASTM 7.











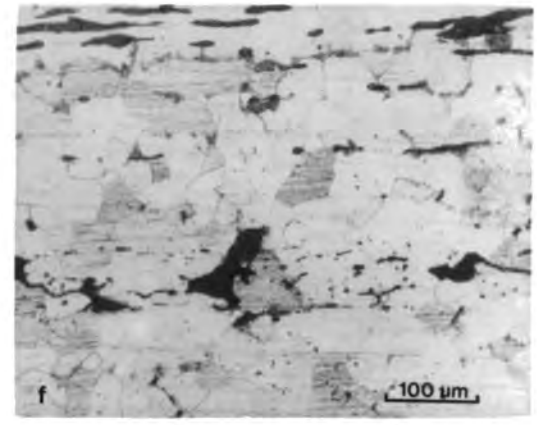


PLATE B31. Metallography of hot chisels No. 94 (S42) and No. 103 (S43).

(a) S42. Diagram of section: inclusion distribution and hardness (HV 0.2).

(b) S42. Carburized edge of section. (c) S43. Diagram of section: inclusion distribution.

(d) S43. Diagram showing relative carbon distribution and hardness (HV 0.2).

(e) S43. Banding. (f) S43. Centre of section: irregular inclusion (centre), stringers (top).

Comments — The small grain structure suggests grain refinement during hot forging. The area of high-carbon at the edge of the section may be the traces of surface carburization, but the sample (and the chisel) is too damaged by corrosion to be certain. The chisel had been finally air-cooled from the fully austenitized condition.

Reference — Ehrenreich 1985, 169, 212, HNY18a.

S43* (Plate B31, c-f) **HOT CHISEL, No. 103** Hunsbury, Northants

Metal sample — LS, through the corner of the cutting edge (Ehrenreich HNY10b). The cutting edge of the chisel is on the left in Plate B31, c-d.

Unetched — Abundant, aligned, multi-phase inclusions and fine particles. At the centre was a broad alignment of large, irregular, duplex inclusions (Plate B31f), and the section (and artifact) has split longitudinally along these lines.

Etched [a] — Much banded structure comprising ferrite, and fine pearlitic iron c. 0.1%C (Plate B 31e, lower right-hand corner of section). The bands were of variable widths; long etching times revealed numerous narrow light lines, either in the ferrite bands or associated with inclusions in the carburized bands. Equiaxed grains.

Hardness — Ferrite: 224 HV 0.2; 195 HV 0.2. Carburized bands: 143 HV 0.2.

Grain size — Ferrite: ASTM 2-4. Carburized bands: ASTM 5-7.

Comments — The much banded structure suggests considerable piling and welding during forging, though the iron remained heavily contaminated with slag and other inclusions. The chisel had been finally air-cooled from the fully austenitized condition.

Reference — Ehrenreich 1985, 166, 211, HNY10b.

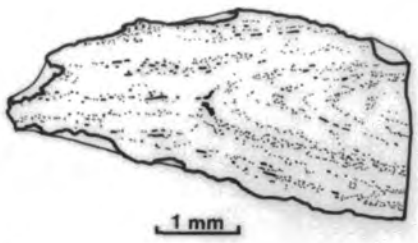
S44* (Plate B32) **HOT CHISEL, No. 100** Hunsbury, Northants

Metal sample — LS, through the middle of the cutting edge (Ehrenreich HNY21a). The cutting edge of the chisel is on the left in Plate B32, a-c.

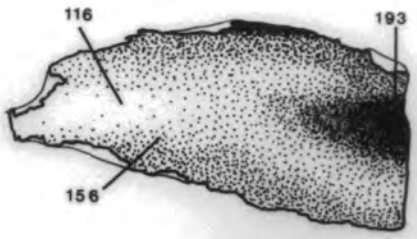
Unetched — Longitudinal alignments of abundant duplex inclusions, with curved alignments of well-broken stringers at the rear of the section.

Etched [a] — There was an even carbon gradation from zones of medium-carbon content which comprised large grains of very fine pearlite and Widmanstätten ferrite, through ferrite with grain-boundary carbide and pearlite, to ferrite alone (centre left, Plate B32b). The highest carbon concentration (c. 0.5%C) was at the rear of the section (Plate B32b, right), and at one edge (Plate B32b, top). The ferritic zones were associated with coarse slag stringers, whereas the carburized zones were associated with finer inclusions, particularly at the rear of the section. Long etching times revealed narrow light lines (Plate B32c) which followed the overall structure but were not directly associated with inclusions. Grains were equiaxed.

Hardness — Ferrite: 116 HV 0.2. Low-carbon: 156 HV 0.2. Medium-carbon (pearlite): 193 HV 0.2.

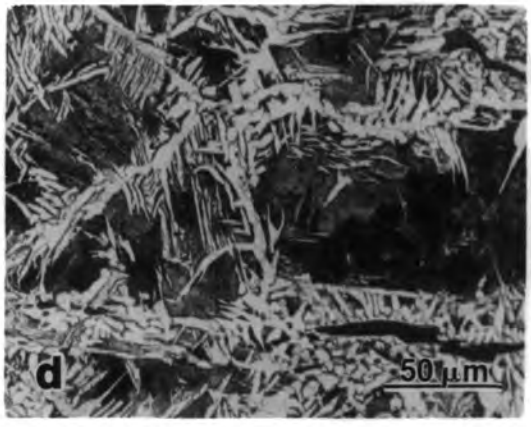


a



b

c



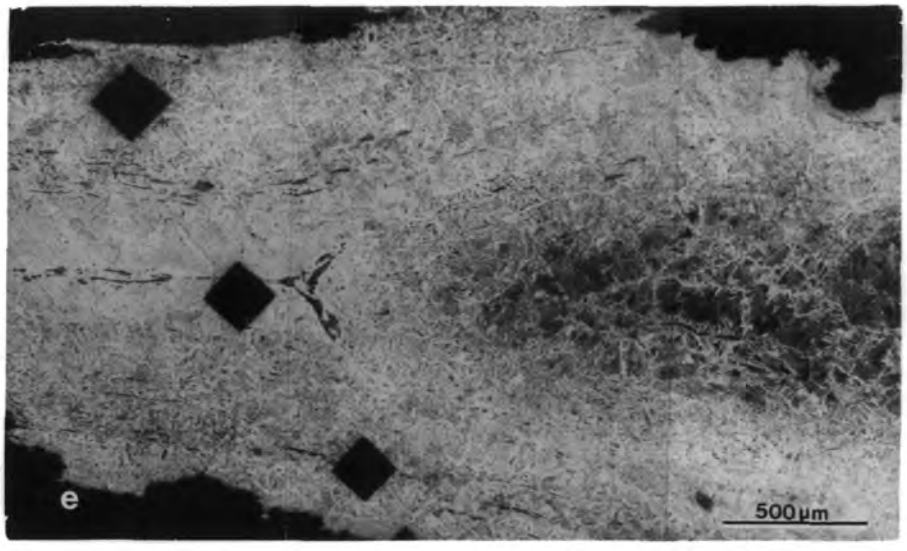


PLATE B32. Metallography of hot chisel No. 100 (S44).
(a) Diagram of section: inclusion distribution. (b) Diagram showing relative carbon distribution and hardness (HV 0.2). (c) Diagram showing light-etching lines.
(d) Rear of section (medium-carbon): pearlite (dark), Widmanstätten ferrite (white).
(e) Part of section (the hardness indents are from analysis by Ehrenreich 1985).

Grain size — Ferrite: ASTM 5. Low-carbon zone: ASTM 4-6. Medium-carbon zone: ASTM 2.

Comments — The alignments of inclusions, carbon variations, and light-etching lines suggests that a core of medium-carbon iron had been inserted between 2 outer pieces of low-carbon iron. Surface carburization is suggested by traces of enhanced carbon (c. 0.5%C) at one side of the section. Possibly the cutting edge of the chisel was made by welding-on outer strips of low-carbon iron and the whole was then surface carburized; corrosion (+ ?resharpening) has removed too much of the original metal to be certain. Since the 'core' of medium-carbon occurs well away from the cutting edge, it seems unlikely that this tool had been intentionally made with a welded-in steel component. The chisel was air-cooled from the fully austenitized condition.

Reference — Ehrenreich 1985, 170, 212, HNY21a.

S45* (Plate B33, a-d) **HOT CHISEL, No. 104** Hunsbury, Northants

Metal sample — LS, through one side of the cutting edge (Ehrenreich HNY55b). The cutting edge of the chisel is on the left in Plate B33, a-c.

Unetched — Aligned duplex inclusions.

Etched [a] — Two bands of low-carbon iron (c. 0.1%C), comprising ferrite and grain-boundary carbide, separated by 2 bands of medium-carbon content (c. 0.6%C) which comprised fine pearlite and Widmanstätten ferrite. Long etching times revealed 3 light lines with associated inclusion stringers, the microstructure continuous beneath.

Hardness — Low-carbon: 151 HV 0.2. Medium-carbon: 185 HV 0.2. Grain size: ASTM 5.

Comments — The banding and light-etching lines suggest that the chisel was piled from an unevenly carburized bloom; it was finally air-cooled.

Reference — Ehrenreich 1985, 181, 213, HNY55b.

S46 (Plate B33, e-f) **FILE, No. 135** Fiskerton, Lincs

Corrosion flake — Sampled from one side of the blade, near the broader end of the file fragment.

Unetched — Traces of spheroidized carbide, either well-dispersed within the corrosion matrix (Plate B33e), or tending to be grouped (Plate B33f).

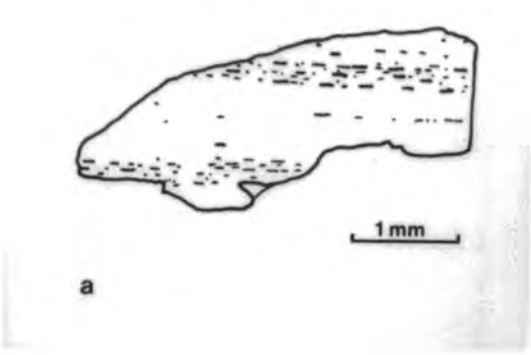
Comments — Low volume fractions of preserved carbides on their own can be misleading. The file may have been thoroughly annealed (and therefore of low hardness), or reheated after manufacture. No further conclusions can be drawn.

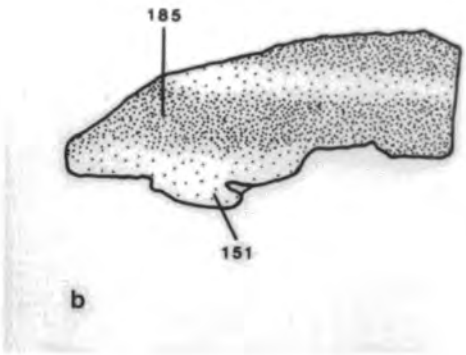
S47* (Plate B34) **FILE, No. 119** Hunsbury, Northants

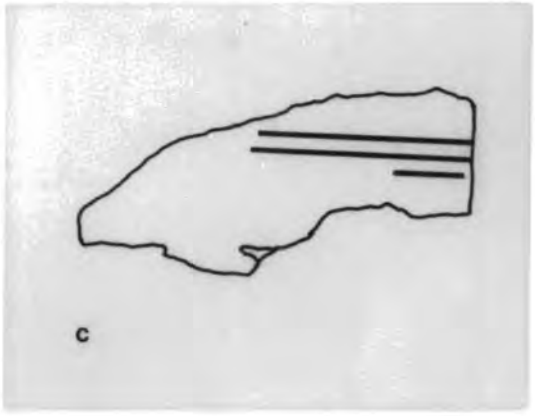
Metal sample — LS, through the tip of the blade (Ehrenreich HNY68a).

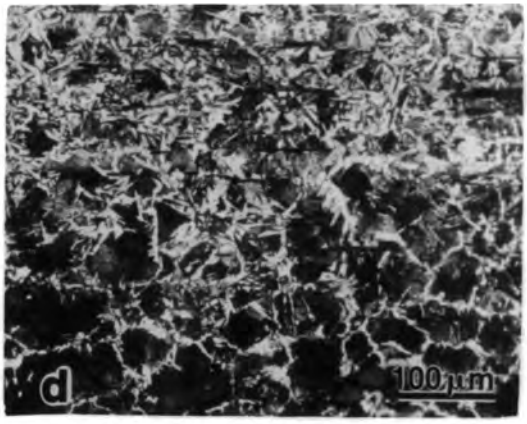
Unetched — Well-broken duplex stringers aligned diagonally across the section.

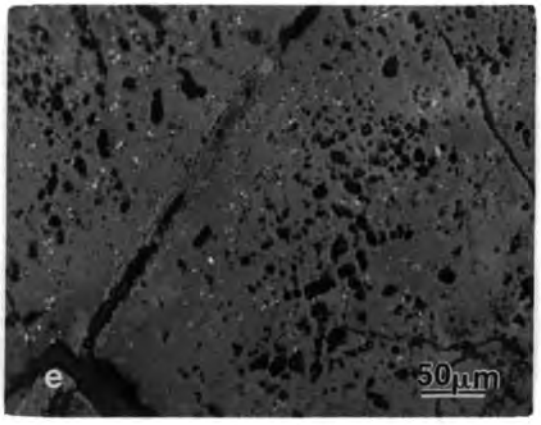
Etched [a] — The carbon content was c. 0.4 - 0.7%C, comprising very fine pearlite (some irresolvable) with Widmanstätten ferrite. There was some banding of the micro-











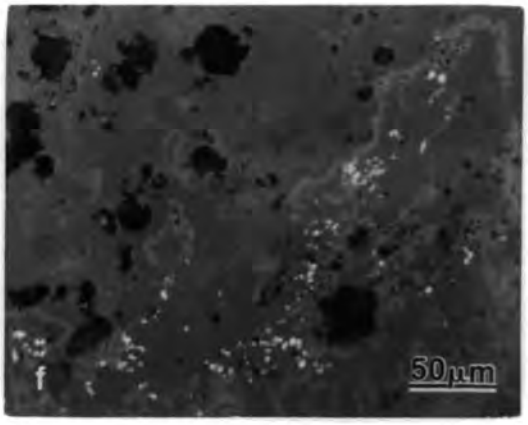
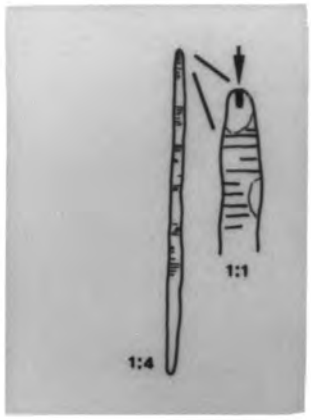
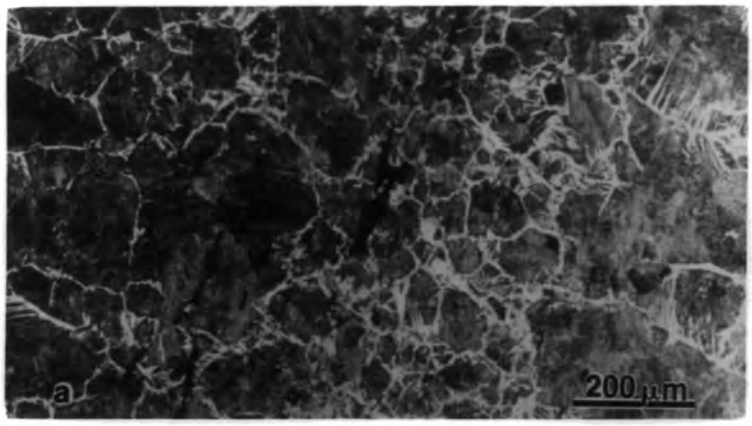


PLATE B33. Metallography of hot chisel No. 104 (S45) and file No. 135 (S46).
(a) S45. Diagram of section: inclusion distribution. (b) S45. Diagram showing relative carbon distribution and hardness (HV 0.2). (c) S45. Diagram showing light-etching lines. (d) S45. Pearlite (dark), Widmanstätten ferrite (white). (e) and (f) S46. Spheroidized carbides (white) within corrosion matrix.





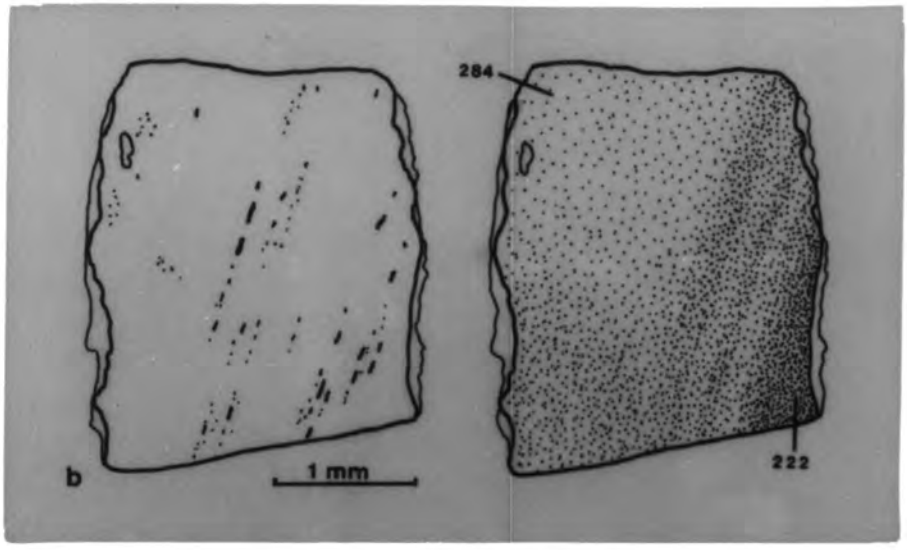


PLATE B34. Metallography of file No. 119 (S47).
(a) Pearlite and Widmanstätten ferrite. (b) Diagrams of section: left, inclusion distribution; right, relative pearlite distribution and hardness (HV 0.2).
(c) Detail of pearlite.

structure, which together with the variation in carbon content, seems to be related to the inclusion alignments.

Hardness — Pearlite: 222 HV 0.2, 284 HV 0.2. Grain size: ASTM 3-4.

Comments — The banding of microstructures and the inclusion alignments were probably effects of forging and piling. The file was finally rapidly air-cooled from the fully austenitized condition. The hardness was higher in the lower-carbon region; this may be due to the fineness of the pearlite in the grains which were analysed.

Reference — Ehrenreich 1985, 185, 214, HNY68a.

S48 (Plate B35) **FILE, No. 120** Meare Village East, Somerset

Metal sample — TS, c. mid-length (100mm from the point), incorporating part of the cut face and parts of 2 plain sides.

Unetched — Groups and lines of rounded duplex inclusions.

Etched [a, c] — Medium carbon content but unevenly carburized with some zoning of the microstructures. One half of the section (including the cut face of the file) revealed martensite, pearlite, and a very small amount of feathery grain-boundary ferrite, possibly bainite. The pearlite was nodular at grain-boundaries or was massed and irresolvable. At the other side of the section (Plate B45e), the carbon content was low, with ferrite (in excess), a spiky light-etching constituent which may have been martensite, and a dark-etching constituent, probably pearlite. A slight lathy appearance developed in the light-etching constituent with longer etching in nital, and with hot alkaline picral. Some of the dark-etching constituent had a feathery appearance at the edges, elsewhere it was more nodular, and some was associated with the light-etching constituent.

Hardness — Medium-carbon region: martensite 708 HV 0.2; 734 HV 0.5. Low-carbon region: all constituents 228 HV 0.2.

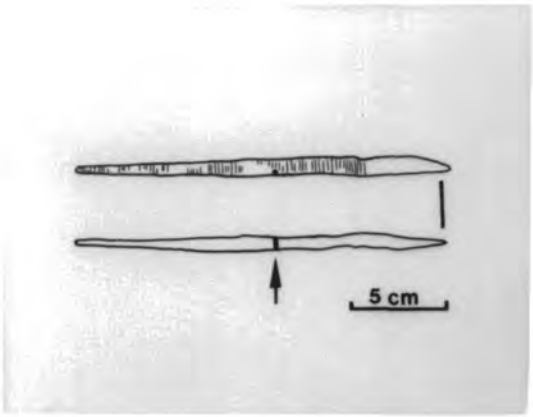
Grain size — High-carbon region: ASTM 3. Low-carbon region: ASTM 8.

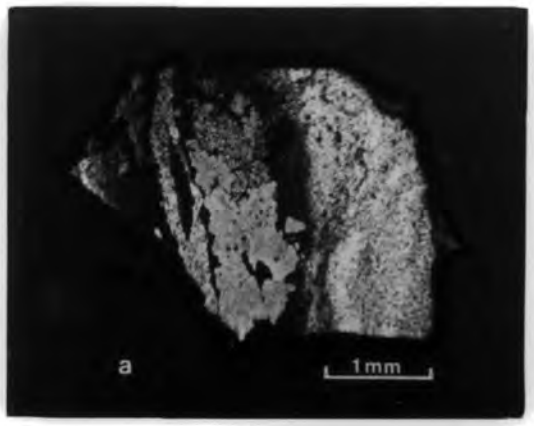
Comments — The zoning of the microstructures may be due to segregations arising during forging, due to, or resulting from, an uneven chemical composition and/or carbon content. It was probably accidental that the cut face was of higher carbon content. The medium-carbon region was fully austenitized during the final heating, whereas the spikiness in the low-carbon region suggests incomplete austenitization. The file was finally quenched.

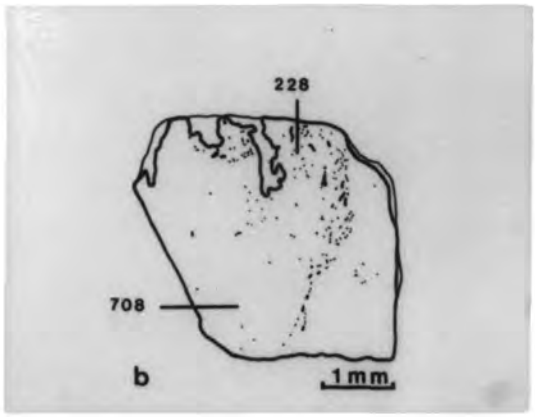
S49 (Plate B36) **FILE, No. 122** Weelsby Avenue, S. Humberside

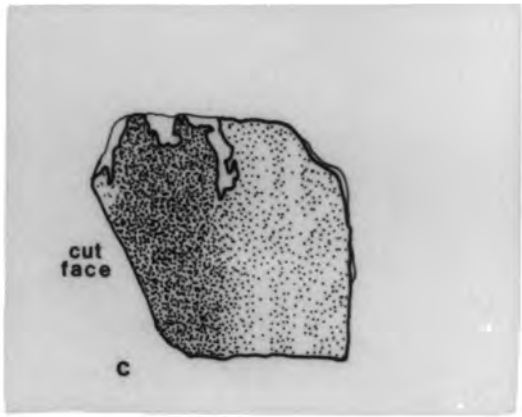
Metal sample — TS, 11-14mm from the first ridge, incorporating part of the cut face, an uncut side, and part of a second uncut face. Much corroded; some carbides survive.

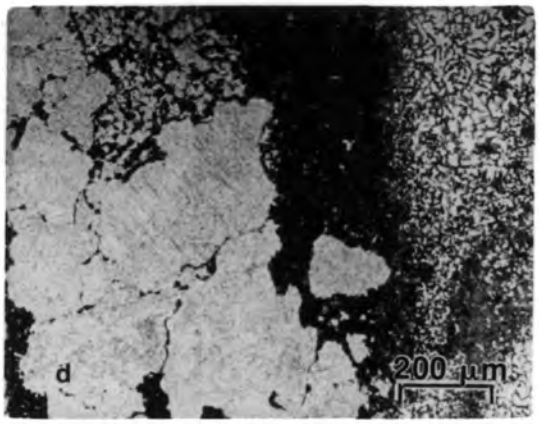
Unetched — Small amount of well-broken, two-phase and glassy inclusions, roughly aligned.











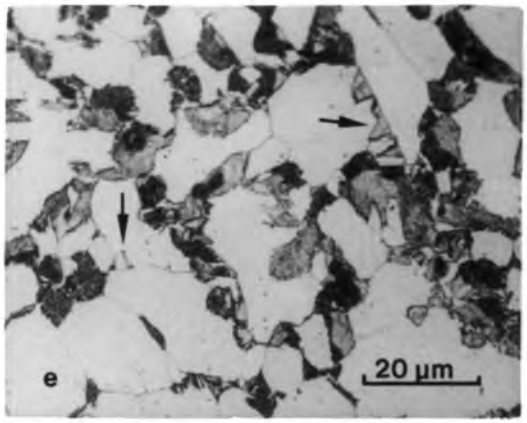
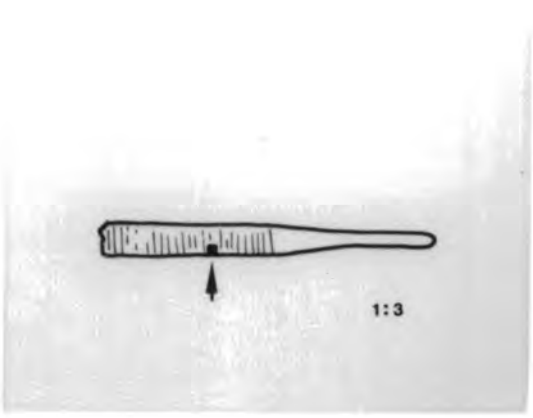
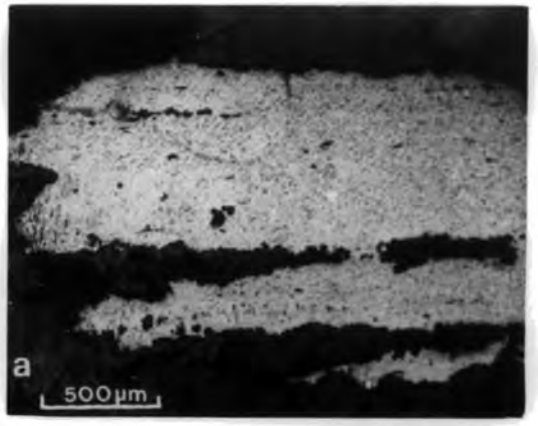
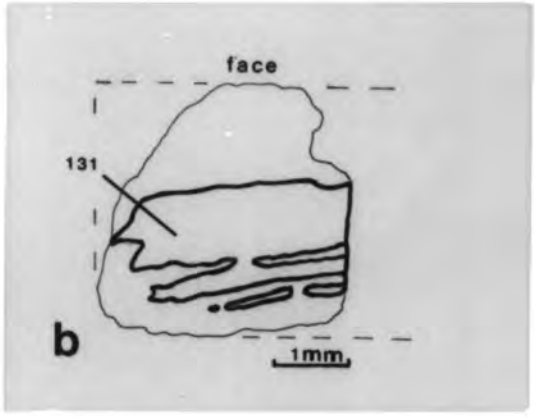
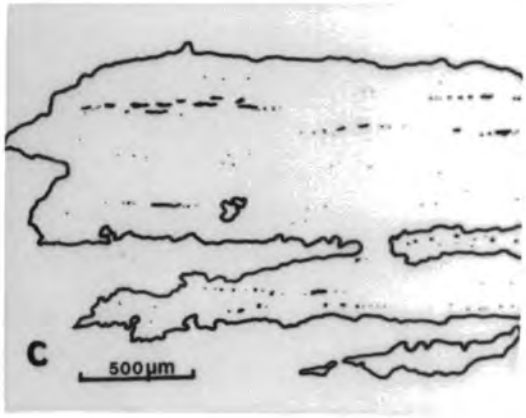


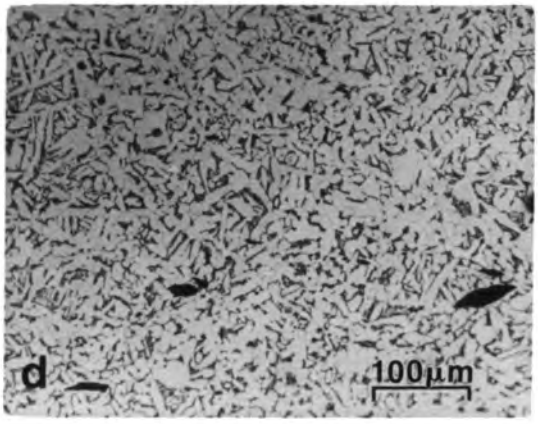
PLATE B35. Metallography of file No. 120 (S48).
(a) Whole section: low-carbon region at right. (b) Diagram of section: inclusion distribution and hardness (HV 0.2). (c) Diagram showing relative carbon distribution. (d) Centre of section: medium-carbon at left (martensite + pearlite), low-carbon at right (ferrite + pearlite). (e) Low-carbon region: ferrite (white), spiky ?martensite (pale grey, arrowed), irresolvable ?pearlite with feathery edges (dark).











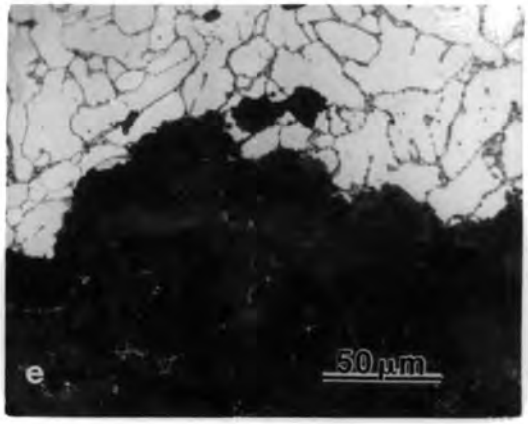


PLATE B36. Metallography of file No. 122 (S49).
(a) Whole section. (b) Diagram of section: hardness HV 0.2. (c) Diagram of section (excluding corroded layers): inclusion distribution. (d) Ferrite, grain-boundary carbide and pearlite. (e) Detail of microstructure at corrosion boundary. Upper: metal, lower: corrosion layer with carbides (white) within corrosion matrix (dark).

Etched [a] Very low carbon content, c. 0.05 - 0.1%, the structure comprising ferrite with grain-boundary carbide and pearlite. The ferrite had a Widmanstätten appearance.

Hardness Ferrite + carbide: 131 HV 0.2; 126 HV 0.5. Grain size: ASTM 7.

Comments The small grain size and homogeneous structure suggests that the metal had been well-worked. The file was air-cooled, probably rapidly from a elevated temperature and during the final forging of the file. Residual carbides in the corrosion layers extend close to the edge of the file and there was no indication of enhanced carburization towards the surface.

S50 **FILE, No. 124** Wetwang Slack, N. Humberside

Corrosion flake A loose flake was detached from the side of the file (adjacent to the ridges), 23mm from the shoulder.

Unetched A few small duplex inclusions.

Etched [a] A short etching time (5s) revealed (within the corrosion matrix) a group of about 10 small equiaxed grains comprising ferrite with a very small amount of grain-boundary carbide. The carbon content was negligible.

Hardness Ferrite: 159 HV 0.05

Comments Grain-boundary carbide is commonly seen in low-carbon irons where there is insufficient carbon to form pearlite. The file was most probably air-cooled.

S51 (Plate B37) **FILE, No. 126** Gussage All Saints, Dorset

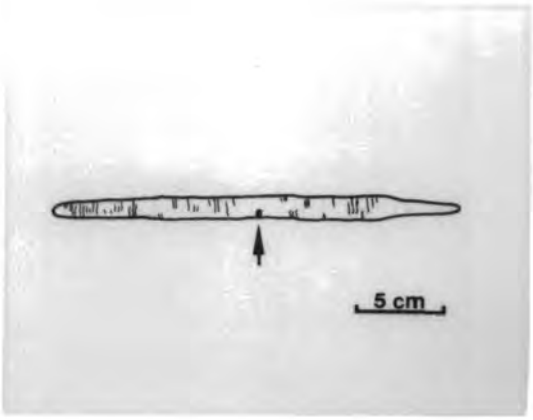
Metal sample TS, 71mm from the point, incorporating parts of both cut faces and one plain face.

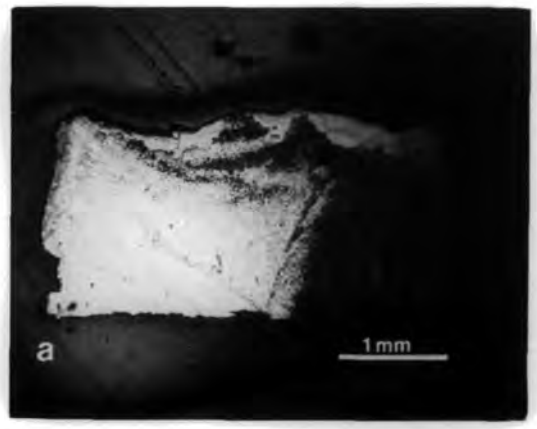
Unetched Several alignments of small multi-phase inclusions.

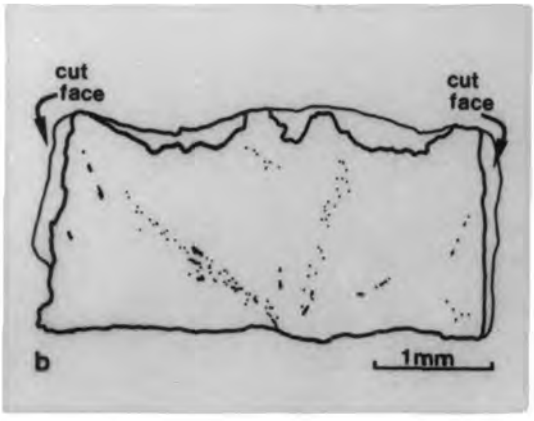
Etched [a, a+b] One half of the section was martensitic apart from one corner where there was a small amount of ferrite (bottom right in Plate B37, a-c). Within the martensite there were a few short quench or corrosion cracks. The other half of the section revealed zones of martensite with a small amount of ferrite, alternating with zones of martensite and ferrite in roughly equal proportions. The inclusion alignments were associated with the regions of higher martensite content. The ferrite was generally Widmanstätten-like although some was more rounded, and there were some intragranular ferrite plates. There was a small amount of an irresolvable transformation product (?pearlite) outlining some of the martensite grains, particularly at the centre of the section adjacent to the wholly martensitic region (Plate B37e, arrowed).

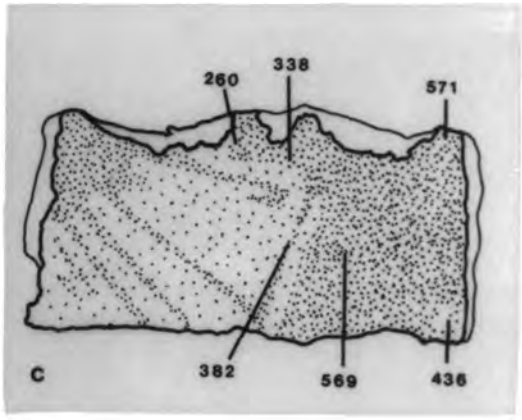
Hardness Martensite: 569, 571 HV 0.2; 613 HV 5. Martensite + ferrite: 260, 338, 382, and 436 HV 0.2. Grain size: ASTM 7.

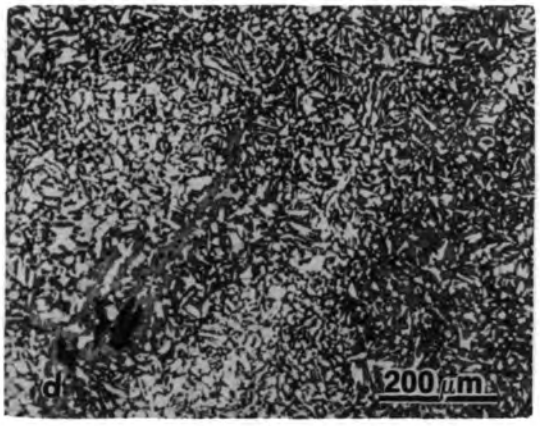
Comments The file was forged from unevenly carburized iron, the moderate hardness of the martensite suggesting a medium carbon content; the range c. 0.2 - 0.5%C. It was











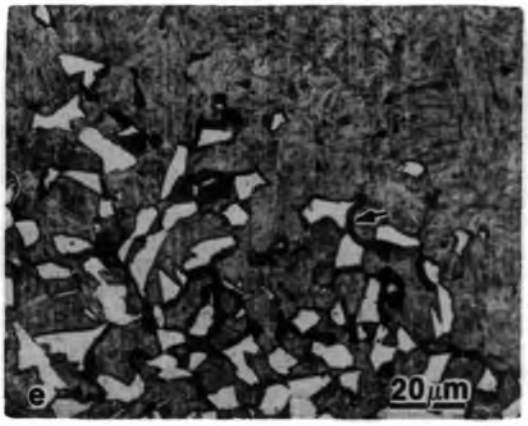


PLATE B37. Metallography of file No. 126 (S51).

(a) Whole section. (b) Diagram of section: inclusion distribution.

(c) Diagram showing relative martensite concentration and hardness (HV 0.2).

(d) Centre of section: ferrite (white), martensite (grey), multi-phase slag inclusion.

(e) Top: martensite zone; lower: ferrite and martensite, with irresolvable ?pearlite (dark).

severely quenched from about the A_3 temperature, and was probably incompletely austenitized in the lower carbon regions. Localised chemical variation, as well as carbon distribution, may have contributed to the zoning of the microstructures.

Reference Fell 1985, 177.

S52 (Plate B38) **FILE, No. 130** Glastonbury, Somerset

Metal sample TS, 15mm from the point of the blade, incorporating parts of 3 cut faces. The file was much corroded, thus the sample is representative of metal from the centre of the metal forming the blade. The sample is now almost polished out.

Unetched A very small amount of well-rounded single-phase inclusions.

Etched [a] Evenly distributed martensite and ferrite in roughly equal proportions, with a small amount of irresolvable pearlite (arrowed in Plate B38, c-d) at the edge of some of the martensite. There was a narrow band of ferrite at one side of the section (top in Plate B38a). The martensite had a lath-like structure (Plate B38d) and some was angular or spiky at the phase boundaries (more visible at low etch, Plate B38c). The carbon content was less than 0.3%.

Hardness Martensite: 337 HV 0.1; martensite + ferrite 144 HV 0.2.

Grain size Very small; not possible to determine ASTM value.

Comments The file had been quenched; the spikiness of the martensite suggests incomplete austenitization. The lath structure of the martensite may indicate that the carbon-concentration was moderate within the locally formed austenite (i.e. the austenite which transformed to martensite).

S53 (Plate B39) **FILE, No. 132** Ham Hill, Somerset

Metal sample LS. A transverse sample was taken, though mounted as a longitudinal section.

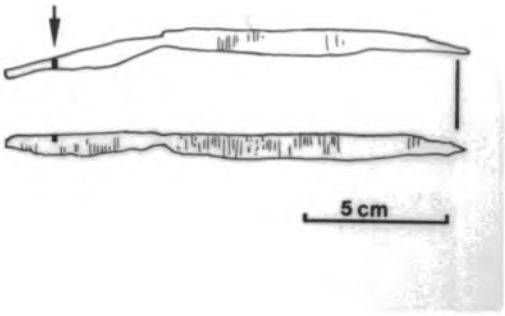
Unetched Many small glassy inclusions which were aligned and grouped; some were angular, others elongated and rounded.

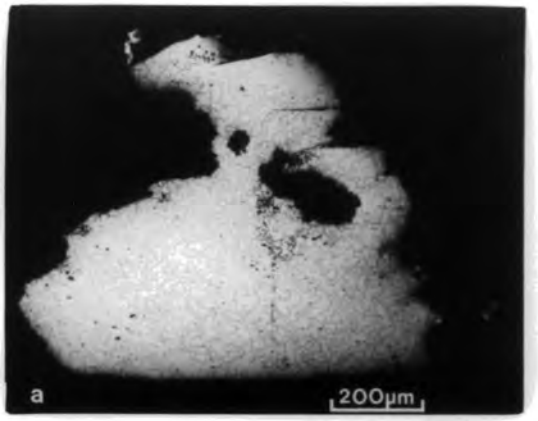
Etched [a] The structure comprised zones of martensite, and zones of martensite with ferrite. In the latter, the martensite was angular or slightly spiky, and some of the martensite had fuzzy edges where it was adjacent to ferrite, possibly therefore a transition martensite/pearlite transformation product (visible in Plate B39c). The carbon content was low, c. 0.3% maximum.

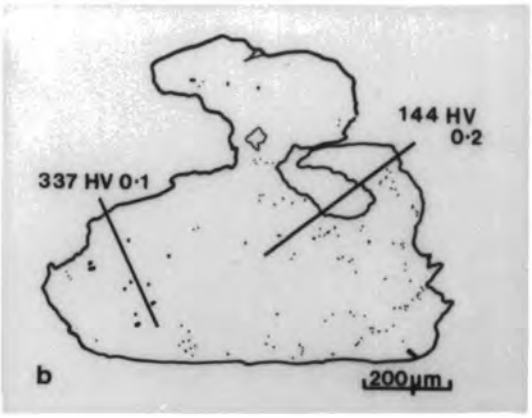
Hardness Martensite: FACE I, 462 HV 0.2; FACE 2, 255 HV 0.2.

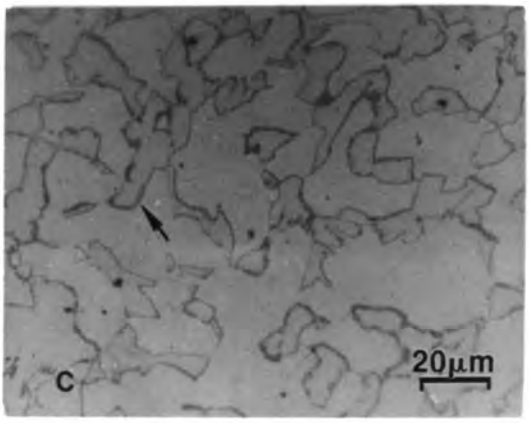
Grain size Very small; not possible to determine ASTM value.

Comments The file was severely quenched; the angularity of the martensite suggests incomplete austenitization.









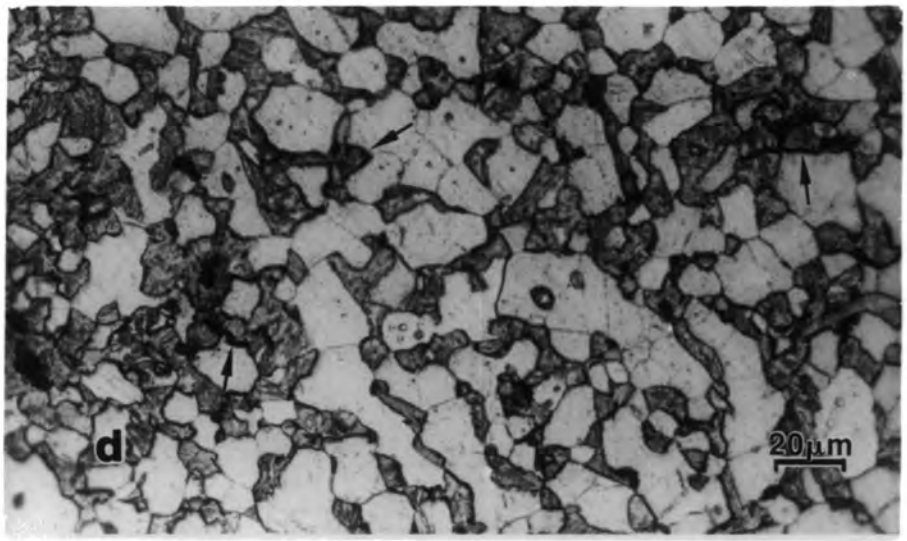
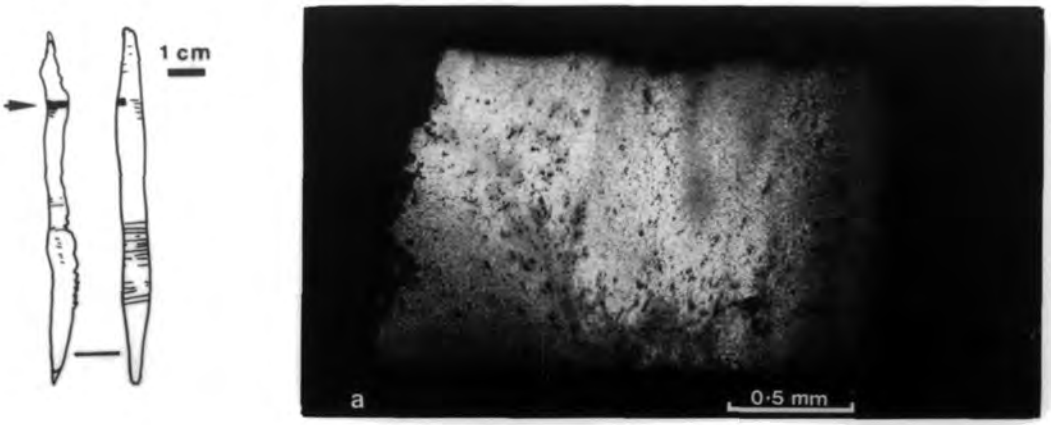
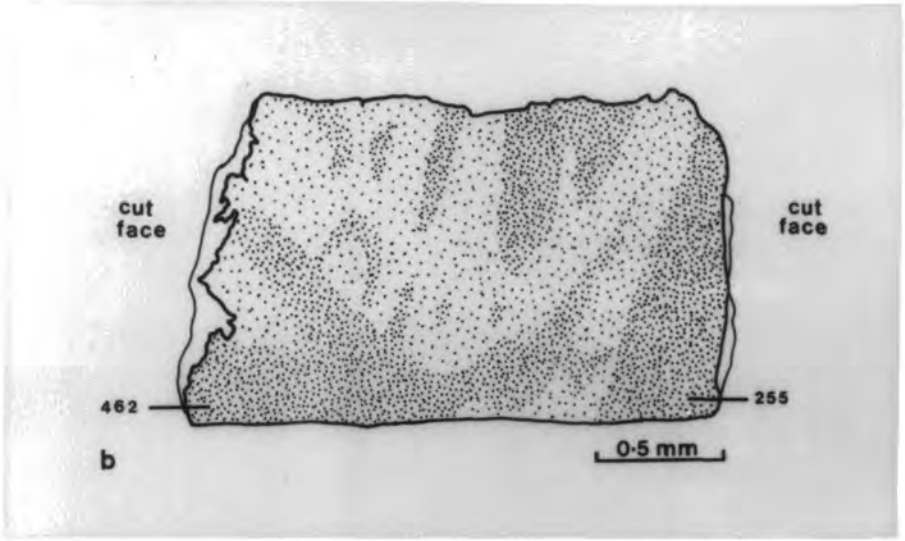


PLATE B38. Metallography of file No. 130 (S52).
(a) Whole section: the 3 cut faces are at the top and sides. (b) Diagram of section: inclusion distribution and hardness. (c) Centre of section, short etch.
(d) Long etch, the martensite now with a lath structure.





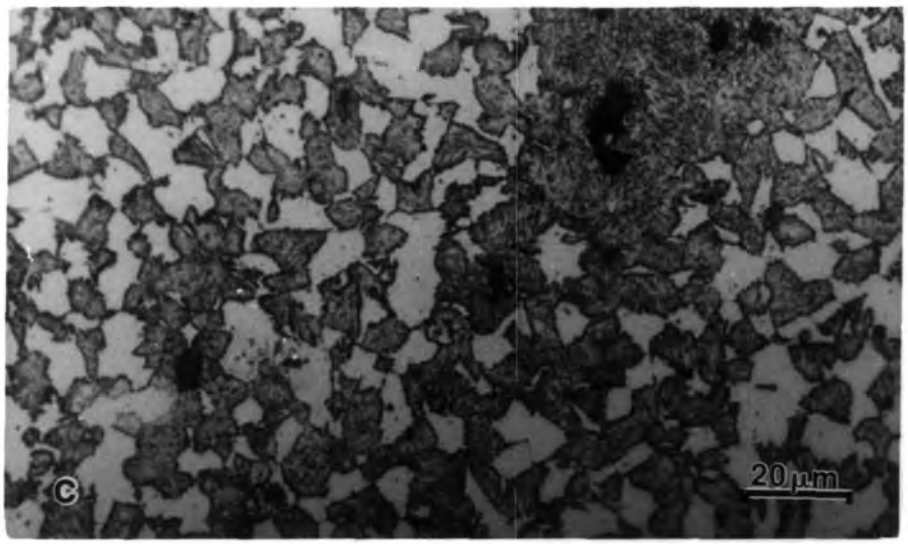


PLATE B39. Metallography of file No. 132 (S53).

(a) Whole section showing inclusion distribution and zoning of micro-structure.

(b) Diagram of section: relative martensite distribution and hardness (HV 0.2).

(c) Centre of section: ferrite and martensite.

S54 (Plates B40 and B41) **FILE, No. 133** Glastonbury, Somerset

Metal sample TS, 45mm from the tip of the tang, incorporating parts of 3 cut faces. The file was much corroded, thus the sample represents metal from within the blade.

Unetched A small number of inclusions, visible as tiny rounded particles, and some large and angular, dendritic duplex inclusions.

Etched [a] There was a carbon gradation from less than 0.1%C to low-medium carbon (at one edge of the section). The latter comprised martensite (Plate B40c), grain-boundary nodular pearlite, and a small amount of feathery grain-boundary ferrite, possibly bainite. Some of the pearlite was feathery at the edges (visible in Plate B40, d-e); in other areas transformation products were irresolvable at magnifications up to X1000, and were lighter etching. At the low-carbon region the ferrite was roughly polygonal and showed some veining (arrowed in Plate B40d).

SEM At the low-carbon region, the microstructure was partly resolved into continuous parallel orientations, suggesting lamellae of cementite (i.e. pearlite). Plate B41a shows the orientated microstructure; Plate B41b shows also carbide (arrowed) growing out from the grain-boundary into adjacent ferrite (i.e. the featheriness visible under optical microscopy).

Hardness Higher carbon region: martensite at edge of section 680 HV 0.5. Low-carbon region: ferrite + pearlite 190 HV 0.2; ferrite 160 HV 0.2.

Grain size Higher-carbon region: ASTM ?4; low-carbon region ASTM 7.

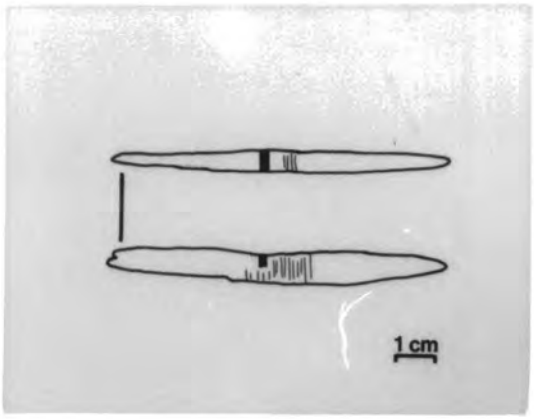
Comments The hardness at the higher-carbon region suggests a medium-carbon content. At the low-carbon region, the transformation products appear to largely comprise pearlite, though other constituents such as martensite and bainite may also be present. The file was quenched, probably from the partly austenitized condition.

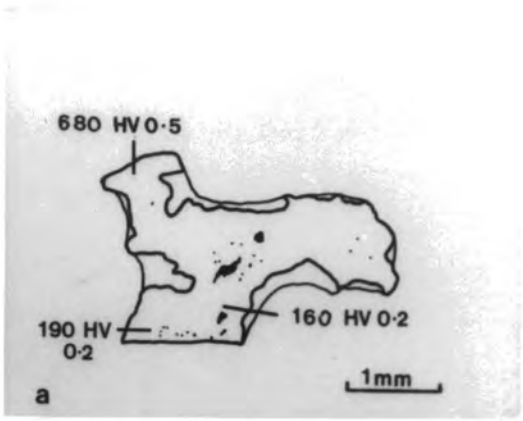
S55 (Plate B42) **FILE, No. 142** Fiskerton, Lincs

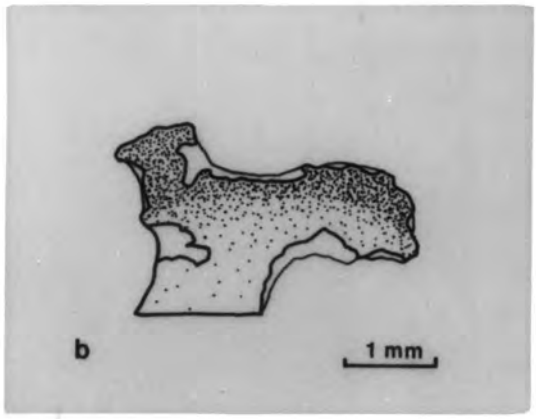
Metal sample Metal survived only at the tang end of the file (Plate IVa); a TS was removed from the most substantial position, 3mm from the tang junction (2nd ridge), incorporating a cut face (top in Plate B42, b-c) and parts of 2 plain faces (left and right in Plate B 42, b-c).

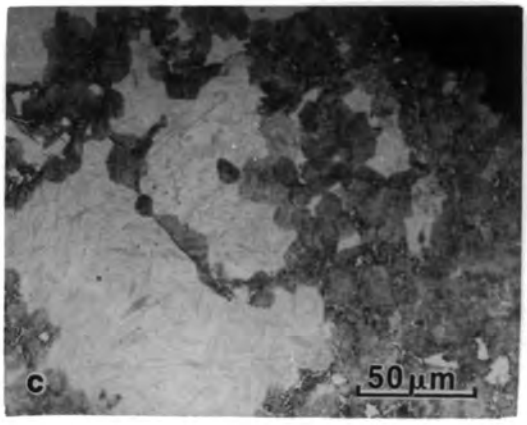
Unetched There were many angular multi-phased inclusions aligned at one corner of the section (apex in Plate B42b), elsewhere as single or grouped particles. Spheroidized carbides survived in the corrosion products.

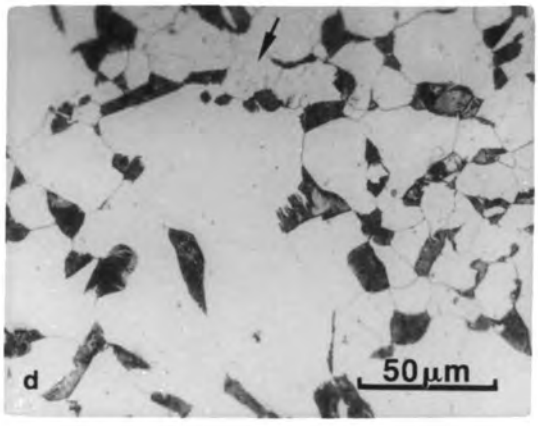
Etched [a] The section comprised zones of phosphoric ferrite and zones of spheroidized carbides. Ferrite was large-grained especially at the centre of the section, and revealed sub-grain strain lines and 'ghosting'. The carbides were either massed or were concentrated at grain-boundaries. At one corner of the section (lower right, Plate B42b), the carbide concentration was high and the grain size very small.











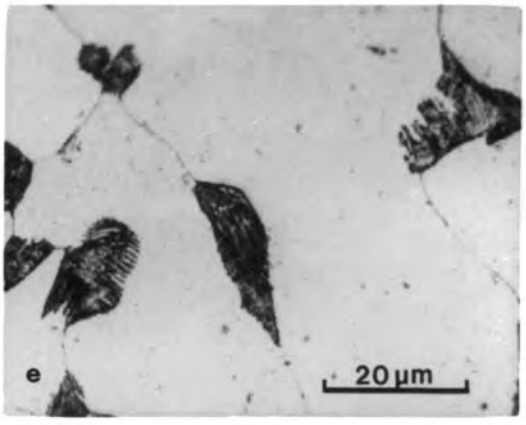
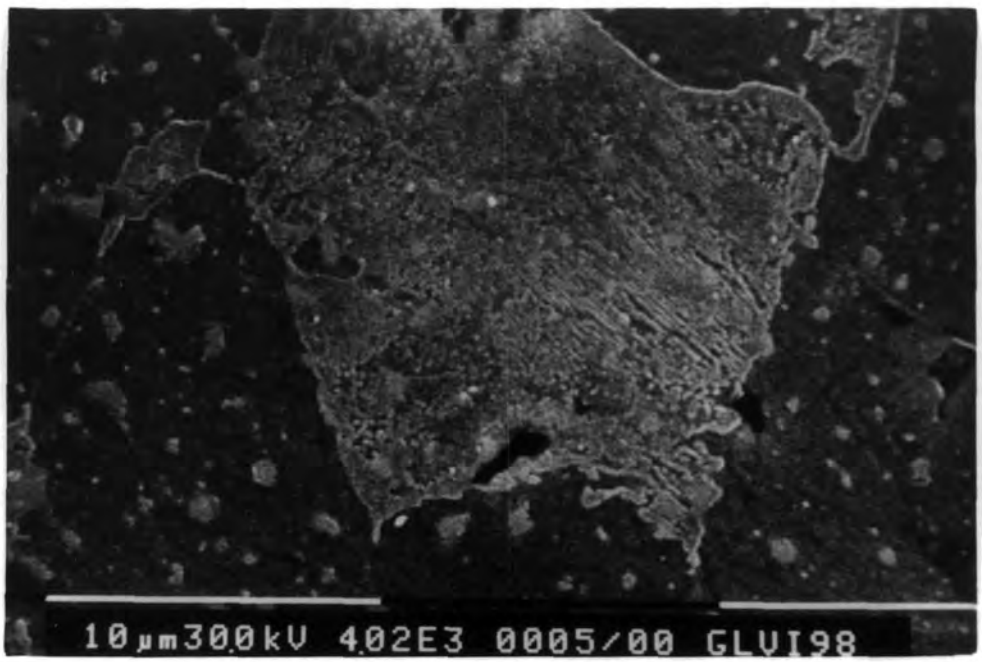


PLATE B40. Metallography of file No. 133 (S54).
(a) Diagram of section: inclusion distribution and hardness, cut faces of the file at top, left, and right. (b) Diagram showing relative carbon distribution. (c) Higher carbon region at edge of section. (d) Low-carbon region. (e) Detail of low-carbon region showing feathery pearlite.



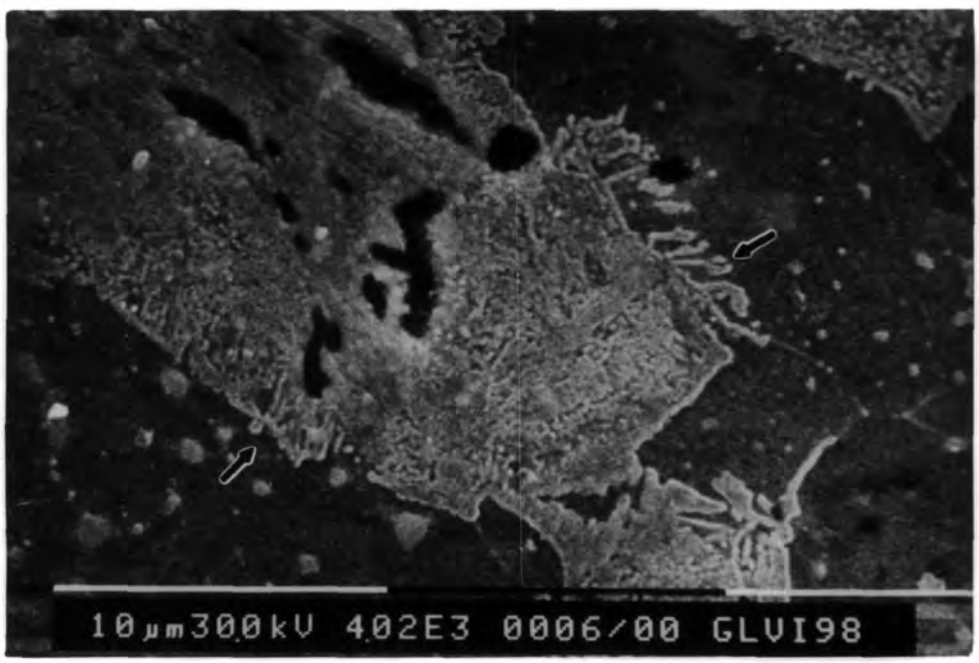
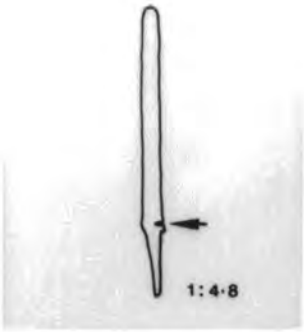
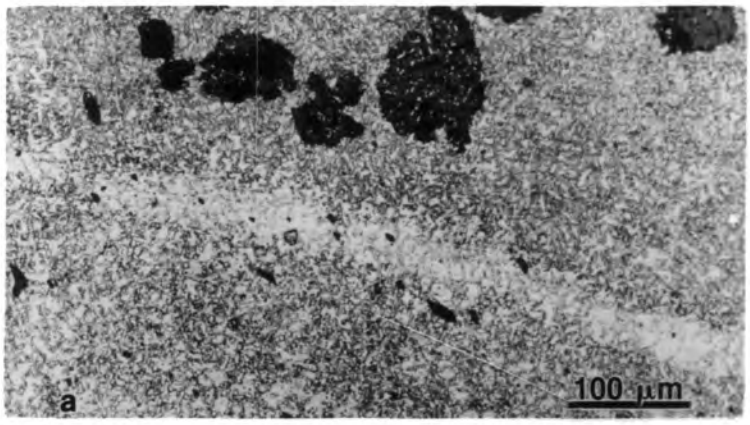
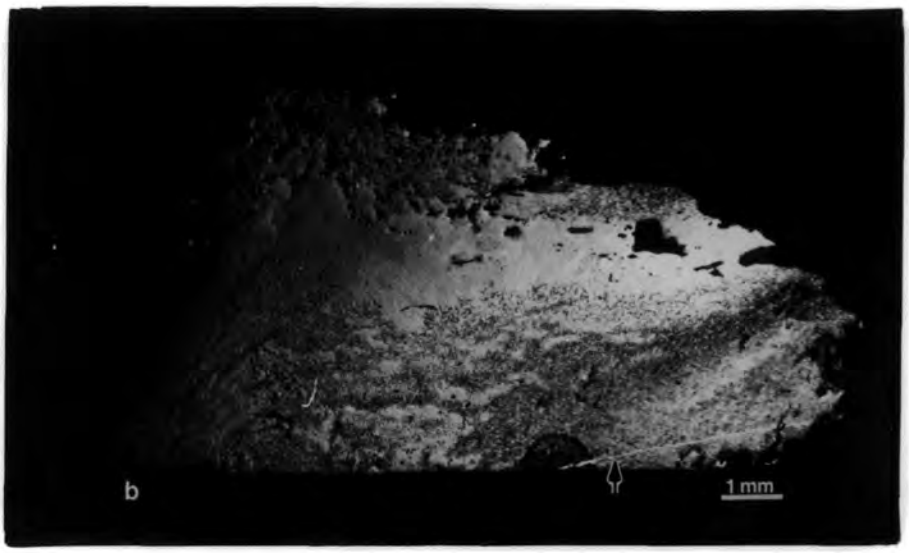


PLATE B41. Metallography of file No. 133 (S54).
SEM micrographs at low-carbon region: fine lamellar pearlite (centre, the carbide is white) within ferrite (dark). (a) Parallel orientations of carbide (white). b) Carbide fingers growing from the grain boundary into adjacent ferrite.







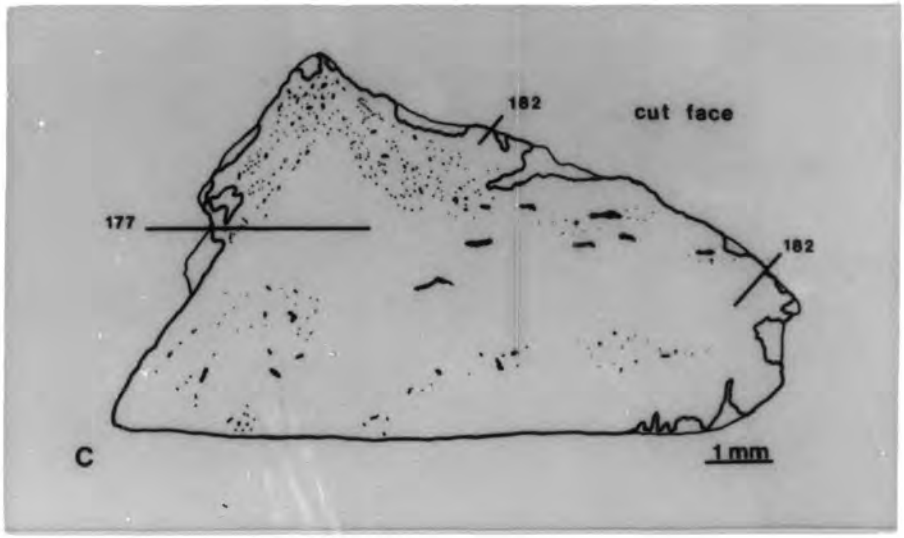


PLATE B42. Metallography of file No. 142 (S55).

(a) High-carbon region: spheroidized carbides, light-etching band running across the section.

(b) Whole section: ferrite (white), carbide zones (dark), light-etching band (arrowed).

(c) Diagram of section: inclusion distribution and hardness (HV 1).

A narrow light-etching band was visible across this corner of the section (Plate B42a, and arrowed in b). Grains were equiaxed.

Hardness — Ferrite: at centre 210 HV 0.2; 177 HV 1; at face 180 HV 1. High-carbon zone: 197 HV 0.2, 182 HV 1.

Grain size — Ferrite: at centre ASTM 2, elsewhere ASTM 4-5. Carburized zones: ASTM 5-8.

SEM-EDXA — Phosphorus was detected in the central large ferrite grains whereas none was detected in the high-carbon region.

Comments — The section revealed an heterogeneous structure, in carburization, grain size, and inclusion content. Phosphorus could account for the relatively high hardness in the ferrite (equal to that in the carburized regions), as well as the carbide segregations. The heterogeneity in structure had probably resulted from forging of a carburized bloom containing phosphorus. The spheroidization of the carbide may be due to hot-working, but equally, the file may have been reheated to a moderately high temperature causing the former microstructure to spheroidize.

S56 (Plates B43 and B44a) **FILE, No. 147** Glastonbury, Somerset

Metal sample — TS, 14-15mm from the point of the blade, incorporating part of the cut convex side and part of the cut flat side.

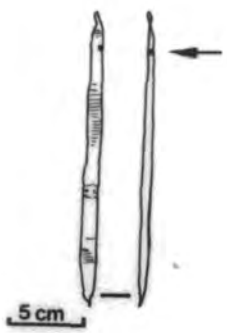
Unetched — Many small, rounded, two-phase inclusions grouped or aligned in curved bands.

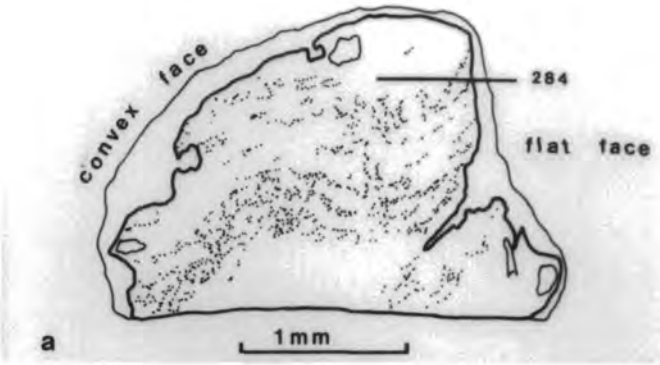
Etched [a, c] — Evenly carburized across the section but of low-carbon content, probably below 0.3%C. The microstructure comprised ferrite and irresolvable transformation products. One constituent was light-etching, angular or slightly acicular, and developed a lathy appearance with long etching times in nital, and in picral. At some of the phase boundaries of this constituent there was a darker-etching constituent (arrowed in Plate B43, b-c). At the centre of the section, the ferrite grains revealed many sub-grain boundaries (veining), whereas at the edges of the section, the ferrite grains were less strained and more rounded. A proportion of the ferrite was present as small rounded pools (marked F in Plate B43c) - probably ferrite which had not been austenitized during the final heating cycle.

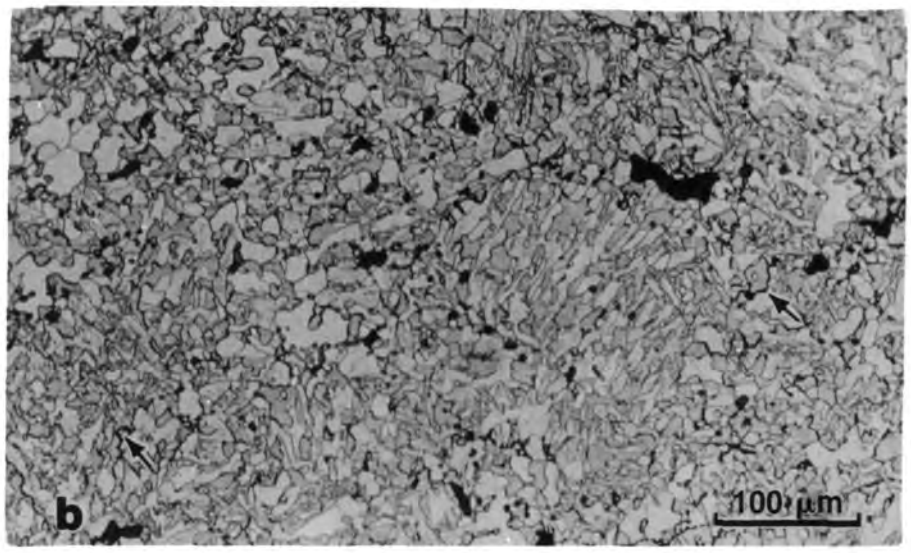
SEM — Very little structure was discernible in the transformation products, except for a few small areas which appeared to be lamellar (Plate B44, a, top centre), and a few lamellar growths into the adjacent ferrite (Plate B44, a, arrowed). Sub-grain boundaries in the ferrite were clearly visible (some circled).

Hardness — All constituents: 284 HV 0.2; 297 HV 1. Grain size: ASTM 8.

Comments — The lathy appearance of the lighter-etching constituent suggests that this was martensite. The darker-etching constituent was probably pearlite. It seems likely that the heating cycle was complex, the final forging and the final heating both within the A_1-A_3 range. The veining in the ferrite suggests hot-forging in the A_1-







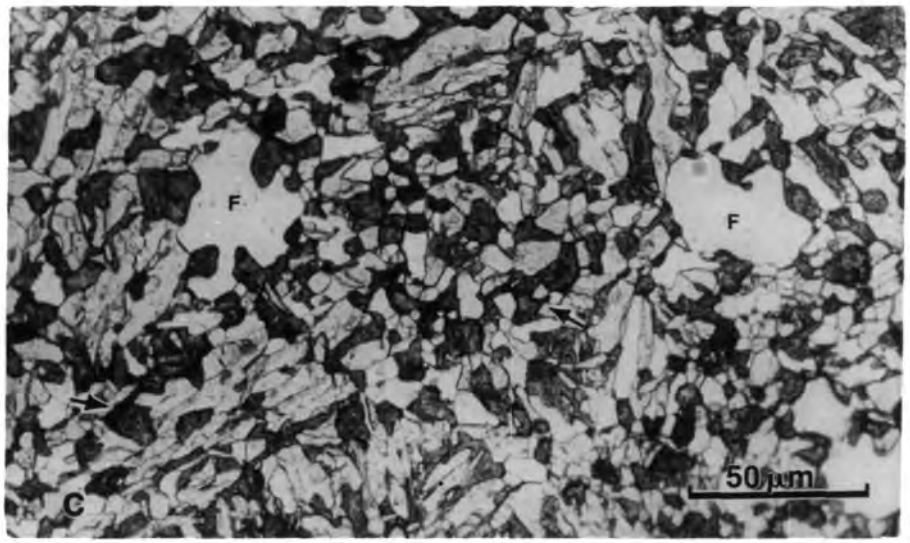
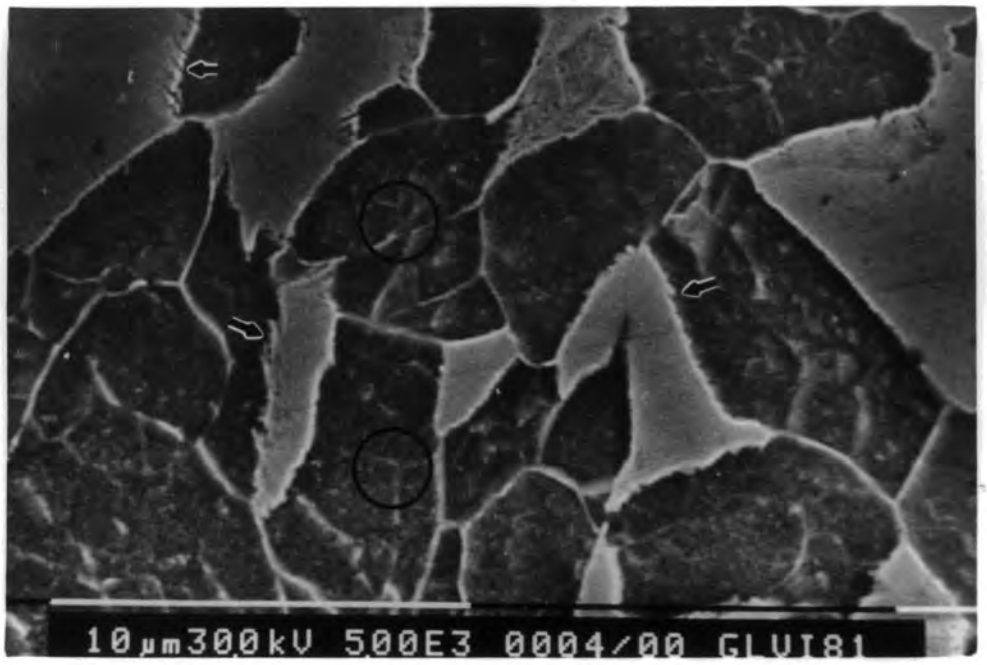


PLATE B43. Metallography of file No. 147 (S56).
(a) Diagram of section: inclusion distribution and hardness (HV 0.2). (b) Centre, short etch. Ferrite (white), ?martensite (pale grey) with ?pearlite at edges (some arrowed), and large dark inclusions. (c) Detail, long etch. The stressed ferrite grains are here grey, the ?martensite is darker grey and lathy, undissolved ferrite is white (marked F).



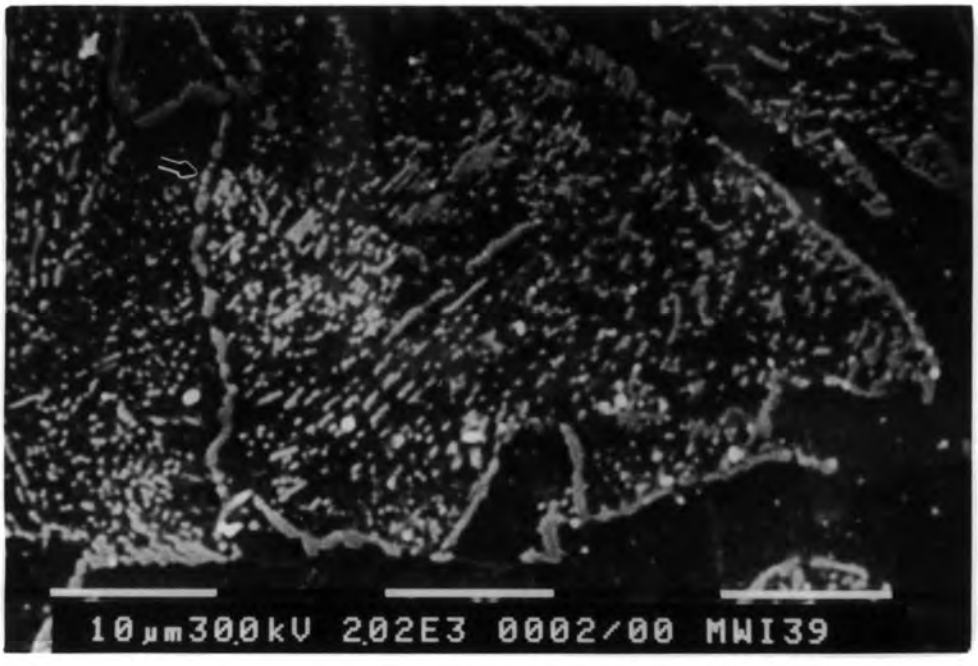


PLATE B44. Metallography of files No. 147 (S56) and No. 150 (S58). SEM micrographs. (a) S56. High-temperature transformation products (light), ferrite (dark) with veining (white lines). (b) S58. Acicular ferrite (dark plain zones), and cementite (white) -- visible as free (grain-boundary) cementite and degenerate (pearlite) cementite.

A_3 range, which possibly occurred during a heating cycle prior to the final heating to quench. Moreover, a previous heating had also been below the A_3 temperature. The rounded ferrite grains at the edges of the section compared with those at the centre suggests that at some stage the outer grains were heated sufficiently to become annealed. The file was finally quenched but its low carbon content resulted in a partially martensitic structure of low overall hardness.

S57 (Plate B45) **FILE, No. 148** Meare Village West, Somerset

Metal sample — TS, 50mm from the tip of the blade, incorporating part of the convex side and part of the flat side.

Unetched — Many single-phased and duplex inclusions, some aligned in curved narrow bands; the majority were small, but one alignment comprised larger angular inclusions.

Etched [a] — Martensite was in excess; some regions were wholly martensitic, and here the martensite was lath-like and etched rapidly. At some of the martensite grain-boundaries was nodular pearlite and a small amount of feathery ferrite, probably bainite (Plate B45d). A few areas of the section comprised ferrite with a range of transformation products which were acicular and only partly resolvable, but may include martensite, pearlite (some of which had a feathery appearance at the edges - arrowed in Plate B45e), or other transformation products. Light-etching, arced segregation lines (visible in Plate B45a), were present towards the centre of the section, and fine inclusion particles were orientated along these lines. The carbon content was low to medium.

Hardness — Martensite: at convex face 663 HV 0.2; 642 HV 0.5; at flat face 467 HV 0.5.

Grain size — Mostly c. ASTM 5.

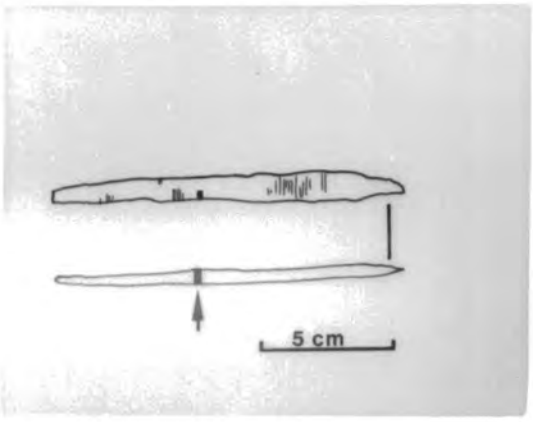
Comments — The file was quenched from A_1-A_3 range, and variation in carbon (and perhaps chemical composition) probably accounts for the range of transformation products which were observed. The segregation lines and inclusion lines indicate welding.

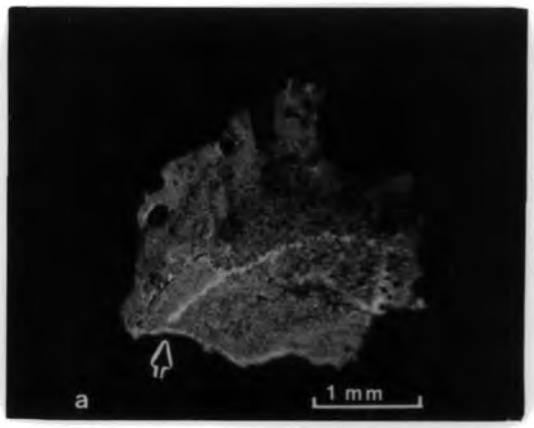
S58 (Plates B44, b and B46) **FILE, No. 150** Meare Village West, Somerset

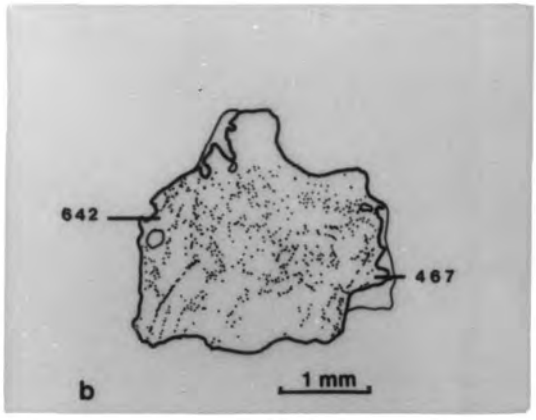
Metal sample — TS, 4mm from the broader end of the file fragment, incorporating parts of both cut faces. The specimen broke into 2 pieces (Plate B46, b-c) during sampling.

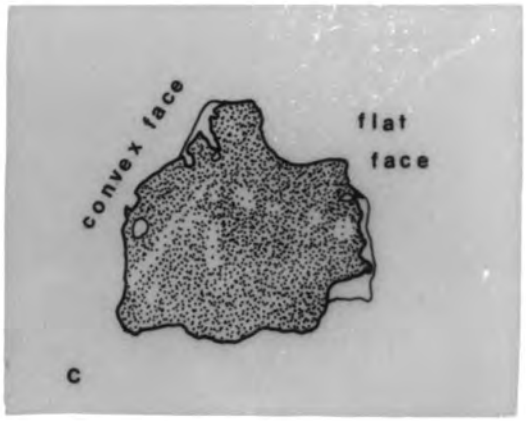
Unetched — Very small amount of rounded single-phase inclusions, plus 3 aligned larger inclusions. Some small grain-boundary and interstitial carbides were present within the corroded layers surrounding the metal.

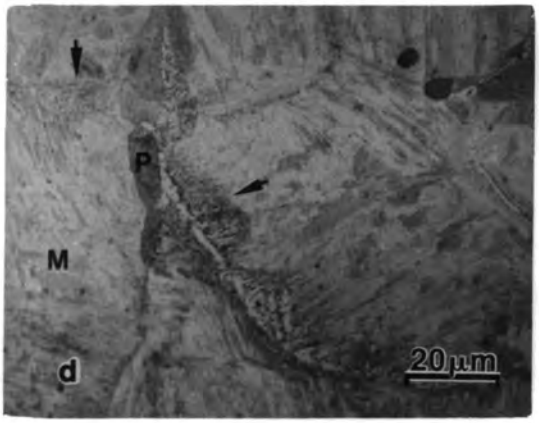
Etched [a] — Fairly homogeneous across the section, but with a slight carbon gradation (within the low-medium carbon range). At some grain-boundaries was acicular ferrite, and cementite films outlined the ferrite. The matrix was barely resolvable at magnifications up to X1000, although some parallel orientations were visible











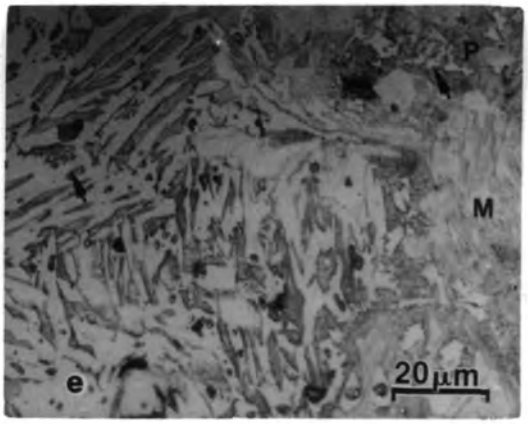
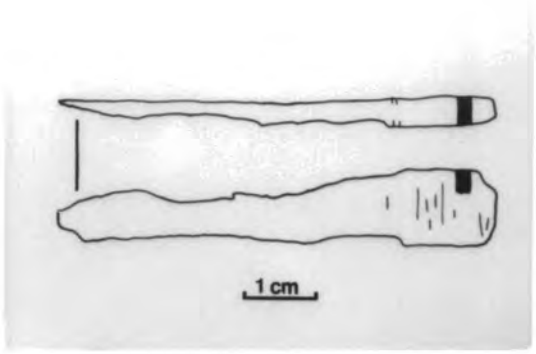
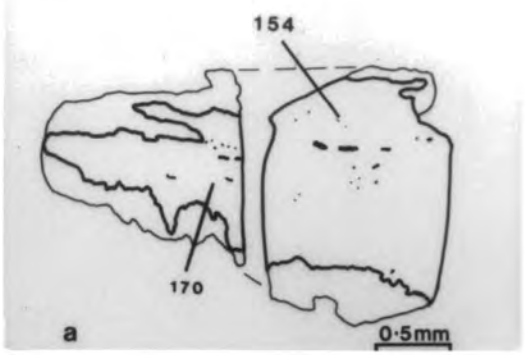
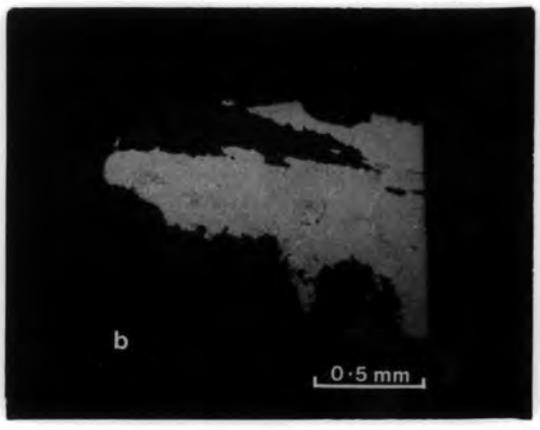
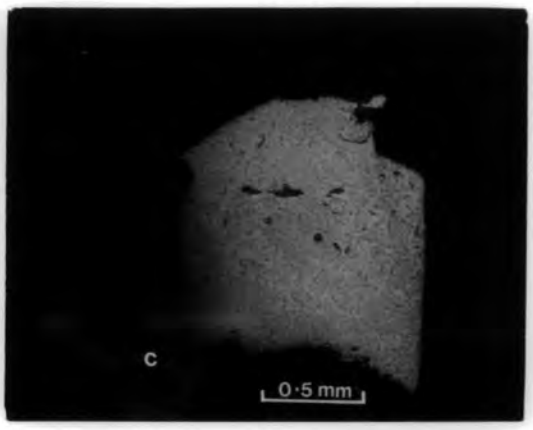


PLATE B45. Metallography of file No. 148 (S57).
(a) Whole section: weld ld line arrowed. (b) Diagram of section: inclusion distribution and hardness (HV 0.5). (c) Diagram of relative martensite distribution.
(d) Martensite (M), nodular pearlite (P), ?bainite (arrowed). (e) Ferrite zone: martensite (M), nodular pearlite (P), spiky ?martensite and feathery ?pearlite (arrowed).









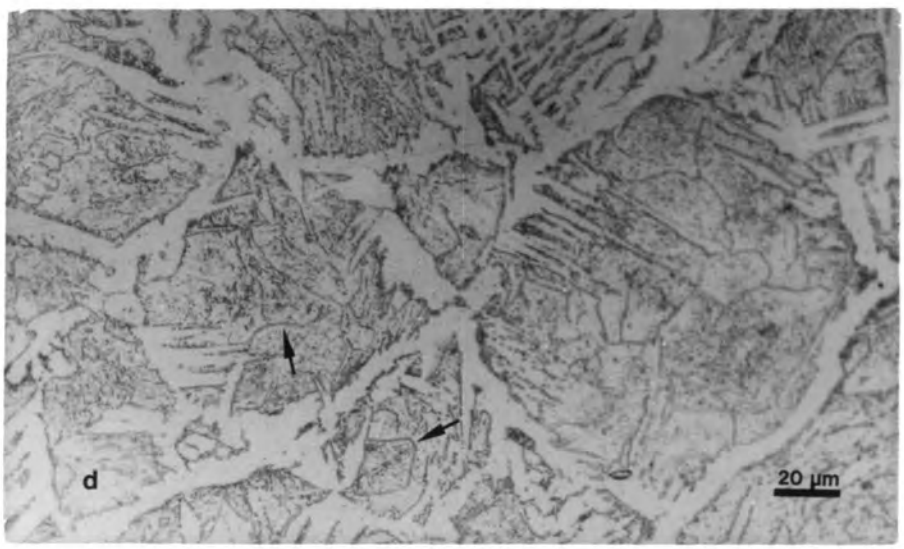


PLATE B46. Metallography of file No. 150 (S58).
(a) Diagram of sample (broken in 2 pieces): inclusion distribution and hardness (HV 0.2). (b) One fragment of sample. (c) Other fragment of sample. (d) Detail of centre of fragment shown in fig. b: ferrite (white), matrix of degenerate pearlite (grey) with free cementite (arrowed).

within the microstructure (Plate B46, d).

SEM — SEM revealed discontinuous morphologies of degenerate pearlite, with cementite outlining the prior austenite grain boundaries (Plate B44, b arrowed). Some continuous growth of pearlite and the free cementite (grain-boundary).

Hardness — Lower-carbon: 154 HV 0.2. Higher-carbon: 170 HV 0.2. Grain size: ASTM 3-4.

Comments — The degeneracy of the pearlite suggests that the carbon content was low (e.g. in the range 0.2 - 0.4%C), and the microstructure was similar to 'low-carbon' pearlite which has been transformed at low temperatures by fast cooling, perhaps even by mild quenching (N. Ridley pers. comm.). The continuous growth of the pearlite and free cementite suggests that the ferrite separation preceded the pearlite formation (Cheetham and Ridley 1975) which, together with the acicular form of the ferrite, suggests that the file was fully austenitized before cooling. Probably not quenched.

S59 (Plate B47) **FILE, No. 159** Meare Village West, Somerset

Metal sample — TS, 6mm from the broader larger end, incorporating parts of 3 cut faces.

Unetched — There was a small amount of glassy inclusions. Much internal corrosion; spheroidized carbides survived in the corroded regions.

Etched [a] — Homogeneous, almost eutectoid composition, with fine spheroidized carbides across the section. Some grain boundaries were delineated by ferrite.

Hardness — Ferrite + carbide 227 HV 0.2. Grain size: ASTM 7.

Comments — The file had been reheated at a sufficient temperature and for long enough to have allowed the former microstructure to totally spheroidize. The small size of the carbides suggests that the former structure had been relatively fine, probably as a result of fairly rapid cooling.

S60* (Plate B48, a-b) **?GRAVER, No. 208** Barbury Castle, Wilts

Metal sample — LS, through the rounded (?spatulate) tip (Ehrenreich BC5b).

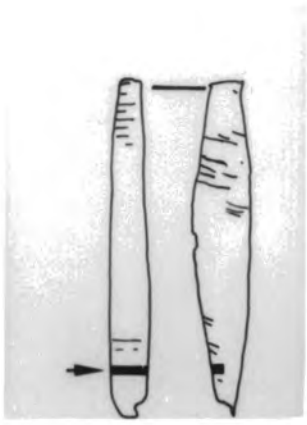
Unetched — Aligned duplex inclusions. Much corroded; spheroidized carbides survive in the corroded layers (some visible in Plate B48b).

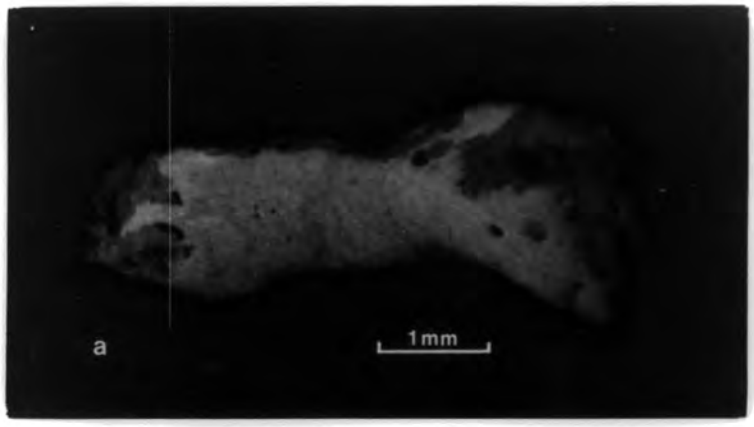
Etched [a] — There was a slight gradation in carbon content; the central longitudinal zone was c. 0.5%C, the outer sides of the section c. 0.6 or 0.7%C. The structure comprised spheroidized carbides; at the higher-carbon regions there was also discontinuous grain-boundary cementite (Plate B48b); a few diffuse light-etching lines.

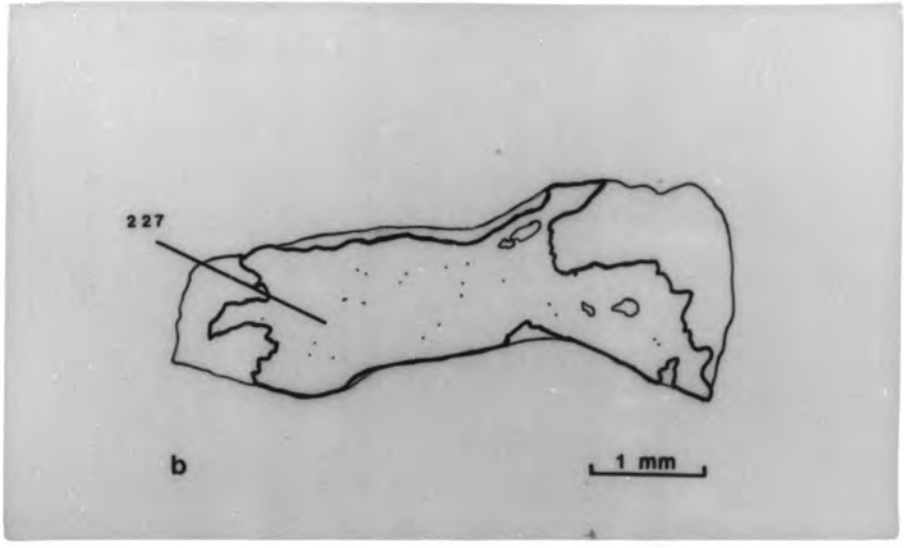
Hardness — 176 HV 0.2.

Comments — The tip of the tool had been reheated sufficiently such that the former microstructure had spheroidized.

Reference — Ehrenreich 1985, 130, 207, BC5b; Ehrenreich and Salter 1984, fig. 10.8, B.







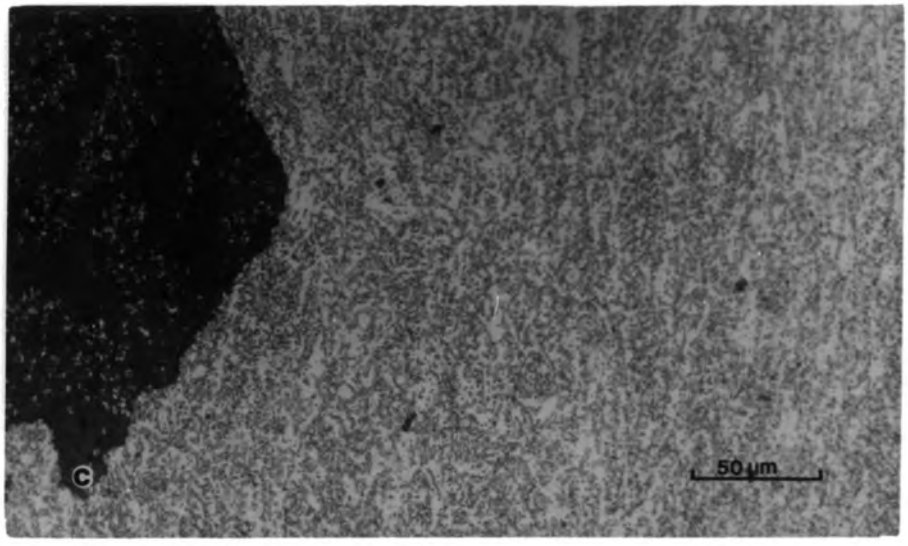
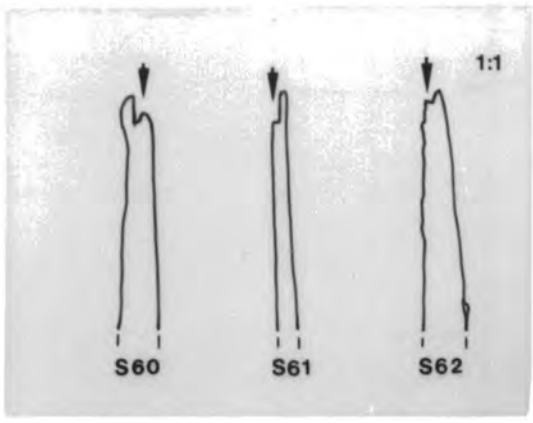
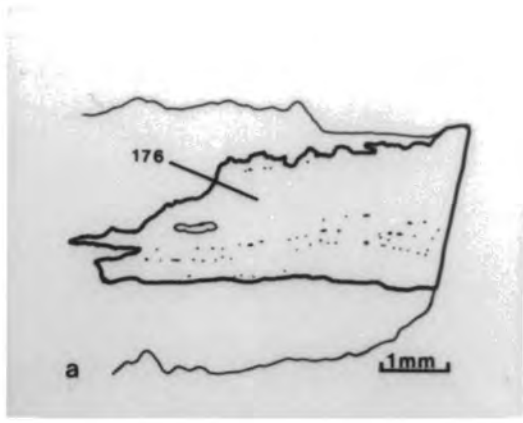
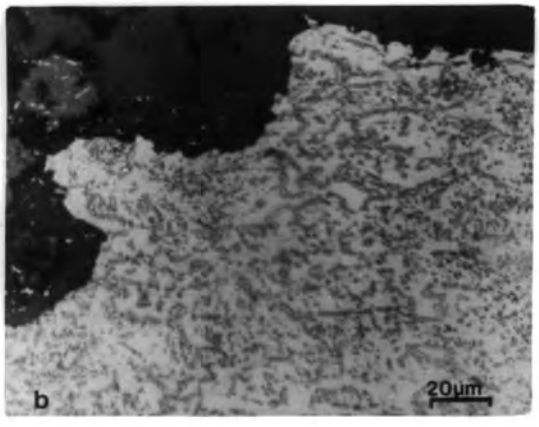
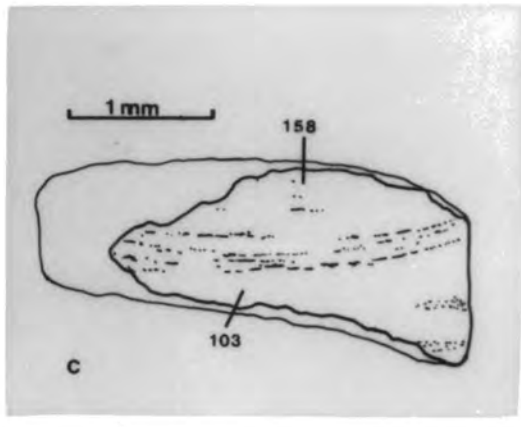


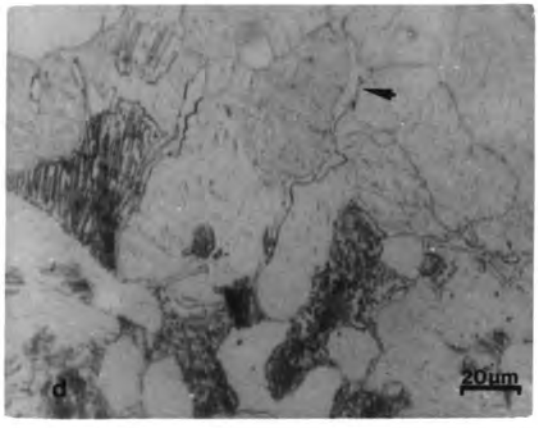
PLATE B47. Metallography of file No. 159 (S59).
(a) Whole section. (b) Diagram of section: inclusion distribution and hardness (HV 0.2).
(c) One edge of section. At left: corrosion layers (black) with carbides (white dots).
At centre and right: spheroidized carbides.











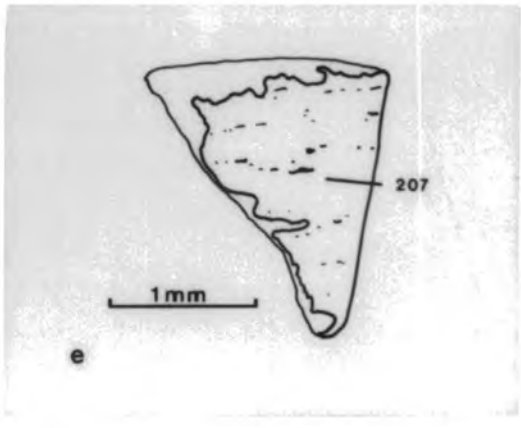


PLATE B48. Metallography of ?graver No. 208 (S60), and ?scribers No. 219 (S61) and No. 220 (S62). (a) S60. Whole section: inclusion distribution and hardness (HV 0.2). (b) S60. Spheroidized carbides. (c) S61. Diagram of section: inclusion distribution and hardness (HV 0.2). (d) S61. Pearlite, grain-boundary carbide. (e) S62. Diagram of section: inclusion distribution and hardness (HV 0.2).

S61* (Plate B48, c-d) **?SCORER/SCRIBER, No. 219** Danebury, Hants

Metal sample LS, through the longer arm of the tool (one half of the tip) (Ehrenreich D33b).

Unetched Aligned duplex, and some ?glassy, inclusion stringers and particles.

Etched [a] There was a carbon gradation from 0 to c. 0.2% C across the section (transverse to the tool's length), One side of the section (lower in Plate B48c) comprised large-grained ferrite with occasional traces of grain-boundary carbide. The other side, where the inclusions were concentrated, comprised ferrite, fine pearlite, and at the edge of the section, also grain-boundary carbide (arrowed in Plate B48d). Grains were equiaxed; sub-grain strain lines (veining) were visible (Plate B48d).

Hardness Ferrite: 103 HV 0.2. Carburized region: 158 HV 0.2. Grain size: ASTM 3-7.

Comments The veining suggests that the tool was forged in the A_1-A_3 range. The tip of the tool had been finally air-cooled.

Reference Ehrenreich 1985, 146, 209, D33b.

S62* (Plate B48e) **?SCORER/SCRIBER, No. 220** Worthy Down, Hants

Metal sample LS, through the straight arm of the tool (one half of the tip) (Ehrenreich WD13b).

Unetched Aligned angular glassy inclusions.

Etched [a] The section comprised ferrite and grain-boundary carbide, the maximum carbon content c. 0.1%. There was some slight variation and longitudinal banding in the concentration of carbon, and in the grain size. Grains were roughly equiaxed.

Hardness 207 HV 0.2. Grain size: ASTM 6-8.

Comments The overall structure suggests that the iron was well-worked, and the grains thus refined during forging. The tip of the tool was finally air-cooled.

Reference Ehrenreich 1985, 200, 215, WD13b.

S63* (Plate B49, a-b) **HOOKED BLOCK (Table 3:2)** Hunsbury, Northants (D144)

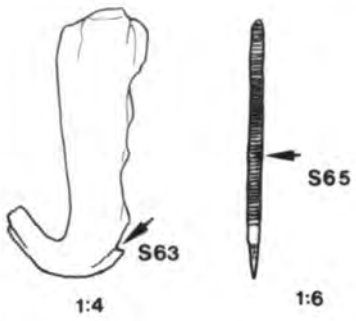
Metal sample ?LS, through the hook, where the metal had fissured (Ehrenreich HNY69a).

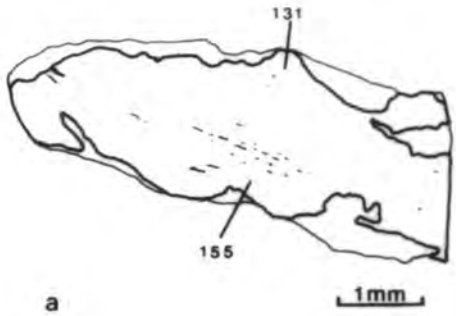
Unetched Aligned multi-phase and ?glassy inclusions. Much corroded: many islands of corrosion within the metal, some with residual (pearlite) cementite.

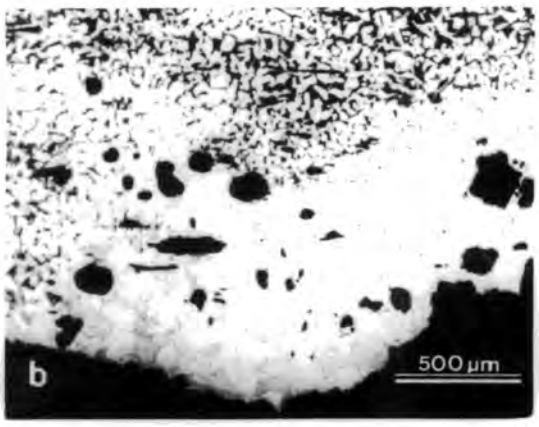
Etched [a] Irregular zones of ferritic iron with traces of grain-boundary carbide within the predominant structure of ferrite with fine pearlite. Plate B49b shows ferritic iron at the edge of the section (lower) and carburization at the centre of the section (upper). The maximum carbon content was c. 0.4%. A slight mottling was visible at grain-boundaries in the ferritic zones, possibly due to the presence of phosphorus. Grains were equiaxed in the ferritic zones whereas the ferrite in the carburized region was angular (almost Widmanstätten-like).

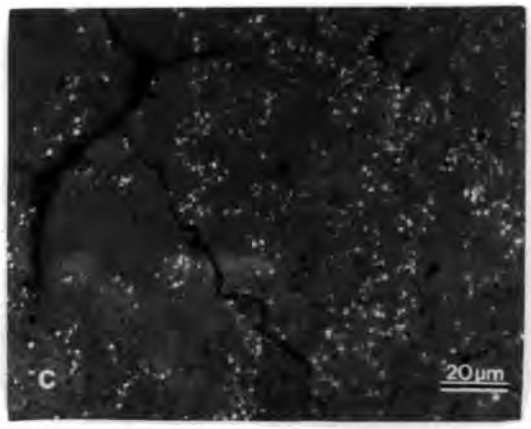
Hardness Ferrite: 131 HV 0.2. Carburized region: 155 HV 0.2. Grain size: ASTM 4.

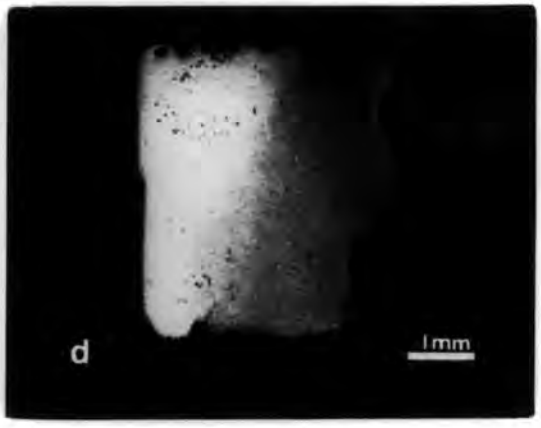
Comments The heterogeneity in carbon may be due to phosphorus segregating the carbon. The











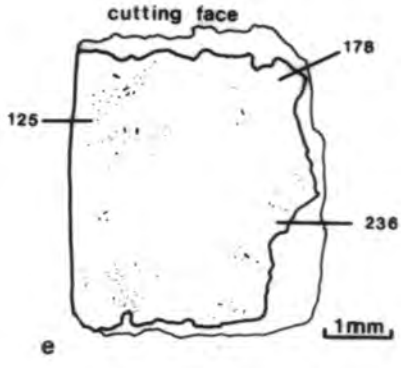


PLATE B49. Metallography of hooked block (S63) and files (S64 and S65).
(a) S63. Diagram of section (ignoring internal corrosion): inclusion distribution and hardness (HV 0.2). (b) S63. Ferritic region (lower), carburized region (top). (c) S64. Carbides (white) within corrosion matrix (dark). (d) S65. Whole section; the high-carbon regions are darkly etched. (e) S65. Diagram of section: inclusion distribution and hardness (HV 0.2).

block was finally air-cooled.

Reference — Ehrenreich 1985, 185, 214, HNY69a.

S64 (Plate B49, c) **FILE (Table 3:6, f)** Fiskerton. Lincs (SF298)

Corrosion flake — A flake was removed from the fracture across the blade, and another from the bend on the cranked tang.

Unetched — In the sample from the tang there were spheroidized carbides in circular formations which betrayed the original grain shape. No residual metal structures survived in the other sample.

Comments — The file was carburized at the tang, the microstructure suggesting possible reheating/annealing. No further conclusions can be drawn.

S65 (Plates B49, d-e, and B50, a-d) **FILE (Table 3:6, g)** Fiskerton, Lincs (SF364)

Metal sample — TS, mid-blade (56mm from the 1st ridge, through the groove between 2 ridges). The section incorporates part of the cut face (one groove), a narrow plain face, and part of the broad plain face. A flake of corrosion products was removed from the opposing narrow plain face of the file, 10mm closer to the tang.

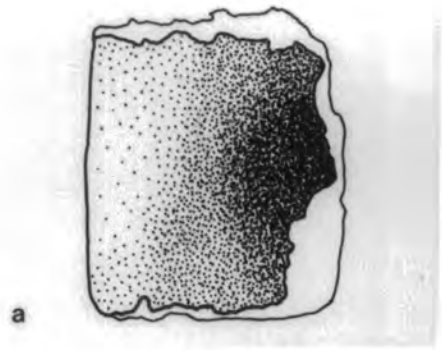
Unetched — Clustered single-phase and duplex inclusions. Abundant grain-boundary and interstitial carbide survived in the corroded layers.

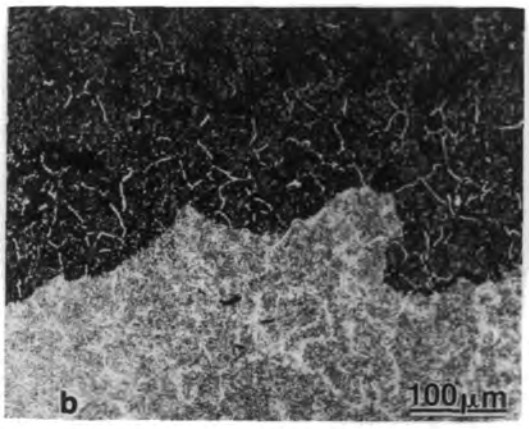
Etched [a, a+b] — There was an even carbon gradation across the section, from low-carbon (below 0.1% C at the centre of the file blade (centre left in Plate B49d, light-etching), to hypereutectoid at the narrow plain face of the file (centre right in Plate B49d, dark-etching). The carbon gradient at the cutting face (below the corroded layers) was c. 0.4%C (top left, Plate B50a) to c. 0.8%C (top right, Plate B50a). At the hypereutectoid region, proeutectoid cementite clearly delineated the grain boundaries and was persistent across the corrosion front. Plate B50, b-c show the hypereutectoid region, the micrographs orientated at 90° to Plate B49d. At the medium- and high-carbon regions, the microstructure comprised coarse, coalescing pearlite; at the low-carbon region there was coarse grain-boundary carbide.

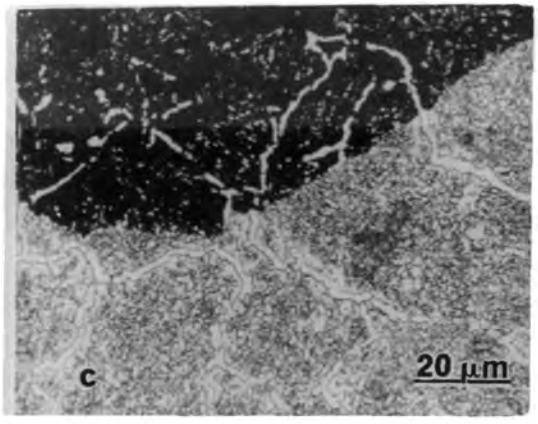
The sample of corrosion products revealed small-grained, fine pearlite cementite (Plate B50d) at a similar proportion to that seen at the top and lower left corners in Plate B49d (i.e. medium-carbon content).

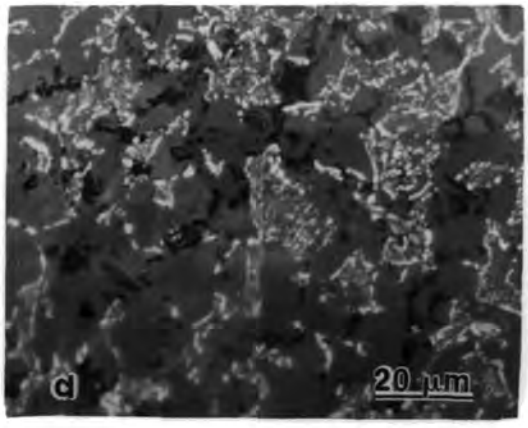
Hardness — Low-carbon: 125 HV 0.2; 104 HV 1. Eutectoid, cutting face: 178 HV 0.2. Hypereutectoid: 236 HV 0.2; 208 HV 1. Grain size: ASTM 6.

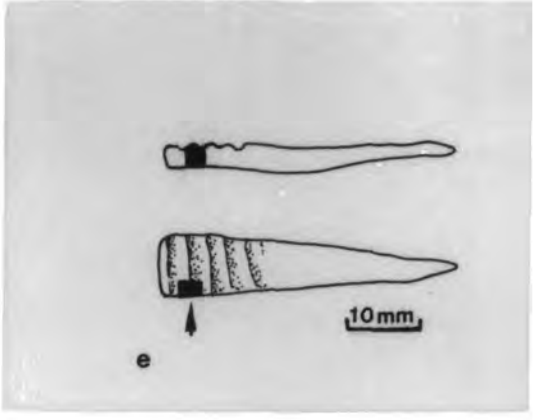
Comments — The even carbon gradient suggests that a carburized bloom was used; there was no evidence for surface carburization. Evidence from the flake of corrosion products suggests that the carburization was heterogeneous across the file and that there had been no preferential use of the highest-carbon metal at the cutting face. The











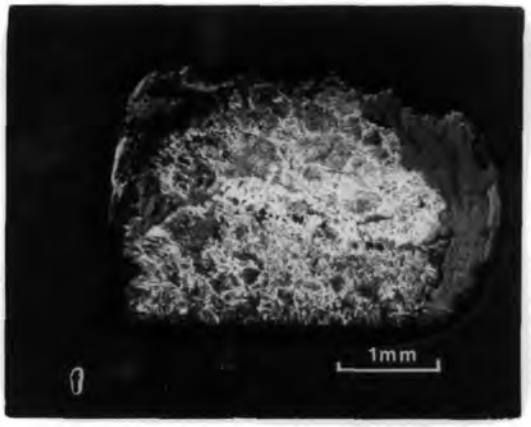


PLATE B50. Metallography of S65 & S66 (files).
(a) S65. Carbon distribution. (b) S65. Hypereutectoid region: edge of metal (lower), corrosion front across centre, corroded layers (upper). Carbides (white) are visible in the metal and corrosion products. (c) S65. Detail of hypereutectoid corrosion front. (d) S65. Opposite face: cementite (white) in the corrosion matrix (dark). (e) S66. (f) S66. Whole section.

file was air-cooled from the fully austenitized condition; the coarseness of the pearlite may be due to the file having been reheated to moderate temperatures, to anneal, or may have arisen during final forging.

S66 (Plates B50, e-f, and B51, a) **FILE (Table 3:6, d)** Meare Village West, Somerset

Metal sample: TS, 2mm from the fracture across the blade; includes one ridge from the cut face.

Unetched: There were a few well-rounded inclusions of duplex dendritic structure. Some were grouped, possibly from fold-welding, and there were a few larger inclusions. Carbides survived within islands of corrosion within the metal.

Etched [a]: Fairly evenly carburized: the structure comprised very fine pearlite with Widmanstätten ferrite. Carbon content c. 0.6-0.7%.

Hardness: Pearlite matrix: 242 HV 0.2. Grain size: ASTM 2-3.

Comments: The file was rapidly air-cooled from the fully austenitized state. The large grain size suggests grain growth from elevated heating.

S67* (Plate B51, b-d) **TANGED TOOL (Table 3:10)** All Cannings Cross, Wilts (20.6)

Metal sample: ?LS, through the ?functional tip, 'from the sharper end' (Ehrenreich ACC2b).

Unetched: A few elongated duplex inclusions. Much corroded, with internal islands corrosion in which some very fine carbides were present.

Etched [a, b, a+b]: The section etched extremely rapidly revealing nodular pearlite, fine and irresolvable pearlite, ferrite, and martensite. Pearlite was the dominant constituent. There was a variation in carbon content: at both ends of the section (top left, Plate B51, c-d, and lower right in Plate B51c) was a region where there was a concentration of ferrite grains in which proeutectoid ferrite was visible (arrowed in Plate B51e). Elsewhere the ferrite was present as grain-boundary Widmanstätten ferrite. Isolated partial grains of martensite were present (e.g. centre left in Plate B51e), particularly towards the tip of the tool.

Hardness: Pearlite: 270 HV 0.2.

Comments: The tip of the tool had been very rapidly cooled. For a rod of this small cross-section the microstructure could have been formed by rapid cooling in air.

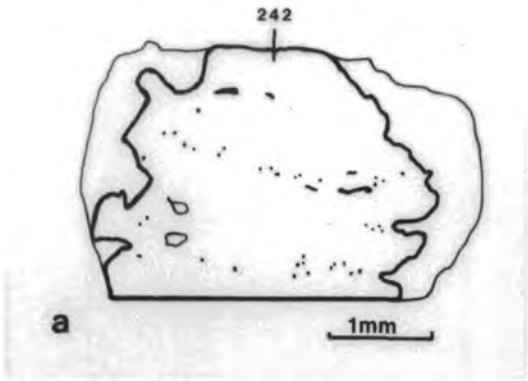
Reference: Ehrenreich 1985, 121, 207, ACC2b.

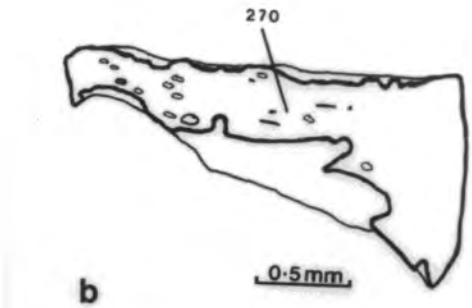
S68* (Plate B51, e) **TANGED TOOL (Table 3:10)** All Cannings Cross, Wilts (20.8)

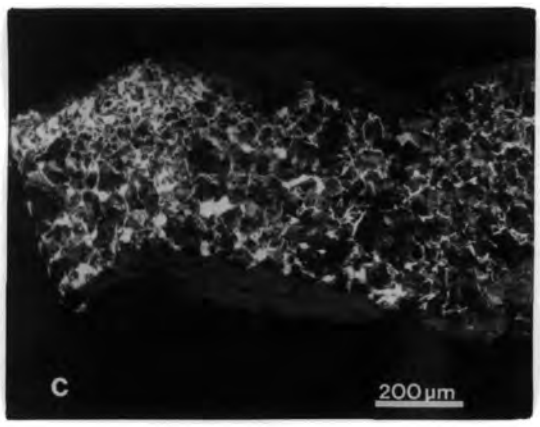
Metal sample: ?LS, through the ?functional tip, 'from the pointed end' (Ehrenreich ACC2a).

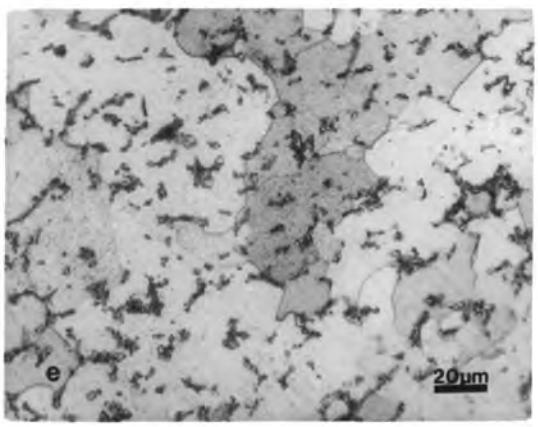
Unetched: No inclusions were visible.

Etched [a, a+b]: Across the section was ferrite and grain-boundary nodular carbide (c. 0.1%C max). Grains were equiaxed and had recrystallized revealing a coarser grain structure, with the carbide now present at the former grain-boundaries (Plate B51f).









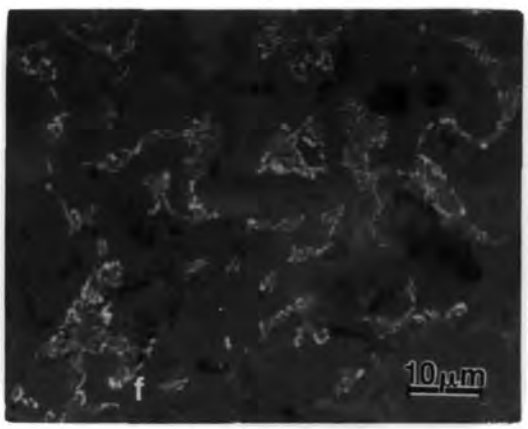


PLATE B51. Metallography of S66 - S69; [file (S66), tanged implements (S67 and S68), and 'saw' (S69)]. (a) S66. Slag distribution and hardness (HV 0.2). (b) S67. Diagram of section: inclusion distribution and hardness (HV 0.2). (c) S67 tip: ferrite (white), martensite (pale), pearlite, and corrosion (dark). (d) S67 tip: proeutectoid ferrite arrowed, martensite at centre left (with Widmanstätten ferrite). (e) S68. Recrystallised ferrite, with carbides. (f) S69. Carbide (white) within corrosion matrix.

Hardness Centre of section: 176 HV 0.2. Grain size: Present: ASTM 4. Former: ASTM 5-6.

Comments The recrystallization with grain growth suggests that the tip of the tool had been reheated below A_1, possibly during annealing. Probably originally air-cooled.

Reference Ehrenreich 1985, 121, 207, ACC2a.

S69 (Plate B51, f) **'SAW' BLADE** Fiskerton, Lincs (SF288A)

Corrosion flake The blade is engraved on both sides; metallurgical information may therefore be useful in interpreting the nature of the tool used to engrave the blade. Sample removed from the surface of the side of the blade (undecorated region).

Unetched Residual cementite from fine pearlite was visible at concentrations suggesting a medium-carbon content in the original structure at the surface.

Comments The pearlite need not be typical of the whole blade, but nevertheless, at least part of the blade comprised carburized iron. The pearlite may be the remains of surface-carburization. The blade had been air-cooled.

APPENDIX C

SITES AND HOARDS WITH METALWORKING TOOLS

Concordance list for catalogued tools (Appendix A), metallographic examinations (Appendix B), type and date of site (or likely date if a hoard), geographic location, and key references.

1) Dates are for the sites (or for the hoards if stated). If there is more than one occupation this is indicated, but pre-Iron Age occupation is not included. The date ranges are estimates; even for recent excavations, the dating is often based on pre-war chronologies (e.g. Hawkes 1931) which cannot easily be translated to Calendar years. Moreover, where there are indications of activity over a long period, few sites have been examined sufficiently thoroughly to be sure of continuity of occupation/intensive activity. Even between the start and end dates indicated for a particular occupation, frequently there is insufficient evidence to demonstrate that occupation was in fact continuous between these dates.
2) Dating is taken from bracketed references, where shown.
3) Other sources: Hogg 1975, Knight 1984, Manning 1985, Coles 1987, Haselgrove 1987, Coles 1989.
4) Context and dating of individual tools is given in Appendix A; tools from asterisked sites and hoards are discussed in Chapter 5.

Site/Hoard Key references	Tool	Appendix A	Appendix B
Bagendon, Gloucestershire			
SP 018064	bench anvil?	53	
Extensive defended settlement,	file?	125	
mid C1st AD.			
Clifford 1961; (Swan 1975;			
Trow 1988)			
Barbury Castle, Wroughton, Wiltshire	anvil	47	S7
SU 149763 *	hammer	75	
Hillfort, ?C4th/3rd BC -	graver?	208	S60
?C1st BC.	graver?	209	
Macgregor and Simpson 1963	graver?	210	
	graver?	213	
	scriber?	227	
Beckford, Hereford and Worcestershire			
SO 984363 *	poker	23	
Settlement, mid C3rd BC - mid			
C1st AD; early and late Roman.			
Britnell 1974; Wills and Dinn			
forthcoming			

Bigbury, Kent

TR 117575 *	anvil	46	
Hillfort,	hammer	63	S16
C5th/3rd BC - mid/late C1st BC.	hammer	68	S21-S23
Boyd Dawkins 1902; Jessop 1932;	hot chisel	93	
Thompson 1983	hot chisel	95	S40

Billingborough, Linconshire

TR 1134	poker	28	
Settlement, ?C3rd BC - ?C1st BC.			
Chowne 1979			

Bredon Hill, Gloucestershire

SO 958400	hammer	73	S28-S29
Hillfort,	hammer	74	
?C3rd BC - early C1st AD.	hammer	77	S33-S34
Hencken 1938	hammer	86	S36
	hammer	89	S37

The Breiddin, Powys

SJ 292144	punch	198	
Hillfort, ?C8th/7th BC;			
?(C3rd BC) - C1st AD; C4th AD.			
O'Neil 1937; Musson 1970; 1976;			
Thorburn 1988			

Bulbury, Dorset

SY 929942 *	set hammer	56	
Hillfort with possible hoard:	set hammer	57	
'hoard', ?C1st BC/C1st AD.			
Cunliffe 1972			

The Caburn, Glynde, Sussex

TQ 444089	hammer	87	
Hillfort, ?C7th BC - mid C1st AD;			
early Roman.			
Curwen and Curwen 1927;			
(Haselgrove 1987)			

Casterley Camp, Wiltshire

SU 115535	hammer	64	
Settlement, ?C2nd/1st BC; early			
C1st AD; late C1st AD - C4th AD.			
Cunnington and Cunnington 1913			

Castle Yard (Castledykes's Camp), Farthingstone, Northamptonshire

SP 617563	poker	20	
Hillfort, ?C5th - ?C1st BC.			
Knight 1988			

Conderton (Danes) Camp, Hereford and Worcestershire

SO 972384	poker	7	
Hillfort,			
C4th/3rd BC - early C1st AD.			
Thomas 1959			

Croft Ambrey, Hereford and Worcestershire			
SO 445668	scriber?	225	
Hillfort,	scriber?	226	
mid C6th BC - mid C1st AD.			
Stanford 1974			
Danebury, Hampshire			
SU 323376 *	anvil	51	
Hillfort,	hammer	60	
mid C6th/5th BC - mid C1st BC	chisel	109	
with limited occupation to	file	123	
mid C1st AD; later activity.	hot punch	163	
Cunliffe 1984b	punch	173	
	punch	176	
	punch	183	
	graver?	214	
	scriber?	219	S61
	scriber?	223	
	scriber?	224	
	burnisher?	231	
Dragonby, South Humberside			
SE 905138	hot punch	165	
Settlement, ?C4th BC - C4th AD;			
limited C6/7th AD activity.			
May 1970; (Eldsdon and May 1987)			
Fiskerton, Lincolnshire			
TF 055716 *	poker?	31	
Possible deposit(s)	bench anvil?	54	S8-S9
found near C5th/4th BC	top-swage	55	S10
causeway: hoard(s) dated to	hammer	62	S12-S15
c. C4th BC or later.	hammer	71	S24-S26
Field 1986; forthcoming	file	128	
	file?	135	S46
	file	142	S55
	file	145	
	punch?	172	
Fison Way (Gallows Hill), Thetford, Norfolk			
TL 86658515 *	punch	178	
Possible religous/ceremonial			
centre, ?C1st BC - 3rd quarter			
C1st AD; C4th AD.			
Gregory 1981; forthcoming			
Garton Slack, North Humberside			
SE 957596 - SE 953603 *	poker	1	
Settlement, C3rd BC - C1st AD.	poker	5	
(See also Wetwang Slack)	tongs	38	
Brewster 1975; 1980			
Glastonbury, Somerset			
ST 493408 *	hammer	84	S35
Settlement, C2nd BC - C1st AD;	hot chisel	92	

?limited use in Roman period.	hot chisel	101	
Bulleid and Gray 1911; 1917;	file	118	
(Coles 1987)	file	129	
	file	130	S52
	file	133	S54
	file	146	
	file	147	S56
	file?	161	
Groundwell Farm, Blunsdon St. Andrew, Wiltshire			
SU 157889	cold set?	117	
Settlement, C5th - C3rd BC.			
Gingell 1981			
Gussage All Saints, Dorset			
ST 998101 *	hot chisel	102	
Settlement, before C5th BC -	cold set?	114	
third quarter C1st AD.	cold set?	116	
Wainwright 1979	file	126	S51
	file?	137	
	file	143	
	file	152	
	file	153	
	file	154	
	file	155	
	file	156	
	hot punch	164	
	hot punch	166	
	hot punch	167	
	punch?	169	
	punch?	174	
	punch	175	
	punch	182	
	punch	186	
	punch	188	
	punch	190	
	punch?	191	
	punch?	192	
	punch?	193	
	punch?	194	
	punch	195	
	punch	196	
	punch?	197	
	punch	199	
	punch?	202	
	graver?	207	
	graver?	215	
	graver?	216	
	graver?	217	
	graver?	218	
	scriber?	221	
	scriber?	228	
	scriber?	229	
	scraper?	230	

Ham Hill, Somerset			
ST 478170	hammer	66	S17-S19
Hillfort, C7th BC - C4th AD;	hammer	76	S30-S32
medieval activity.	hot chisel	97	
Gray 1924; 1926; (Burrow	file	132	S53
1981; Morris 1987)	hot punch	168	
	punch	180	
Hod Hill, Dorset			
ST 857106 *	hammer	59	
Hillfort,	hammer	81	
C4th/3rd BC - mid C1st AD;	hammer	83	
early Roman (to AD 51).	hot set	90	
Brailsford 1962;	chisel	106	
Richmond 1968	hot punch	162	
	punch	170	
	punch	171	
Hunsbury, Northamptonshire			
SP 738583 *	poker	12	S1
Hillfort, late C5th/4th BC -	poker	13	S5
end C1st BC/?C1st AD	poker	14	
Fell 1936; (Knight 1984;	poker	16	S3
Cunliffe 1978)	poker	17	S4
	poker	19	S6
	poker	21	
	poker	25	S2
	hammer	61	S11
	hammer	72	S27
	hot chisel	91	S41
	hot chisel	94	S42
	hot chisel	100	S44
	hot chisel	103	S43
	hot chisel	104	S45
	hot chisel	108	S38
	file	119	S47
King Harry Lane, St. Albans, Hertfordshire			
TL 133065 *	hammer	65	
Cemetery, C1st AD - C2nd AD	hammer	79	
with main use AD 1 - AD 60;			
(settlement, late C1st AD -			
C3rd AD).			
Stead and Rigby 1989			
Llyn Cerrig Bach, Gwynedd			
SH 306765 *	tongs	39	
Possible ritual deposits,	tongs	43	
c. C2nd BC - early C1st AD.			
Fox 1946; (Savory 1976a)			
Madmarston, Swalcliffe, Oxfordshire			
SP 386389 *	poker	8	
Hillfort, ?C5th/4th BC;	hot chisel	107	

?late C2nd BC - mid C1st AD;			
C4th AD.			
Fowler 1960			
Maiden Castle, Dorset			
SY 669885	cold set?	115	
Hillfort, C5th BC - C1st AD;			
C4th AD.			
Wheeler 1943; (Sharples 1985;			
1989)			
Meare Village East, Somerset			
ST 446421 *	poker	26	
Settlement, C2nd BC - C1st AD;	poker	27	
?limited use C2nd - C4th AD.	anvil	48	
Coles 1987	anvil	52	
	hot chisel	99	
	file	120	S48
	file?	160	
	punch/graver	189	
Meare Village West, Somerset			
ST 444422 *	poker	18	
Settlement, C3rd BC - C1st AD;	poker	24	
?limited use C2nd - C4th AD.	chisel	111	
Bulleid and Gray 1948;	file	134	
Gray and Bulleid 1953;	file	148	S57
Gray 1966; (Coles 1987)	file	150	S58
	file	158	
	file	159	S59
	punch	187	
	punch	200	
	chisel?	206	
	graver?	212	
Midsummer Hill, Hereford and Worcestershire			
SO 760375	hammer	69	
Hillfort,	hammer	70	
mid C5th BC - mid C1st AD.	file	127	
Stanford 1981	file?	140	
Mynydd Bychan, Llysworney, Glamorgan			
SS 963756	file?	139	
Hillfort,			
end C1st BC - mid C1st AD.			
Savory 1955			
Oare, Wiltshire			
SU 172643	hammer	80	
Possible settlement: single			
pit, early-mid C1st AD.			
Cunnington 1909; (Swan 1975)			

Rainsborough Camp, Northamptonshire

SP 526348	hot chisel	96
Hillfort, ?C6th/5th - C4th BC; ?late C2nd BC; ?late C1st AD; ?C4th AD.		
Avery *et. al.* 1967		

Rudston, North Humberside

TA 095692 - TA 094703 *	tongs	40
Cemetery, C4th BC - C1st BC.	hammer	78
Stead 1976; 1979; forthcoming	hammer	82

Santon, Norfolk

TL 837873 *	tongs	41
Hoard, mid C1st AD.	tongs	42
Smith 1909; (Sprating 1975)	hammer	85
	file	136

Sheepen, Colchester, Essex

TL987253	poker	10
Settlement, C1st AD.	poker	11
Hawkes and Hull 1947;	poker	15
Niblett 1985	hammer	88

Skeleton Green, Puckeridge, Hertfordshire

TL 387240	punch	177
Settlement, later C1st BC - mid C1st AD.		
Partridge 1981		

South Cadbury, Somerset

ST 628252 *	chisel	110
Hillfort, *c.* C8th BC - early	punch	203
C1st AD; ?C3rd - C4th AD;	scriber?	222
C5th - C11th AD; later use.		
Alcock 1967; 1970; 1971; 1980;		
Spratling 1970a; 1970b		

Southcote, Reading, Berkshire

SU 698724	poker	6
Settlement, from ?C4th BC.		
Piggott and Seaby 1937		

Sutton Walls, Hereford and Worcestershire

SO 525464	poker	32
Hillfort, *c.* mid C1st BC - C4th AD.		
Kenyon 1953		

Tre'r Ceiri, Gwynedd

SH 373446	poker	22
Hillfort, ?C2nd/1st BC - C1st AD; C4th AD.		
Hughes 1907; Hogg 1960		

Tywn-y-Gaer, Gwent

SO 294219	tongs	44	
Hillfort,	chisel	112	
c. C5th BC - C3rd BC or later.	file	138	
Probert 1976; forthcoming			

Wakerley, Northamptonshire

SP 940983	punch	181	
Settlement,			
?C2nd BC - C3rd AD or later.			
Jackson and Ambrose 1978			

Waltham Abbey, Town Mead, Essex

c. TL 3700 *	poker	9	
Probable ritual deposit,	poker	29	
late C1st BC/mid C1st AD.	poker	30	
Manning 1980; 1985	tongs	33	
	tongs	34	
	tongs	35	
	tongs	36	
	tongs	37	
	anvil	45	
	anvil-swage	49	
	anvil-swage	50	
	hammer-swage	58	
	file	141	

Weelsby Avenue, Grimsby, South Humberside

TA 283085 *	chisel	105	
Settlement,	file	121	
C1st BC - first quarter C1st AD.	file	122	S49
J. Sills forthcoming	file	144	
	file	151	
	file	157	
	punch	179	
	chisel?	204	

Wetwang Slack, North Humberside

SE 945602 *	file	124	S50
Settlement,	punch	185	
?4th/3rd BC - ?C2nd AD.	chisel?	205	
(See also Garton Slack)	graver?	211	
Dent 1982; forthcoming			

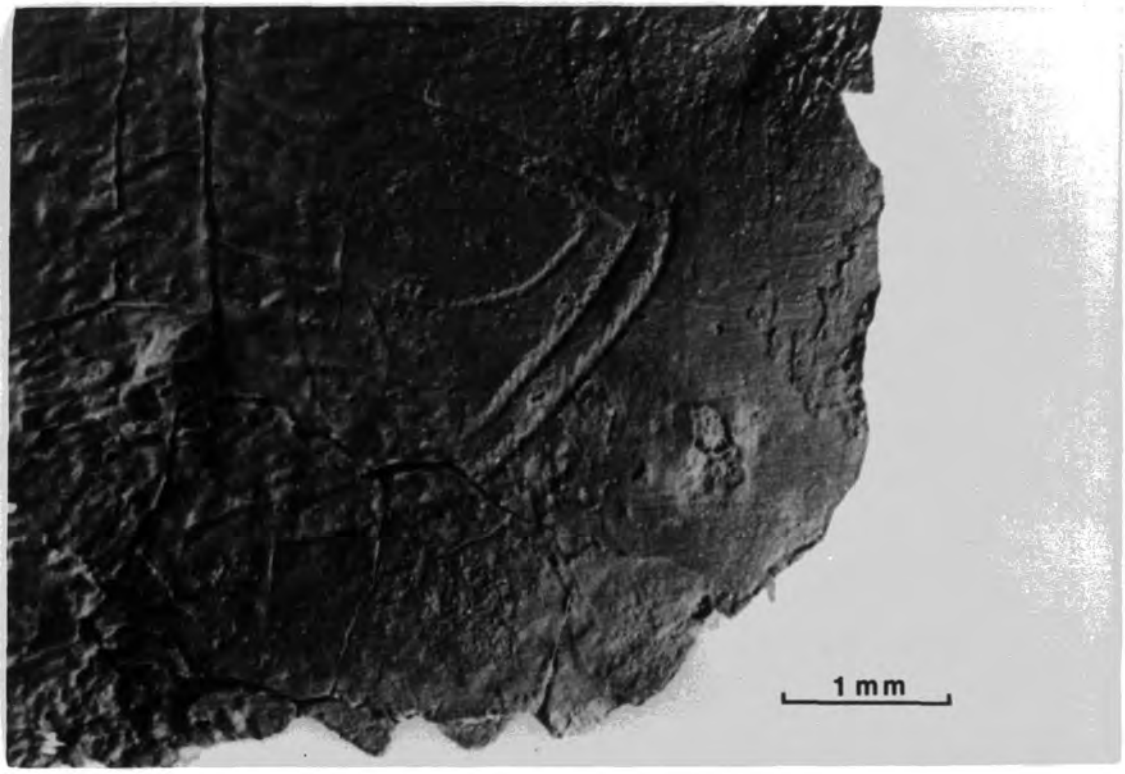
Whitcombe, Dorset

SY 711881 *	hammer	67	S20
Cemetery,	file	131	
C1st BC - early C2nd AD.			
Aitken 1967; Collis 1972;			
Whimster 1981; Aitken and			
Stead forthcoming			

Witham Bury (Chipping Hill Camp), Essex

TL 820152 *	poker	2	
Hillfort,	poker	3	

?C4th/3rd BC - ?C1st BC; late and post-Roman activity. Repton 1844; Rodwell 1976	poker	4	
Woodeaton, Oxfordshire			
SP 53641255	file?	149	
Settlement with C1st AD temple adjacent, late C7th/5th BC - late Roman. Harding 1987	punch?	184	
Worthy Down, Headbourne Worthy, Hampshire			
SU 469350	cold set?	113	S39
Unenclosed settlement, ?C6th/5th BC; *c.* C3rd/C2nd BC - mid C1st BC; mid C1st BC - mid C1st AD; Romano-British. Hooley 1931	punch?	201	
	scriber?	220	S62
Worthy Down, South Wonston, Hampshire			
SU 459358	hot chisel	98	
Settlement, MIA; C3rd AD. Whinney 1985; forthcoming			



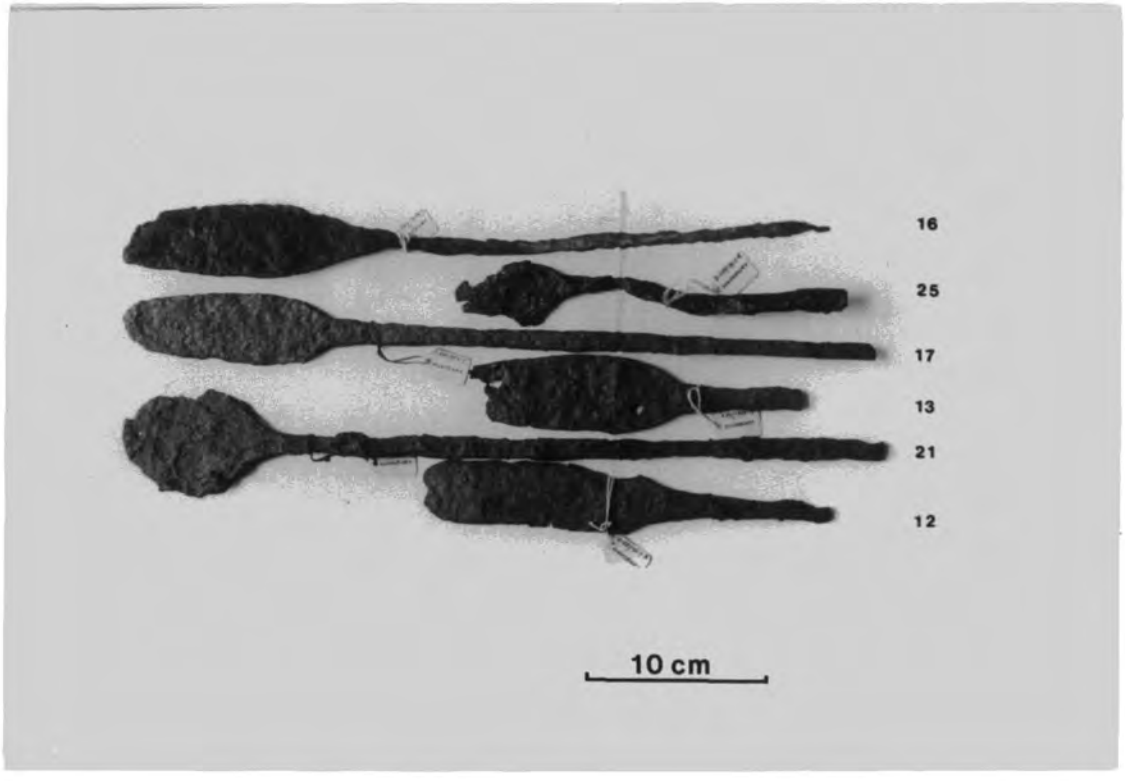


PLATE I

(a) Upper. Detail of engraved iron 'saw'-blade from Fiskerton

(b) Lower. Pokers Nos 12, 13 16, 17, 21 and 25 (from Hunsbury)

PLATE II

(a) Upper. Hammers Nos 62 and 71 (from Fiskerton)

(b) Lower. Hammers Nos 73, 77, 86 and 89 (from Bredon Hill)

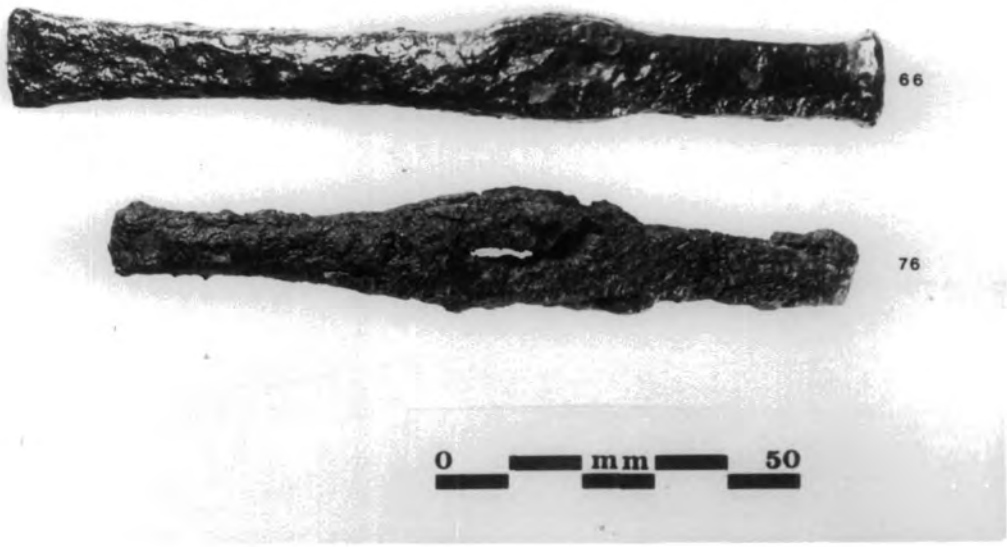


PLATE III

(a) Upper. Hammers Nos 66 and 76 (from Ham Hill)

(b) Lower. X-radiograph showing hammer marks on a bronze vessel fragment from Potterne. x1.
(Circled: marks from the use of a ?damaged hammer. Arrowed: narrow elongated marks.)

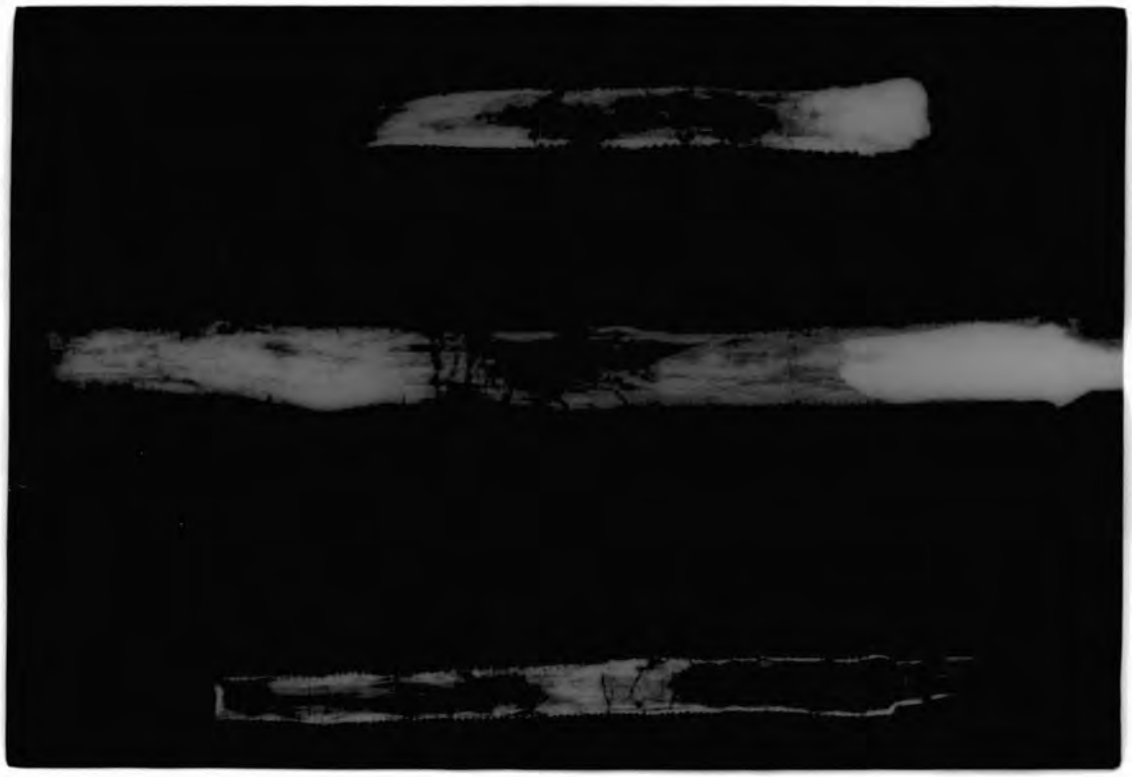


PLATE IV

(a) Upper. X-radiographs of files Nos 128, 142 and 145 (from Fiskerton). x1

(b) Lower. X-radiographs of file No. 122. (Plan and side views.) x1

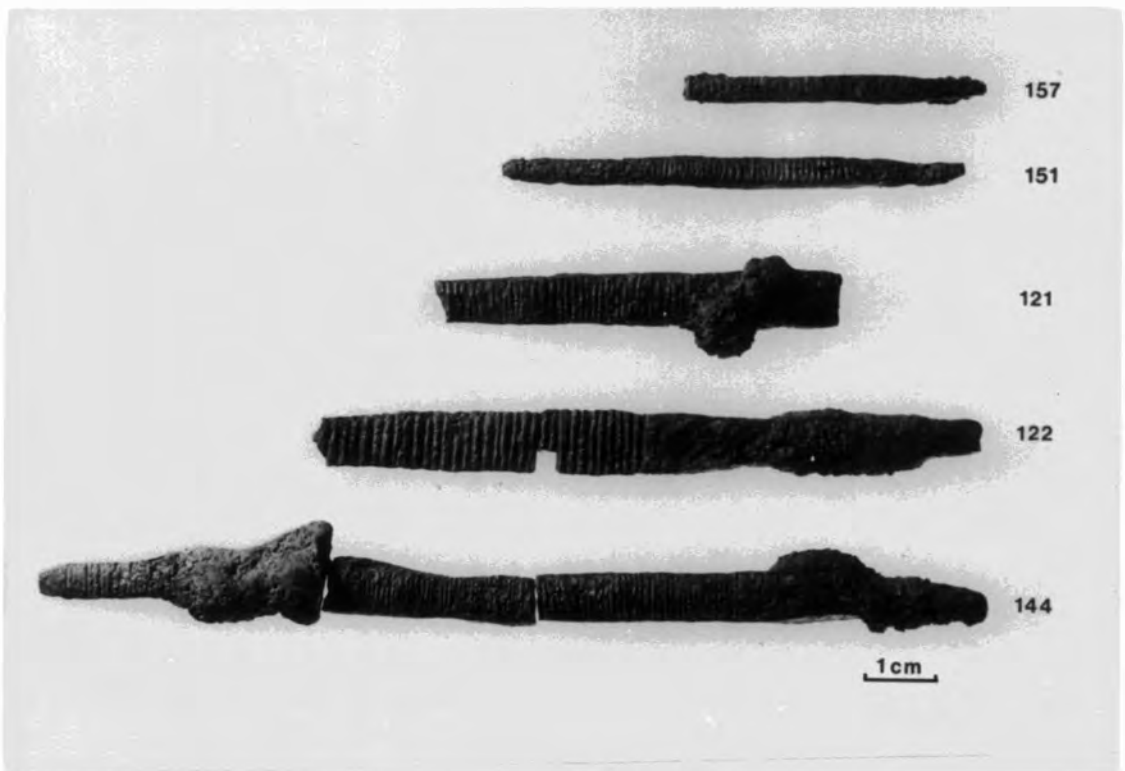


PLATE V

(a) Upper. File fragments Nos 152-156 from pit 209 at Gussage All Saints
(b) Lower. Files Nos 121, 122, 144, 151 and 157 (from Weelsby Avenue)

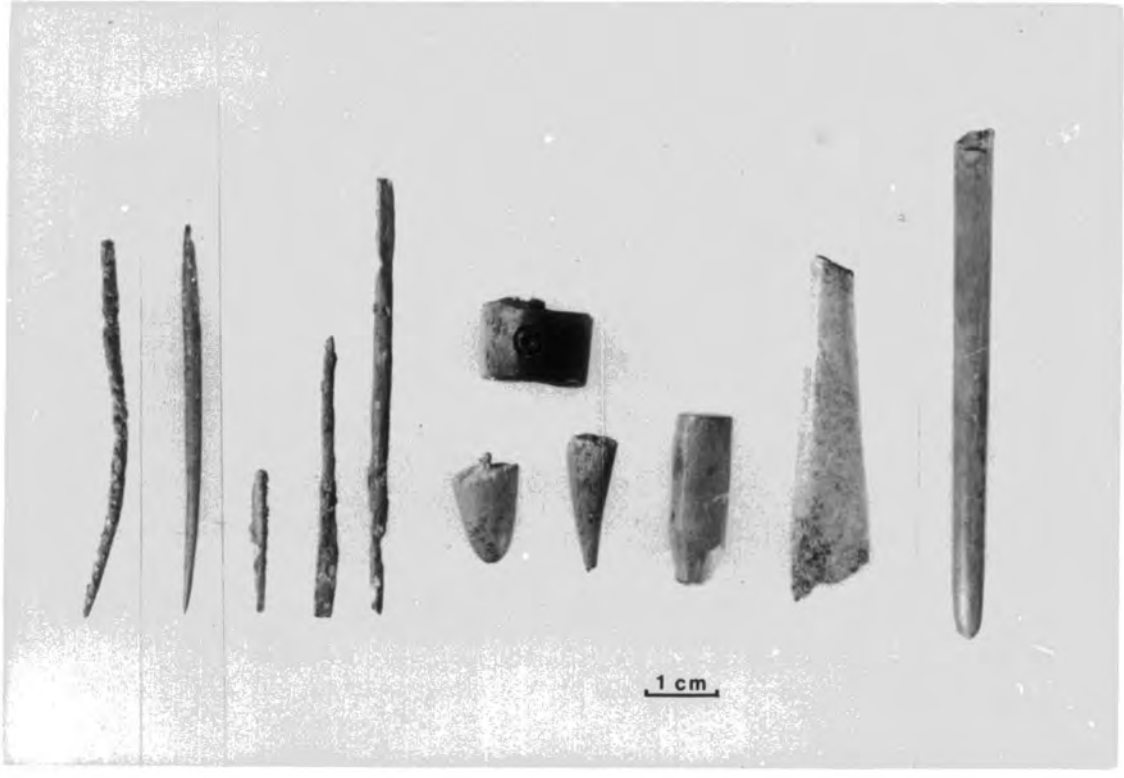


PLATE VI

(a) Upper. X-radiograph showing tool marks on part of a repoussé decorated copper alloy sheet metal mount from the Marlborough bucket. x1. (b) Lower. Possible implements and tools in copper alloy and bone from Weelsby Avenue. (The 5 on the left are copper alloy.)

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Abbreviations

Abbreviations are those recommended by the Council for British Archaeology, with the following additions:

AML Rep.	Ancient Monuments Laboratory (AML) unpublished (interim) reports series, available from AML, Historic Buildings and Monuments Commission for England (HBMCE), London.
BAR	British Archaeological Report British Series
BAR -S	British Archaeological Report Supplementary Series
BBCS	Bulletin of the Board of Celtic Studies
CBA	Council for British Archaeology
CPSA	Comité pour la Sidérurgie Ancienne
DoE	Department of the Environment
Dorset Proc.	Proceedings Dorset Natural History and Archaeological Society
Hants Proc.	Proceedings Hampshire Field Club and Archaeological Society
JISI	Journal of the Iron and Steel Institute
OUCA	Oxford University Committee for Archaeology
PPS	Proceedings Prehistoric Society
PSAS	Proceedings of the Society of Antiquaries of Scotland
UKIC	United Kingdom Institute for Conservation
UISPP	Union Internationale des Sciences Préhistoriques et Protohistoriques
WAM	Wiltshire Archaeological Magazine

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