THE EXCAVATION AND METALLOGRAPHICAL ANALYSIS OF A BRONZE AGE SWORD RECOVERED FROM IVINGHOE BEACON

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The circumstances under which a Late Bronze Age sword was found within the hillfort on Ivinghoe Beacon are described. The sword, which probably dates to the end of the eleventh century BC, was the subject of analysis and a metallographic study

INTRODUCTION

During May of 2000 the National Trust were alerted to the fact that a bronze sword had been removed from the hillfort on Ivinghoe Beacon, Buckinghamshire (grid reference centred on SP960168) as a result of unauthorized metal detecting. A photograph taken soon after its discovery and made available to the National Trust suggested that the sword was of high quality in terms of its manufacture, and in an excellent state of preservation. The sword was eventually recovered and identified as being of Wilburton type, and therefore dateable to the Late Bronze Age, c.1150–1000 BC.

It is fortunate that the precise findspot of the sword on the north side of the hill fort was known. The National Trust therefore took the decision, in consultation with English Heritage, to carry out an archaeological excavation in order to recover information about the context from which the sword was recovered. The metal detecting activity had also pinpointed six other potential non-ferrous findspots in close proximity to the sword location. Three of these signals , which had been marked with plastic tent pegs, were therefore also investigated archaeologically in order to determine the nature of the readings.

This article is into two sections. The first summarises the results of the excavations and provides a discussion of these results, relating them to the conclusions presented by Cotton and Frere after their excavations in the early 1960s (Cotton and Frere, 1968). The second section by Dr Peter Northover of the Department of Materials at Oxford University describes the results of a study carried out on the sword after samples were taken for metallurgical analysis.

RESULTS OF THE EXCAVATION

Four trenches were excavated, each 1m square. The previous excavations by Cotton and Frere in the 1960s had investigated seven areas (A–G). The trenches excavated in 2000 were numbered 1–4.

Fig.1 shows the location of the excavations on the north side of the hill fort. In trenches 2 and 3 the metal detector signals were soon identified respectively as a tin can and aluminium (?) lined drinks carton. These were recovered from the base of the topsoil and the two excavations were curtailed without further investigation.

In trench 4 the cause of the signal was not identified. Two contexts were present (Fig. 2), the topsoil (151), which was found to contain flecks of charcoal (almost certainly originating from modern scrub burning and clearance), and a layer of loose silty-loam and chalk rubble (152) infilling a slight depression in the surface of context 153. The latter (153) consisted of a solid, compacted layer of broken chalk, the surface of which dipped slightly along the south edge of the trench, possibly reflecting the top of the profile of the ditch at the foot of the rampart

Trench 1 was excavated to examine the findspot of the sword. It was found to have lain at the base of the topsoil (002). The detectorist had made a cut (001) into the topsoil 0.67 metres in length, and between 0.16 and 0.34 metres in width. The depth of the cut

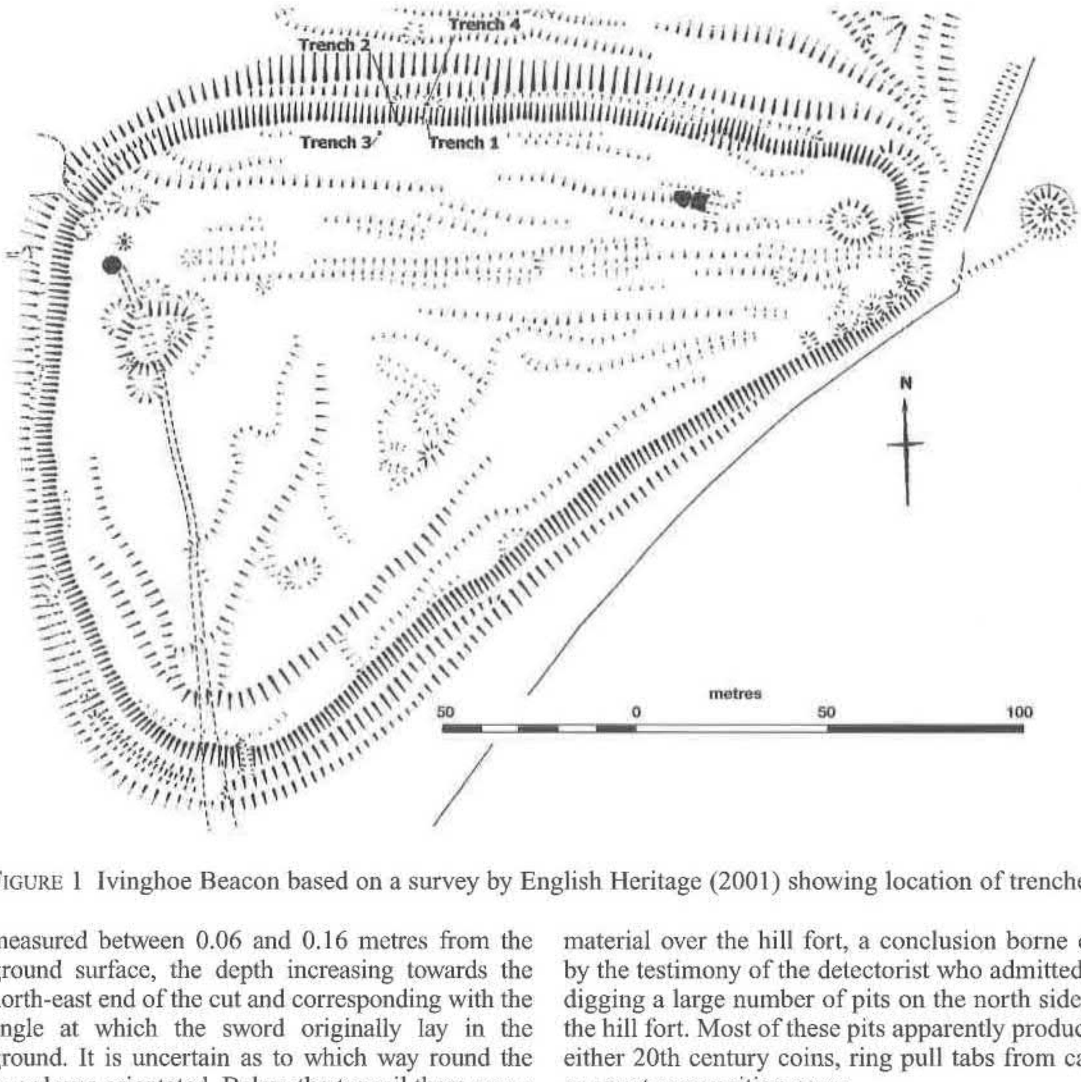

FIGURE 1 Ivinghoe Beacon based on a survey by English Heritage (2001) showing location of trenches.

measured between 0.06 and 0.16 metres from the ground surface, the depth increasing towards the north-east end of the cut and corresponding with the angle at which the sword originally lay in the ground. It is uncertain as to which way round the sword was orientated. Below the topsoil there was a layer of broken chalk in a matrix of light grey silty-soil (003). This was removed to reveal the surface of a layer of compacted broken chalk in a matrix of light brown silty-soil (004) at a depth of between 0.24 and 0.3 metres below the ground surface.

DISCUSSION

It is difficult to draw firm conclusions from these excavations since they were limited in extent and depth. Trenches 2 and 3 showed the metal detector signals to have been caused by modern debris. It would appear that there is a large spread of such material over the hill fort, a conclusion borne out by the testimony of the detectorist who admitted to digging a large number of pits on the north side of the hill fort. Most of these pits apparently produced either 20th century coins, ring pull tabs from cans or spent ammunition cases.

Two contexts were recorded during the excavation of trench 4, the lowermost (152) filling the depression in the surface of context 153. This depression may represent the top fill of the ditch at the foot of the rampart, although it is likely to be the fill of a tree hole. Cotton and Frere found the depth of the ditch on the north side of the fort at Area A to be 8½ feet, and the width as 10½ feet, although they concluded that 8½ feet for the original width was more likely since the outer edge had become eroded. According to their excavations the outer edge of the ditch should lie about 9½ feet distant from the foot of the rampart. This is slightly

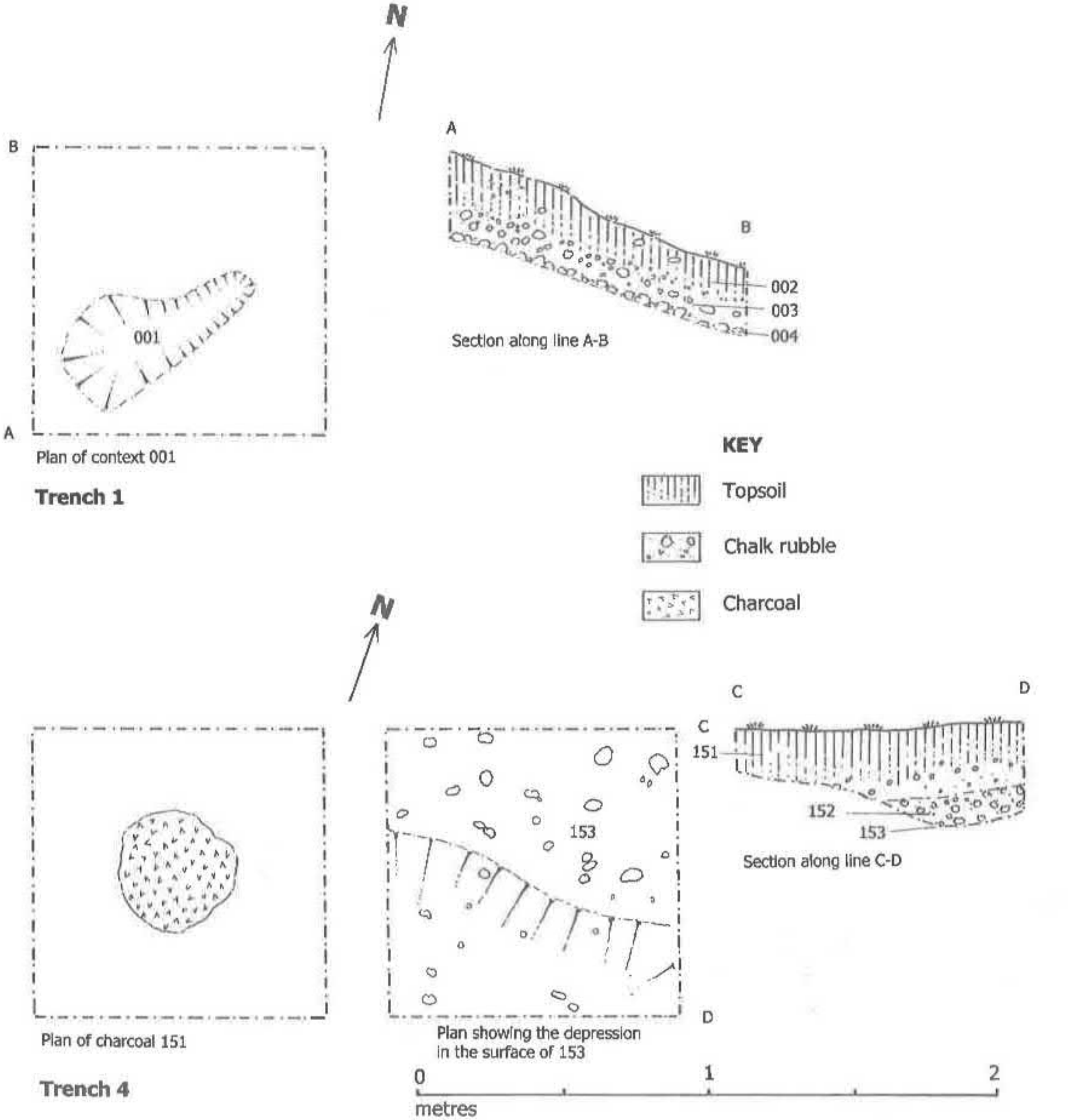

FIGURE 2 Ivinghoe Beacon: plan, section drawings; 001 is the outline of the cut after removal of the sword.

greater than the distance between the base of the depression in context 153 and the base of the rampart slope, suggesting that the depression does lie within the confines of the ditch. The northern edge of the rampart is, however, difficult to determine precisely since it is marked only by a gentle slope which flattens out south of trench 4. Cotton and Frere concluded that the ditch had become infilled with chalk eroding from the cut into the bedrock soon after its excavation, followed by deposition of a layer of topsoil. Above the topsoil there were layers of recent origin. The loose chalk rubble in trench 4 (152) may correspond with the recent layers identified in the 1960s excavations.

The sword was shown to have been recovered from the base of topsoil (trench 1). From slightly below the break-of-slope on the crest of the hill, Cotton and Frere's excavations on the north side of the hillfort established that the topsoil overlies the collapsed rampart, which was pushed downslope to fill the ditch. The sword could not, therefore, have been recovered from a rampart contemporary with rampart construction. Several pieces of pottery of Late Bronze Age date were recovered from associated topsoil context 002 but such material is widely spread through the upper horizons on the hillfort as a consequence of mole activity. Pieces of burnt bone were found in context 003 but these were not human and not therefore from a cremation burial associated with the sword and are likely to be of recent origin. It is possible that late medieval or early post-medieval ploughing has taken place within the interior of the fort, and as a result artifact material has become intermixed with some of the uppermost horizons. There is direct evidence for ploughing in the form of lynchets on the north slope below the fort, which have been identified by a recent English Heritage survey (Brown, 2001). Evidenece for ridge and furrow ploughing can also be seen ascending on the opposite south slope below the hill fort.

Though this seems the most likely conclusion i.e that the Ivinghoe sword has been relocated from the original context in which it was deposited, it should be stressed that there are examples of Bronze Age weapons having been recovered from within the ramparts of similar earthwork defenses. A Bronze Age knife blade was recovered from the south-west rampart of the hill fort at Medmenham in 1959 (Bucks. County SMR, record 1168) and the same site also produced a bronze spear head when the western section of the rampart was removed in 1910 (Recs Bucks, 1910). It was also reported that a bronze sword was found in 1927 in the rampart at Bulstrode, Gerrards Cross, by the then owner (unpublished, information provided by John Gover, Phd student at Reading University).

The sword is at present on long-term loan to the Buckinghamshire County Museum Service and is intended for display. A replica of the sword is on display at the National Trust's visitor centre at Ashridge.

THE FINDS

Pottery

Seventy-five sherds of pottery were recovered from the excavations. These were examined by Alistair Barclay of Oxford Archaeological Unit and identified as being of Late Bronze Age; there were few diagnostic sherds. Cotton and Frere had identified the pottery arising from the 1960s excavations as Iron Age. However, recent re-dating has placed it in the Late Bronze Age (Green, 1981) and the material recovered from the recent excavations is therefore consistent with this dating. However, the pottery recovered cannot safely give a Late Bronze Age date to any of the contexts revealed by the excavations since it came either from the base of the topsoil, or from the underlying subsoil which has been heavily affected by mole disturbance and other post-occupation activity.

Bone

Oxford Archaeological Unit also examined this material. A total of ninety-eight fragments of bone were recovered, consisting mainly of teeth and ribs. Other elements included fragments from the feet, pelvis and fragments from two long bones. The majority of the bone was in good condition, with only a small amount of attritional damage. One cattle tibia from trench 3 (context 101) had a butchery mark mid shaft. Two fragments of burnt bone were also found in this context. A further nineteen fragments of burnt bone were recovered from trench 1.

Cattle, sheep and pigs appear to have been the animals most common on site and although the bone assemblage is small, the elements recovered do appear to be representative of butchery waste. Cotton and Frere concluded that pastoralism was particularly important to the inhabitants of the fort, the outlines of which were probably deliberately extended along the eastern side of the brow of the hill to provide extra corralling for animals.

Fossil

A single fossil was found in the spoil thrown out by the detectorist alongside trench 1. This has been identified by John Gover as the internal cast of Spondylus spinosus, anUpper Cretaceous bivalve. The Beacon is of Middle and Lower Chalk and the nearest existing Upper Chalk is on Steps Hill, approximately 1 kilometre distant. Gover has, therefore, suggested that because it is such a well-preserved example it could have been placed as a ritual object alongside the sword.

ANALYSIS AND METALLOGRAPHY OF THE SWORD

A Late Bronze Age sword of Wilburton type was submitted for metallurgical study on behalf of the National Trust. The sword was a metal detector find at SP 9603 1683 on the northern rampart of Ivinghoe Beacon hillfort; a subsequent excavation of the find-spot has been reported on by Marshall (Marshall, 2000 and above). This report contains a description of the sword with comments, by Dr S.P. Needham of the British Museum.

The sword has the characteristic slotted hilt with flared terminal, broad, slightly curved shoulders with two rivets in each, and a strongly curved ricasso (fig.3). The leaf-shaped blade has a sublozengic cross-section with a slight central ridge and hollow-ground, bevelled edges. There is very little edge damage. The patina as described and illustrated in Marshall's report is earthy in colour with dark green patches showing; after cleaning the sword has a dark patina overall, typical of tin-rich corrosion products on bronze and which preserves much original surface detail. Inspection under a binocular microscope also revealed areas of the blade with the original dendritic structure of the casting showing clearly, perhaps enhanced by localised tin sweat.

The sword measures 550 mm in length and 35 mm in maximum width.

The Wilburton period is traditionally seen as the first phase of the British Late Bronze Age (LBA I) and was first defined by Savory in 1958 (Savory, 1958). It is contemporary with Bronze Final II in France, with HaB1 in central Europe and Montelius period IV in northern Europe. The period's swords have been discussed in detail by Burgess and Colqhoun in their corpus of British Bronze Age swords (Burgess and Colqhoun, 1988). They divide the class into seven variants, a level of detail which the material probably cannot really support. However, if we do follow their scheme, the Ivinghoe Beacon sword would most fall into variants E-F (perhaps D as well), with rivet holes in the shoulders rather than slots, and with a relatively short and slender blade. They suggest a date late in the Wilburton period, probably towards the end of the eleventh century BC. Both these variants are rather few in number but there is a good parallel for both size and weight in a sword recovered during the reconstruction of Sandford Lock on the River

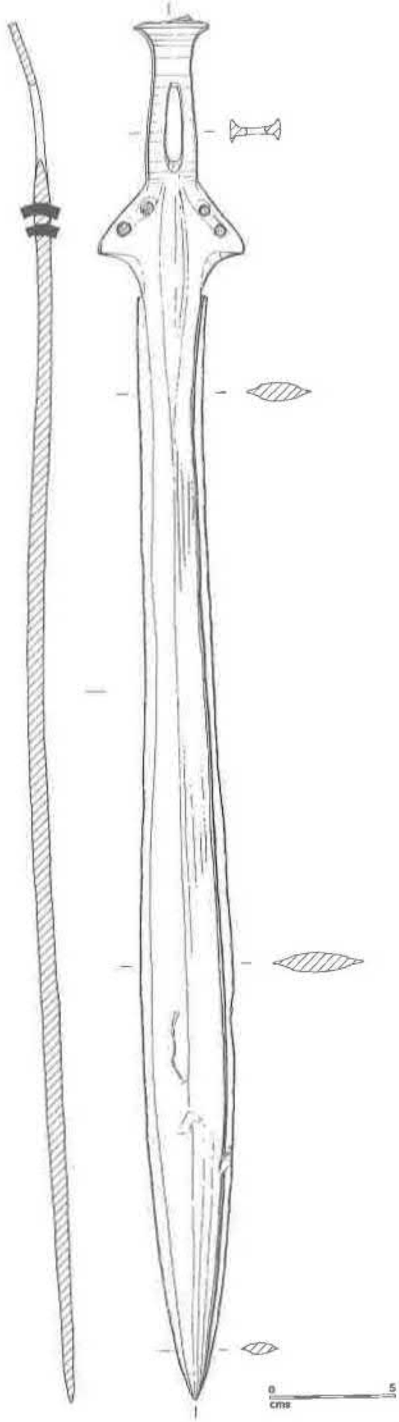

FIGURE 3 Late Bronze Age sword from Ivinghoe Beacon. Drawing by O. Jessop (⅓ scale).

Thames near Oxford in 1972; this sword is 565 mm in length and 34 mm in maximum width, a close relation indeed of the Ivinghoe Beacon sword (Burgess and Colqhoun, 1988, *op. cit.*, No.221, Pl. 35).

This sword is not the only item of Wilburton metalwork from the region. One of two sword fragments excavated from within the hill fort (Cotton and Frere, 1968) was reported as being potentially of Wilburton type although this is not very certain. More important are the Wilburton sword fragment and an assemblage of Wilburton weapon fragments found by metal detecting about two kilometres south of the hill fort, in beech woods on a valley side. The assemblage was well worn and corroded and dispersed over about a 30m-diameter area, suggesting that soil movements or forestry activity had disturbed it. Both the single fragment and the assemblage have been analysed and published (Dalwood, 1987). The single fragment is bent and cracked and has clearly been forcibly broken up, perhaps as an act of deliberate, ritualised destruction rather than prior to recycling. Burgess and Colqhoun put it in their variant D, mainly distributed along the Thames, with two fragments in the Isleham, Cambridgeshire hoard (Burgess and Colqhoun, *op. cit.,* No.214, Pl. 34). The sword fragments in the assemblage were not classified by Burgess and Colqhoun but can be placed in their variants C and E/F, the latter showing some consistency with the sword, which is the subject of this report. Finally, aside from weapon finds in the River Thames, for example at Taplow, the only other Wilburton period find from Buckinghamshire is a sword of Burgess and Colqhoun's variant B from Hawridge, near Cholesbury, and only a few kilometres south of Ivinghoe Beacon (Burgess and Colqhoun,, *op. cit.*, No. 190, Pl. 31).

Sampling and analysis

A single sample labelled as #R2004, was cut from one edge of the sword near the hilt using a fine jeweller's saw. To minimise visible damage to the cutting-edge the sample was cut in a shallow arc rather than as a wedge shape running into the edge. Consequently the sample was mounted flat so as to give a plan view of the edge rather than a section transversely through it. The sample was hot-mounted in a carbon-filled thermosetting resin, ground and polished to a 1um diamond finish. Analysis was by electron probe microanalysis with wavelength dispersive spectrometry; operating conditions were an accelerating voltage of 25kV, a beam current of 30nA, and an X-ray takeoff angle of 40°. Thirteen elements were sought, as listed in the accompanying table; pure element and mineral standards were used with a counting time of 10s per element. Detection limits were typically 100–200ppm with the exception of 400ppm for gold.

Ten areas, each 30×50μm, were analysed on the sample; the analysis areas were in a line running from the sound metal across the corrosion product at the cutting-edge of the sample. The individual compositions and the mean of those on the sound metal, normalised to 100%, are shown in the accompanying table. All concentrations are in weight %. After analysis the sample was examined metallographically in the as-polished state and etched states. The etch used was an acidified aqueous solution of ferric chloride further diluted with ethanol.

The alloy

The sword was cast in a leaded, low to medium tin bronze with 7.2% tin and 8.1% lead. The principal impurities were 0.19% iron, 0.16% cobalt, 0.23% nickel, 0.75% arsenic, 1.22% antimony, 0.32% silver and 3.7% sulphur; there was a possible small trace of zinc and some bismuth was detected in the corrosion products. The measured amount of lead needs some qualification. It has been discovered that Wilburton and contemporary swords were cast in such a way that there could be considerable segregation of lead from the surface to the centre line of the blade; an extreme example has been published where there is a 10:1 ratio between the two (Hughes, Northover and Staniaszek, 1982). More usually the ratio is of the order of 2:1 which would here give some 16% lead at the centreline, a not unreasonable value. The lead concentrations in the sword fragments from the Ivinghoe assemblage and single find mentioned above vary from 2.5% to 23.5%.

The bronze of the Wilburton period has been extensively analysed (Northover, 1982, Northover, 1988) and this sword is very typical of the great majority. The key features of Wilburton bronze are the use of leaded bronze, often heavily leaded, and an impurity pattern with elevated levels of arsenic

TABLE 1 Analysis of Ivinghoe Sword

Sample	Object	Part	Fe	Co	Ni	Cu	Zn	As	Sb	Sn	Ag	Bi	Pb	Au	S
R2004/1	Wilburton sword	edge	0.31	0.20	0.13	66.52	0.03	0.41	0.88	4.61	0.25	0.00	19.66	0.00	7.00
R2004/2			0.42	0.15	0.21	80.37	0.04	0.52	0.76	5.35	0.30	0.00	5.45	0.05	6.39
R2004/3			0.04	0.19	0.37	84.61	0.00	1.02	1.69	9.40	0.36	0.00	2.28	0.00	0.03
R2004/4			0.22	0.12	0.27	82.65	0.00	0.75	1.18	7.17	0.33	0.00	3.24	0.00	4.08
R2004/5			0.02	0.17	0.17	85.66	0.00	0.73	1.15	7.24	0.24	0.00	1.73	0.00	2.88
R2004/6			0.15	0.12	0.25	69.48	0.00	1.04	1.67	9.24	0.44	0.00	15.95	0.00	1.67
R2004/7			*0.07*	*0.12*	*0.22*	*53.65*	*0.01*	*1.25*	*2.29*	*13.83*	*0.34*	*0.00*	*10.32*	*0.06*	*1.50*
R2004/8			*0.21*	*0.15*	*0.24*	*27.41*	*0.03*	*1.95*	*2.92*	*23.45*	*0.27*	*0.04*	*9.48*	*0.00*	*0.19*
R2004/9			*0.13*	*0.18*	*0.36*	*39.47*	*0.08*	*2.06*	*2.85*	*20.04*	*0.44*	*0.00*	*6.38*	*0.00*	*0.10*
R2004/10			*0.62*	*0.20*	*0.31*	*7.50*	*0.03*	*2.27*	*3.51*	*26.09*	*0.14*	*0.10*	*18.22*	*0.11*	*0.11*
R2004/Mean 3.68	Wilburton sword	edge	0.19	0.16	0.23	78.22	0.01	0.75	1.22	7.17	0.32	0.00	8.05		0.01

and antimony, commonly with Sb > As, and significant nickel and silver concentrations. In some of this bronze cobalt is also an important impurity. In the literature it has been argued that this metal was imported into Britain, initially at the end of the Middle Bronze Age in the form of the precursors of the Wilburton sword, and that the metal had one or more sources in central or alpine Europe. The innovation of the Wilburton period itself was the development in Britain of a highly skilled bronzecasting industry based on the use of this imported bronze alloyed with lead produced in Britain (Northover, 1982, *op. cit,* Needham and Rohl, 1998). The use of lead in the alloy improved castability by reducing the viscosity of the melt, lowering the liquidus temperature and increasing the freezing range of the alloy. All these features would make it easier to fill a long, slender mould cavity and produce a sound casting.

While the impurity pattern of this sword fits very well within the general range of Wilburton bronzes that range is very broad and contains some potentially significant variations. One observation was that the total impurity concentration tended to decrease with time and that supposedly typologically early hoards, such as that from Andover, Hampshire, would have the highest concentrations of arsenic and antimony. Over the last two decades, however, our view of later Bronze Age chronology and typology has changed somewhat so it may be that the variations relate to different flows in the circulation of this type of bronze, and that there may be no clear overall chronological trend. More interesting in the context of this sword, is the variation of individual impurities, in this case cobalt. Most cobalt contents in Wilburton bronze are well below 0.1% and only a few percent of the total have, as this sword, more than 0.1%. This could ultimately point to a specific provenance for the metal but there is much more research to be done before that goal is reached.

A final feature of the composition is the high sulphur content. The copper used to make the bronze would have been smelted from copper ores of *Fahlerz* (grey ore) type, comprising copper-arsenic-iron and copper-antimony-iron sulphides. Imperfect roasting of the ore can mean that a high percentage of sulphur is tapped off with the metal. Its presence at this level suggests that the metal had not been remelted many times from the original copper, an idea supported by the 0.19% iron, a rather high value for Wilburton bronze. Often bronze is remelted in insufficiently reducing conditions and iron and sulphur, as well as antimony and arsenic, will tend to be lost to the oxide phase.

METALLOGRAPHY

The metallographic examination of a sample from a metal artifact can provide a great deal of information about both its manufacture and its subsequent history. To increase our understanding of the history of this sword a metallographic study was made (figures 4–5).

The process of manufacture of Bronze Age swords has recently been explored experimentally (Faoláin and Northover, 1999) so we are now better able to relate microstructure to process. Evidence from macro- and microstructure, and from sprue from Bronze Age swords, suggests very strongly that the weapons were cast in ceramic piece-

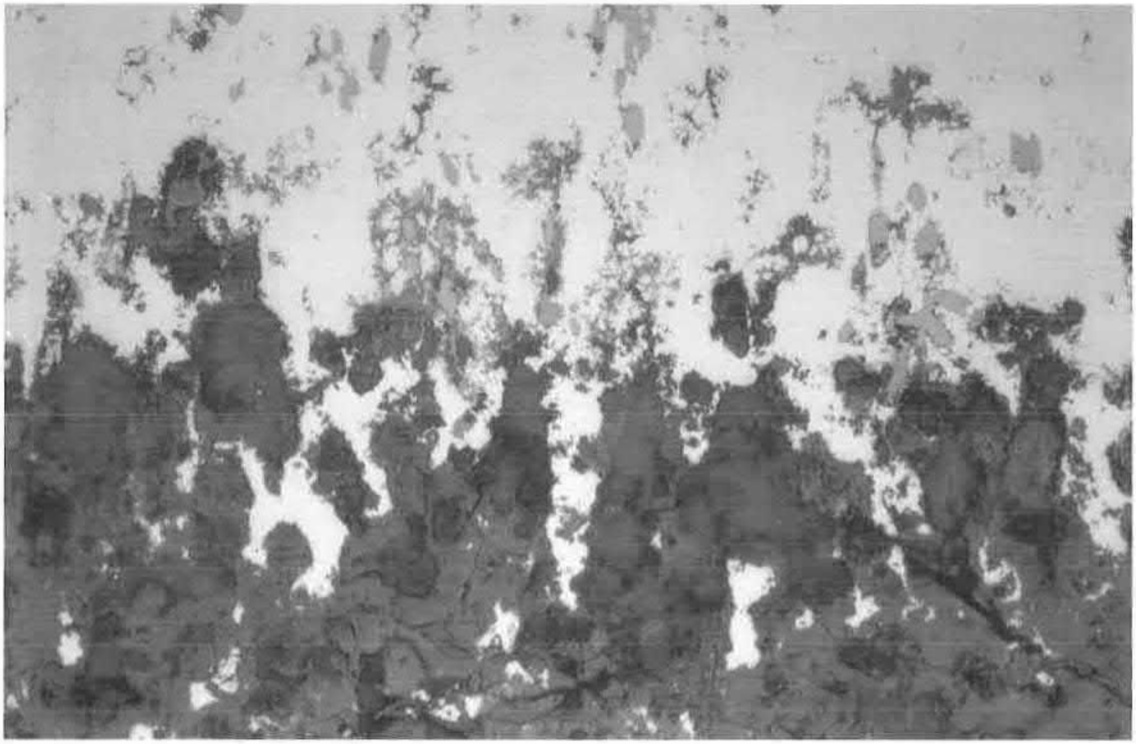

FIGURE 4 #R2004, sample mounted to give a plan view of the cutting-edge; corrosion is partly controlled by segregation of alloying elements and impurities in the microstructure so bands of internal intergranular corrosion are balanced by bands of bronze (α) phase preserved in the corrosion product, unetched, ×150.

moulds inclined at 30–40° to the horizontal, the sword being supported in the hearth used to preheat the mould. The mould could be heated to as high as 500–600°C before pouring, with the casting then being furnace cooled. It is this slow cooling which gives rise to the extreme segregation remarked on above. Some traces of the original cast structure remain in the microstructure but the sample area has been heavily modified by the forming and possible reforming of the cutting-edge of the sword.

Figure 4 shows the interface between the bulk of the sound metal in the sample and the corrosion products. The actual surviving edge of the sword is a little beyond the top of the image and it is clear that this part of the blade edge is almost entirely corrosion product. This is brittle and easily chipped and inspection of the edge suggests that the original edge of the sword has been lost although the present edge was probably very close to the original. The sound metal tongues of uncorroded bronze project into the corrosion product, reflecting segregation of both alloying elements and impurities in the metal. These tongues break up into isolated islands of the a phase. Corrosion also spreads into the sample in bands of intergranular corrosion, which are in effect a mirror image of the tongues of uncorroded bronze; the corrosion bands link the sulphide and lead inclusions and will be following high tin/high impurity bands in the microstructure. The copper sulphide inclusions, large, rounded blue-grey particles are very prominent. From the appearance of the intergranular corrosion the grain size must be rather small.

The outer layers of corrosion product are illustrated in more detail in figure 5 and contain only small uncorroded areas of bronze. Under plane polarised light much of this area appears translucent olive to brown and almost certainly corre-

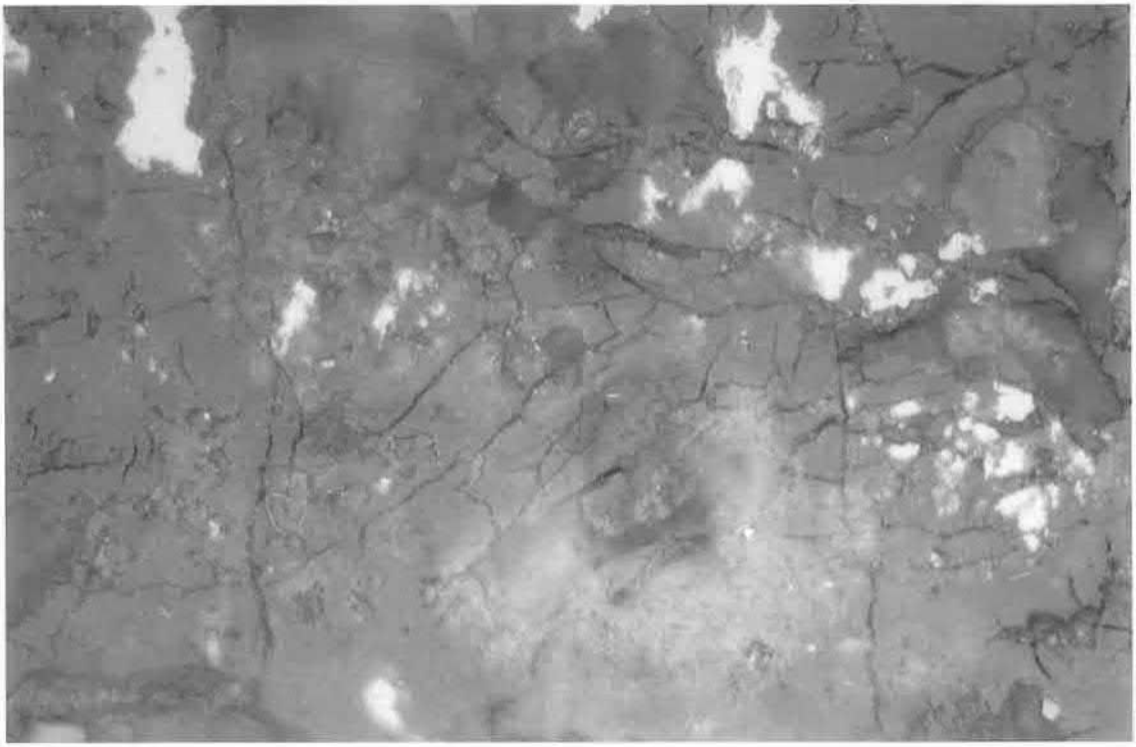

FIGURE 5 #R2004, detail of corrosion crust with preserved bronze particles (light); fractures are probably induced by the stress of the mounting process, unetched, ×750.

sponds to areas of tin compounds: the analysis of the corrosion products in the table show clearly that the corrosion products are dominated by tin and lead. The areas rich in lead corrosion products are likely to be much whiter and less translucent. At the outer edge will undoubtedly be some calcium carbonate picked up from the chalky burial environment. The fracturing of the corrosion product probably occurred during the mounting of the sample.

Details of the internal corrosion are not illustrated in this paper because of the fineness of the detail and because colour is required to convey the information in the structure most clearly. There is intergranular corrosion and it can be seen to relate to a very small grain size; more massive areas of corrosion show where lead particles have been replaced by corrosion products. The elongation of the sulphide inclusions from the forging of the cutting-edge may also be observed. Under plane polarised light the internal corrosion products vary from white (mainly lead compounds) to yellow to red (coloured by cuprite, Cu_2O). The sulphide inclusions are identified by appearing black under polarised light. As the field of view moves away from the edge the internal corrosion becomes more limited, but elongated sulphide inclusions remain a prominent feature. A lighter grey than the sulphides are broken up particles of the d phase of the copper-tin system (or given the antimony content, possibly κ phase of the antimony-copper-tin system). This phase is rather brittle and has been fractured by the forging of the cutting-edge. A final feature of the uncorroded metal is that some sulphide inclusions appear to be multi-phase

The etched microstructure is not illustrated because the very small grain size makes micrographs clear enough for reproduction very difficult to obtain. The grain size is indeed very small, certainly less than 10μm. At low magnification the grain structure is almost invisible and the view is dominated by a pattern of colour contrast from the residual segregation ("coring") remaining from the cast structure after the extensive working carried out to form the cutting-edge. The actual grain structure is fully recrystallised with equiaxed grains with annealing twins, all showing slip traces with duplex slip in many grains and some deformation of the grain outlines. The grain diameter is of the order of 7.5:m; the fine grain size increases both the toughness and hardness of the edge. This corresponds to a final cold reduction of 25–30% after the last anneal; the elongation of the sulphide inclusions indicates a minimum total reduction of some 60% in thickness from the original casting.

Conclusions

The sword found at Ivinghoe Beacon belongs to the Wilburton tradition and can be placed in variants E/F of the published typology. It is close to a small cluster of other Wilburton period (LBA I) finds close to the Chiltern scarp. A date in the eleventh century BC is plausible, although it could be slightly earlier. The composition is also very typical of Wilburton practice.

The sword would have been cast in a preheated ceramic piece mould and slowly cooled. With sufficient care in preparing the mould a sufficiently clean casting with a good surface can be produced which minimises the work of finishing. After removal from the mould any sprue and flash would be knocked off and, probably, some preliminary cleaning of the blade carried out. The hollow bevel to the cutting edge would then be rough formed with a suitably shaped light hammer. This forming would require a number of cycles of cold work and annealing, the annealing time and temperature not being sufficient for the as-cast segregation to be homogenised, although the cold work was sufficient to severely deform the dendritic pattern of the segregation. The edges, and the blade surface as a whole, would then be ground and polished, probably using both shaped stones and loose abrasives. The cutting-edge would be left in a moderately cold worked state to give it a sufficiently high yield stress but not so much that toughness is seriously reduced.

The hardness was not measured because of the interference from corrosion and segregation but could be expected to be in the range 190–200HV. In this condition in combat it could be expected that the blade edge would be deformed rather than chipped and so be repairable afterwards (Bridgford, 2000). The near-perfect state of the edges of this sword mean either that they have been successfully repaired by hammering out the damage, annealing and re-hardening the edge, or that the sword has never been used. With just a single small sample from the edge it is not possible to decide. Another aspect of the appearance of the sword concerns the dark patina formed of tin-rich corrosion products. This type of corrosion is known to provide good preservation of original surface detail and grinding and polishing marks do survive on the blade. The question here, though, is whether the patina is natural or artificially produced. If it had been artificially made it would have given the sword a clear dark, almost black, patina similar to those in Chinese black bronze mirrors, rather than a golden bronze one. Absolute certainty is not possible because of the extent of corrosion and the loss of the absolute edge of the blade. On the balance of probability the patina is natural but the excellent state of preservation of the sword at least allows us to ask the question.

The final problem to consider is the find-spot of the sword. We have become used to the discussion of the deposition of items of prestige metalwork in watery and waterlogged environments, but the context of the Ivinghoe Beacon sword is the very opposite. It should be noted that riverine or lacustrine deposition is by no means universal, Bronze Age weapons in Wales being frequently being deposited on summits or mountain passes. Perhaps something like this applies to Ivinghoe Beacon and the other Wilburton finds in the area, around a major gap in the Chiltern scarp and at a considerable elevation. The exact context in the rampart needs further consideration given the current dating of Wilburton metalwork to the eleventh century BC or even a little earlier, but if the hill fort can be, as has been suggested, related to ritual activity the sword might well be connected.

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