# A Gündlingen type sword from the Polesfleet Stream in Crawley

By Jaime Kaminski

*In 1952 a Late Bronze Age Gündlingen type sword was recovered from the Polesfleet Stream near Crawley, West Sussex. Cast from a low-lead bronze alloy, this sword is one of an above average number of Gündlingen type swords which have been recovered from rivers and other watery places. Microscopic examination of the sword blade reveals that it was undamaged when it entered the Polesfleet Stream and may have been made specifically for the purpose of votive deposition.*

## INTRODUCTION

In June 1952 workmen employed to canalise the Polesfleet Stream in Crawley discovered a Late Bronze Age sword at a depth of 60–90cm (*see* Fig. 1).[1] The works, close to the junction with the River Mole (TQ 2611 3944), north of what is now Langley Green, were carried out for the Crawley Development Corporation as part of the extensive works for Crawley New Town which had begun in the late 1940s.[2] The sword remained in the possession of the Crawley Development Corporation until its dissolution in 1962, when it was donated to Crawley Museum.

## DESCRIPTION

The Crawley sword is an example of a Hallstatt C sword of Gündlingen type (*see* Fig. 2).[3] It consists of a generally well-preserved blade with a small stub of the tang remaining.[4] Gündlingen swords are characterised by wide tangs, short, widely-splayed shoulders and a short ricasso. The blades are long and narrow, with beading and grooving. Their overall shape is similar to that of Ewart Park swords, but they can be differentiated by variations in the shape of the tang and pommel.[5] Swords of the Gündlingen type date to the Llyn Fawr metalwork phase (*c.* 800–650 BC), which marks the transition from the Late Bronze Age to the Early Iron Age.[6]

The Crawley sword is 613mm long and weighs 646.5g. The blade, which extends from the ricasso to the point, is the principal component of any sword; the Crawley example has a blade length of 570mm and a maximum blade width of 32mm. The width is entirely characteristic of Gündlingen blades, the majority of which cluster between 30 and 40mm (*see* Fig. 3). The estimated width of the sword at the shoulders is 66mm[7] and its median thickness prior to the taper is 7mm. Gündlingen type swords have been divided typologically into five separate variants (a1, a2, b, c and d) based on the morphology of the tang.[8] The loss of the tang means that the Crawley sword remains unclassified.

The blade sections of Gündlingen swords are broadly lenticular. In the Crawley example the distinctive bevels are oriented approximately 20 degrees below the horizontal. There is a slight bend in the blade two degrees below the horizontal, beginning 80mm from the tip. It is unclear if the blade was bent in antiquity or during recovery by the workmen in 1952, but the bend is sufficiently inconspicuous to suggest it was not an example of ritual destruction.

The sword blade was in pristine condition when it entered the stream. The only edge damage is apparently recent in origin and comprises a linear gash which begins 24.8mm below the shoulder and extends along the upper length of the blade edge (*see* Fig. 4).[9] The metal on this gash is unpatinated and the damage was probably caused during recovery. The gash extends from the blade, across the ricasso and into the shoulder, where it slices through one of the rivet holes. It is highly unlikely that this could have been done when the hilt plates were still attached. The blade edge does not show any evidence of resharpening.

Many western European swords of the Late Bronze Age have leaf-shaped blades. The widest part of the blade is usually about two thirds of the way down from the terminal. The Crawley sword employs an intriguing optical illusion. Visually, it appears to be leaf-shaped, yet the blade edges are parallel prior to the taper (the blade width ranges between a maximum of 32mm and a minimum of 30.5mm, deviating by only 1.5mm across its

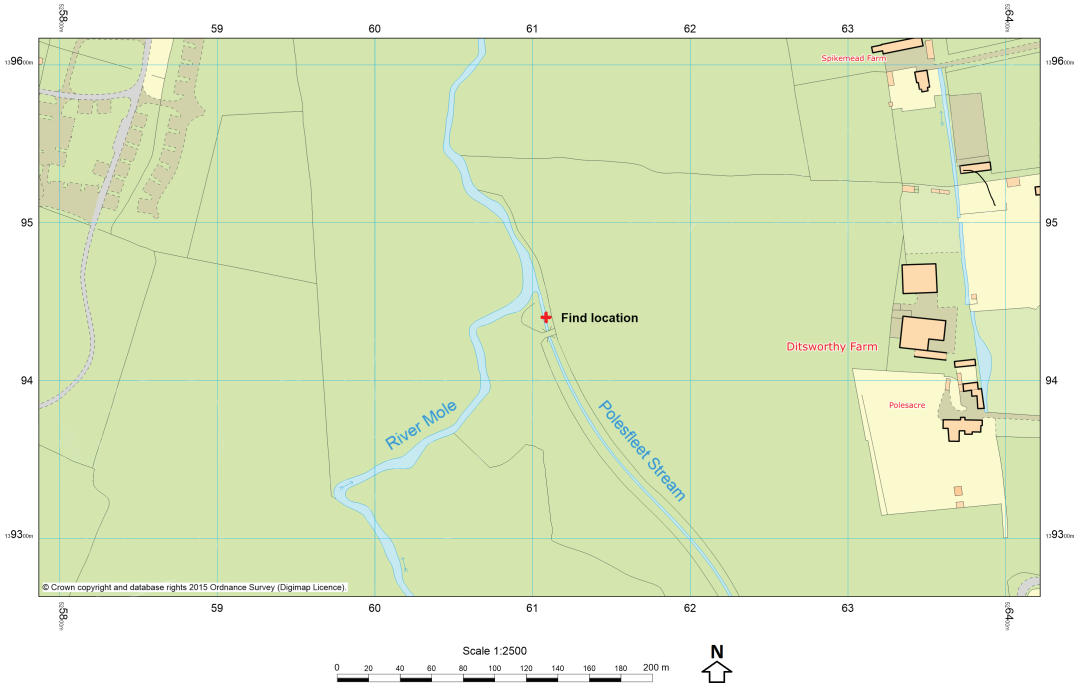


Fig. 1. The find spot of the Crawley sword.

Fig. 2. The Crawley sword (front and reverse views, scale in cms).

length). The illusion has been created by subtle variations in the width of the blade bevel.

**THE TANG**

Only 20mm of the tang remains, the rest having broken off 38mm above the shoulder (*see* Fig. 4). The break is heavily patinated, suggesting that it is an old fracture rather than one caused during recovery.[10] The break has occurred at a rivet hole which has created a plane of weakness.

Three of the bronze rivets used to hold the hilt plates in place are still attached. The rivets are not round in section but have squared edges and are approximately 3.4mm in diameter at the centre and 3.7mm at the splayed terminals. The rivets give an indication of how the hilt grips were fastened to the tang. Holes would have been made in the hilt plates which aligned with the holes in the tang. Rivets of approximately 3.4mm diameter would then have been hammered through the holes in

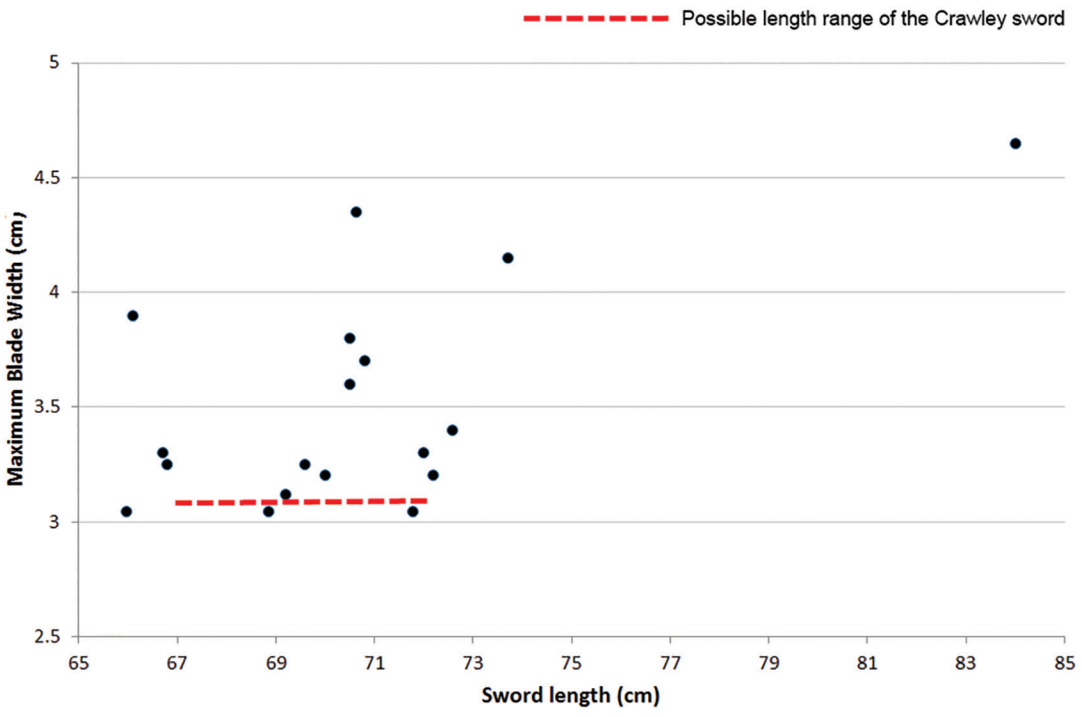


Fig. 3. A comparison of the sword length and blade width of complete Gündlingen type swords from Britain with that of the Crawley sword.


Fig. 4. The fractured tang of the Crawley sword (front and reverse views).

the hilt plates and tang. The irregular squared edges of the rivets would have helped the rivet grip the rivet hole. Then, with the base of the rivet on a solid surface such as an anvil, the upper end of the rivet would have been hammered. This would have caused the head of the rivet to expand, thereby holding the hilt plates in place. The process would then have been reversed. The hilt would have been turned over and the expanded head of the rivet would have been placed on a solid surface and the other end of the rivet hammered. Hammering both ends might also bend the rivet slightly, which would further help hold the rivet in place. One of the remaining rivets on the tang shows just such bending. The rivets were possibly supplemented by hide, or other glue, to hold the hilt plates in place. Experimental archaeologists and re-enactors have found that the hilt plates can become loose after a while if held solely by the rivets. Once both ends had been hammered, the heads of the rivets would have been filed flush with the hilt plates.

The nature of Gündlingen hilts and pommels is poorly understood. This contrasts to the contemporary Mindelheim type sword for which a number of exotic hilt plates and pommels have been preserved. Some of these have been carved from ivory, with cut-outs for amber or red coral inlays; others have bronze pommels.[11] In contrast, there are far fewer examples of preserved Gündlingen hilt plates and pommels. The Gündlingen (variant d) sword found during gravel extraction at Holme Pierrepont, Nottinghamshire, in 1966 apparently held hilt plates of wood, bone, antler or horn before these subsequently disintegrated.[12] A 2003 metal detectorist working in St Erth parish, Cornwall, exposed a fragment of the copper alloy grip from a Gündlingen type sword. This had one rivet hole extant in the grip and one at the head of either shoulder.[13] A wooden model of a Gündlingen sword recovered at Cappagh, Co. Kerry, reveals a pommel in the shape of a truncated cone which was oval in plan.[14] This is a simplified version of the Mindelheim pommel.[15]

The projection of the rivets above the tang also gives an indication of the thickness of the hilt. The three remaining rivets indicate that each part of the handle would have been 4.5mm at the centre, decreasing to 3.0mm at the periphery.

## PRODUCTION

The casting of a sword like the Crawley example was a highly skilled operation.[16] It appears that a low-lead alloy was used.[17] This is broadly consistent with the data derived from metallurgical analysis of a limited number of Gündlingen swords (*see* Table 1).[18]

The quantity of lead in the alloy is generally much reduced from that of the preceding Ewart Park swords, the majority of which contain quantities ranging between four and 11 percent.[19] The low levels of lead broadly correspond to the levels seen in swords of Carp's Tongue type.[20]

The sword was cast through the handle in a bivalve mould. Such moulds were made from stone, clay or sand.[21] It is possible that the sword was modelled on a wooden pattern or another extant sword.[22] There are no casting defects on the remaining parts of the blade. Once cast, the sword would have been fettled in order to remove excess moulding materials and casting irregularities. After fettling, increasingly fine abrasive materials would have been used to polish the blade. Fine striations running parallel to the length of the blade are the remnants of polishing, although it is unclear whether this polishing was part of the production process or undertaken while the sword was in use (*see* Fig. 5). The absence of any wear on the blade suggests that the sword could either have been unused or had a use that left no indication on the blade when it was deposited in the stream.

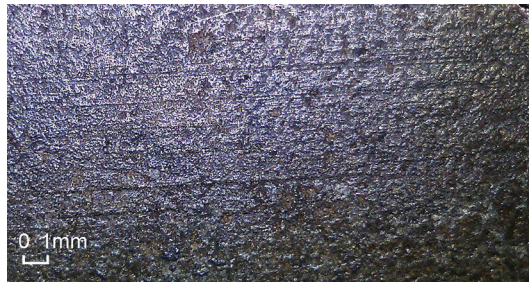


Fig. 5. Fine striations running parallel to the length of the blade of the Crawley sword.

## SITE OF DEPOSITION

The sword was found at approximately 59m AOD in the Polesfleet Stream, 15–20 metres from the junction with the River Mole.[23] This river rises in

Table 1. Material composition of Gündlingen type swords from Britain and Ireland.

| Provenance | Location | Acc. No. | Composition | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cu | Sn | As | Sb | Pb | Co | Ni | Ag | Zn |
| Brogyntyn, Salop | National Museum of Wales | 32.254 | 84.83 | 10.60 | 0.17 | 0.18 | 4.10 | 0.02 | 0.10 | x | x |
| Possibly the River Thames | Museum of London | O.1351 | 88.95 | 6.68 | 0.23 | 0.47 | 3.50 | tr | 0.17 | tr | x |
| River Bann at Gortgole | Ulster Museum, Belfast | UML.24: 1936 | 87.0 | 11.7 | nd | 0.39 | 0.54 | nd | 0.15 | 0.15 | 0.04 |
| River Bann | Ulster Museum, Belfast | UM 104: 1951 | 84.7 | 14.0 | nd | 012 | 1.2 | nd | 0.086 | 0.066 | 0.04 |
| Portora, Co. Fermanagh | Queen's University, Belfast | – | 89.1 | 10.1 | 0.19 | 0.10 | 0.50 | nd | 0.069 | 0.057 | 0.04 |

Baldhorns Copse, south of Rusper, West Sussex. It skirts the northern suburbs of Crawley where it is joined by the Polesfleet Stream and flows broadly north to join the Thames at Molesey.[24] The locality comprises solid geology of Lower Cretaceous Weald Clay, with alluvial drift deposits from the River Mole.[25]

The Crawley area and the western Low Weald are generally sparse in Bronze Age remains.[26] One exception to the relative dearth of Bronze Age activity is a partially enclosed Late Bronze Age settlement lying on the edge of the River Mole floodplain in the north-west zone of Gatwick Airport, just two kilometres north of the junction of the Mole and the Polesfleet.[27]

Analysis of pollen, macrobotanical and insect remains indicates that the settlement was sited in an area of previously cleared woodland and forest. An open landscape of grassland extended over the floodplain, with scattered alder and willow carr, pondweed, bur-reed, reedmace and sedges.[28] Cultivation was thought to have taken place on the higher ground rather than the floodplain. As the settlement developed, the landscape witnessed increased clearance and the floodplain became drier, possibly because of the modification and management of the watercourses and the increasing intensity in land use.[29]

In view of the close geographical proximity of the Gatwick Airport site, which spans the Late Bronze Age, it seems probable that at the time of the sword's deposition the environment at the junction of the Polesfleet and the Mole would have been marshy, intermixed with damp grassland and dotted with alder-willow carr.

## WATERY DEPOSITION

Gündlingen type swords are frequently deposited in watery places, especially in northern and western Europe.[30] In Britain, 28 examples of Gündlingen type swords have been recovered from watery contexts, compared with nine from dry land contexts (*see* Table 2). The river finds are dominated by those from the River Thames, with smaller concentrations in the Tyne and the Tay.[31]

Table 2: The context of Gündlingen type sword finds from Britain.

| Variant | Total | Land | Watery | Unprovenanced | Water/land |
|---|---|---|---|---|---|
| a2 | **1** | 0 (0%) | 1 (100%) | 0 (0%) | 100% |
| b | **13** | 3 (17%) | 8 (66%) | 2 (17%) | 73% |
| c | **6** | 1 (17%) | 5 (83%) | 0 (0%) | 83% |
| d | **8** | 1 (13%) | 7 (87%) | 0 (0%) | 87% |
| Unclassified | **18** | 4 (22%) | 6 (33%) | 8 (44%) | 60% |
| **TOTAL** | **46** | 9 (19%) | 27 (59%) | 10 (22%) | 75% |

Of course, with less dredging taking place in 21st century Britain and more metal detector finds being recorded through the Portable Antiquities Scheme, it is likely that the ratio of land finds will gradually increase, relative to water finds.

The association between Gündlingen type swords and watery deposition is also evident in Ireland. Here 26 Gündlingen type swords (classified as Eogan's Class 5) have been found in rivers and lakes, with most coming from the Rivers Bann and Shannon, with an additional two swords from the Golden Bog of Cullen, in Tipperary. The remaining 16 examples of Gündlingen type swords are provenanced only to the country or county, so little can be said regarding their depositional context.[32]

It is unclear if the Crawley sword was deposited with its scabbard. Being made predominantly of organic material the scabbard is unlikely to survive, while the metal scabbard fittings are likely to detach when the scabbard decays. There is, however, tentative evidence that at least some swords were deposited with their scabbards.

A complete Gündlingen type (variant b) sword (J.93-436) with chape (J.93-436) was discovered alongside another sword of the same type and variant in 1861 at Ebberston, East Yorkshire, "with human bones and other objects".[33] In Henley-on-Thames, Oxfordshire, a Gündlingen (variant b) sword was discovered during the digging of a cutting for the Thames. The sword had a distinctive khaki-coloured patina which was not present on the blade tip. This suggested that the blade was deposited with the scabbard chape attached and that this was subsequently lost. On the continent, Gündlingen Hallstatt C swords are often associated with winged or boat-shaped chapes. In County Galway, Ireland, two such chapes have been found at Keeloge Ford on the River Shannon, where a sword of Gündlingen type was also found.[34]

Clearly there is a long established association between the deposition of Bronze Age swords and other metalwork in watery places across Britain.[35] Such deposition is most evident in the major river systems and wetlands on the eastern side of Britain, such as the Thames and the East Anglian fenland.

While the Crawley region and the wider Weald may seem an unusual choice for watery deposition, there are tentative clues that such practices may have been undertaken in the locality. Just 9.5 kilometres to the south of the Polesfleet Stream three Sussex Loops and a bronze ring were found in "a moss" at Handcross, near Crawley, prior to 1833.[36] The apparent location of the assemblage is intriguing. It could imply deposition in a watery location and, if so, would be the only known example of Sussex Loops deposited in this way. Analysis of Bronze Age hoards from the Sussex Weald reveals an association between certain hoards and the sites of springs and rivers.[37]

It is evident that the peoples of the Late Bronze Age inhabited a complex ritual world in which deposition in watery places was one of many different forms of votive activity. For example, the Late Bronze Age pit and post-hole complex in the northern part of the Gatwick Airport site included two features with deposits interpreted as votive offerings in tree throws.[38] These were interpreted as either pottery offerings placed in the ground below upstanding trees (possibly a shrine), or as offerings placed in tree holes after tree clearance, possibly as part of an act of replenishment or appeasement.

There may be another reason for the choice of the Crawley region for the deposition of a Late Bronze Age sword. It may be that increasing awareness of the iron resources of the Weald had been a driver for the act of deposition at a time of transition.

There are differences between the condition of Gündlingen type swords which have come from watery places and those from dry land contexts. Those from watery contexts tend to be complete, or very nearly complete; of the six unidentified finds from watery contexts, four have part of the tang missing while two have the blade tip missing (*see* Table 3).[42]

The missing tang evident on some Gündlingen swords, including the Crawley example, is intriguing. The patina on the tang of the Crawley sword indicates that the fracture occurred prior to the recovery of the sword in 1952. The tang itself is comparatively robust and, while it is thinner than the blade, the addition of a flange creates an H-shaped profile which increases rigidity.[43] This increased rigidity is somewhat compromised by the addition of the rivet holes required to hold the hilt plates in place, which adds a plane of weakness. However, it may be that the break was natural following this plane of weakness, although it has been suggested that in some instances the hilt plates were deliberately removed prior to deposition, which may have unintentionally led to the fracture of the tang. The hilt plates may have held

Table 3. The provenance and dimensions of Gündlingen type swords from Britain of variants a–d and unclassified (U).

| Variant | Provenance | | Water find | Land find | Complete | Length (cms) | MBW (cms) | Discovery date | Reference |
|---|---|---|---|---|---|---|---|---|---|
| **a2** | Brentford, Middlesex | R. Thames | ✓ | x | ✓ | 71.80 | 3.05 | 1864 | 702 |
| **b** | Wandsworth Bridge, London | R. Thames | ✓ | x | ✓ | 70.50 | 3.60 | 1907 | 703 |
| **b** | Henley, Oxfordshire | R. Thames | ✓ | x | ✓ | 68.85 | 3.05 | Before 1882 | 704 |
| **b** | Newark, Nottinghamshire | R. Trent | ✓ | x | ✓ | 66.70 | 3.30 | Before 1936 | 705 |
| **b** | River Thames | R. Thames | ✓ | x | ✓ | 70.80 | 3.70 | Before 1923 | 706 |
| **b** | Ebberston, Yorkshire | | x | ✓ | ✓ | 70.50 | 3.80 | 1861 | 707 |
| **b** | Unknown | Unknown | ? | ? | ✓ | 70.65 | 4.35 | Before 1847 | 708 |
| **b** | Brentford, Middlesex | R. Thames | ✓ | x | ✓ | 72.50 | ? | 1864 | 709 |
| **b** | Battersea, London | R. Thames | ✓ | x | ✓ | 72.60 | 3.40 | ? | 710 |
| **b** | Brentford, Middlesex | R. Thames | ✓ | x | ✓ | 40.50 | 2.90 | 1897 | 711 |
| **b** | London | R. Thames | ✓ | x | x | 20.90 | NA | ? | 712 |
| **b** | Ebberston, Yorkshire | | x | ✓ | x | 61.10 | NA | 1861 | 713 |
| **b** | Unknown | Unknown | ? | ? | ✓ | 72.20 | 3.20 | ? | 714 |
| **b** | North Tuddenham, Norfolk | Founder's hoard | x | ✓ | x | ? | ? | 2001 | NMS2464 |
| **c** | Newcastle upon Tyne, Northumberland | R. Tyne | ✓ | x | ✓ | 69.20 | 3.12 | Before 1903 | 715 |
| **c** | Newcastle upon Tyne, Northumberland | R. Tyne | ✓ | x | ✓ | 69.60 | 3.25 | Before 1886 | 716 |
| **c** | Taplow, Buckinghamshire | R. Thames | ✓ | x | ✓ | 72.00 | 3.30 | 1936 | 717 |
| **c** | Kingston upon Thames, Surrey | R. Thames | ✓ | x | ✓ | 61.60 | 3.30 | Before 1963 | 718 |
| **c** | Battersea, London | R. Thames | ✓ | x | ✓ | 70.00 | 3.20 | ? | 719 |
| **c** | North Tuddenham, Norfolk | Founder's hoard | x | ✓ | x | ? | ? | 2001 | NMS2464 |
| **d** | Bray, Berkshire | R. Thames | ✓ | x | ✓ | 84.00 | 4.65 | 1951 | 738 |
| **d** | Perth, Perthshire | R. Tay | ✓ | x | ✓ | 73.70 | 4.15 | 1877 or before | 739 |
| **d** | Brechin, Angus | Peat moss | ✓ | x | ✓ | 66.80 | 3.25 | ? | 740 |
| **d** | Unknown | Unknown | ? | ? | ✓ | 50.20 | 4.20 | 1809 | 741 |
| **d** | Holme Pierrepont, Nottinghamshire | Gravel | ✓ | x | ✓ | 66.10 | 3.90 | 1966 | 742 |
| **d** | Rhynd, Perthshire | R. Tay | ✓ | x | x | 62.90 | 3.38 | ? | 743 |
| **d** | Nr Renfrew, Dunbarton | R. Clyde | ✓ | x | ✓ | 65.95 | 3.05 | ? | 744 |
| **d** | Wandsworth, London | R. Thames | ✓ | x | x | 64.50 | ? | ? | 745 |
| **U** | Billinghay, Lincolnshire | Billinghay Dales | x | ✓ | x | 48.90 | 4.00 | 1852 | 720 |
| **U** | Billinghay, Lincolnshire | Billinghay Dales | x | ✓ | x | 61.80 | 4.20 | 1852 | 721 |
| **U** | Unknown | Unknown | ? | ? | x | 60.30 | 3.05 | ? | 722 |
| **U** | Brechin, Angus | Peat moss | ✓ | x | x | 66.00 | 3.65 | ? | 723 |
| **U** | Unknown | Unknown | ? | ? | x | 47.85 | 3.35 | ? | 724 |

Table 3. (*continued*).

| Variant | Provenance | | Water find | Land find | Complete | Length (cms) | MBW (cms) | Discovery date | Reference |
|---|---|---|---|---|---|---|---|---|---|
| **U** | Unknown | Unknown | ? | ? | x | 64.20 | 3.90 | ? | 725 |
| **U** | Crawley | Polesfleet Stream | ✓ | x | x | 61.30 | 3.20 | 1952 | 726 |
| **U** | Teddington, Middlesex | R. Thames | ✓ | x | x | 35.30 | 3.10 | Before 1961 | 727 |
| **U** | Mugdrum Island, Perth | R. Tay | ✓ | x | x | 62.20 | 2.55 | Before 1899 | 728 |
| **U** | Newcastle upon Tyne | R. Tyne | ✓ | x | x | 60.10 | 2.75 | Before 1923 | 729 |
| **U** | Cantray, Strathnairn [39] | Unknown | x | ✓ | x | 65.30 | 3.00 | Unknown | 730 |
| **U** | Unknown | Unknown | ? | ? | x | 60.20 | 3.25 | ? | 731 |
| **U** | Brogyntyn, Shropshire | Unknown | ? | ? | x | 38.00 | 3.05 | Before 1850 | 732 |
| **U** | Unknown | Unknown | ? | ? | x | 32.00 | 2.95 | Before 1824 | 733 |
| **U** | Boyton, Suffolk | While ploughing at Boyton | x | ✓ | x | 2.40 | ? | ? | 734 |
| **U** | Witton, Norfolk[40] | Unknown | ? | ? | x | 7.50 | 2.90 | 1964 | 735 |
| **U** | Unknown | Unknown | ? | ? | x | 13.50 | ? | ? | 736 |
| **U** | Lambeth, London | R. Thames | ✓ | x | x | 32.00 | ? | Before 1877 | 737 |
| **U** | Jackfield, Shropshire | R. Severn | ✓ | x | x | ? | ? | 1992 | Bell and Watson 1993 [41] |
| **U** | Crundale, Kent | Founder's hoard | x | ✓ | x | 60.60 | 36.3 | 2003 | PAS ID: KENT-7C3863 |

ritual significance as objects of retained memory, heirlooms, or simply practical components to be used on another sword.[44] Alternatively, some swords may have been made ritually unusable through the destruction of the pommel.

In contrast to the relatively complete water finds, the dry land finds are often fragmented. Some examples from the plough soil could have been damaged during episodes of ploughing. None have definitely been found with a burial, although the Gündlingen type variant b sword discovered in 1861 at Ebberston, Yorkshire, was found with "human bones and other objects".[45] Gündlingen type swords are increasingly found as fragments in apparent founders' hoards. For example, an 82 piece Late Bronze Age founder's hoard from North Tuddenham, Norfolk, included two complete socketed axe heads, eight complete spearheads and nine complete gouges. There were also fragmentary gouges, spearheads, socketed axes, swords, knives, two bag-shaped chapes, a fragment of winged axe, part of an axe mould, three casting sprues and three lumps of copper alloy cake. The sword fragments were of the Ewart Park and Carp's Tongue traditions, and one variant b and one variant c fragment of Gündlingen sword hilts.[46]

A Late Bronze Age founder's hoard from Crundale, Kent, contained 188 objects including 57 south-eastern type socketed axe fragments, 16 spearheads, large numbers of broken tools, 37 ingot fragments and metalworking equipment. One Gündlingen sword fragment, 17 Ewart Park and 10 Carp's Tongue sword fragments were also included.[47]

## CONCLUSIONS

The Gündlingen swords are some of the last of the cast Bronze Age swords to have been produced and used in Britain. During the later Bronze Age the experience and skill of the bronze smiths was at its height, which is reflected in the fineness of this sword.

The Crawley sword is one of an above average number of Gündlingen type swords which have

come from rivers and other watery places. The practice of depositing swords in watery places is evident throughout the British Isles and much of Europe. The sword blade appears to have been undamaged when it entered the Polesfleet Stream; microscopic examination of the blade edge could discern no unambiguous evidence, such as nicks or indentations, of use wear. This lack of practical use is further reiterated by the lack of evidence for resharpening of the blade. It could be, therefore, that the sword was made specifically for the purpose of votive deposition. Alternatively, any use that the blade was put to prior to deposition was entirely symbolic or ritual and involved no physical damage to the blade itself.

## NOTES

1 The find was first published in the Surrey Archaeological Collections. In the 1950s the Surrey county boundary ran less than 200 metres south of the find spot. Changes to local government boundaries in 1974 drew the find spot into West Sussex. 'Bronze Age sword found', *Crawley Observer*, 26 Sept. 1952; G. D. Johnston, Bronze Age Sword, *Sussex Notes and Queries* **13** (1953), 291; A. W. G. Lowther, A Late Bronze Age sword from Charlwood, *Surrey Archaeological Collections* **55** (1957), 122–123.

2 *cf*. T. P. Hudson (ed.), Crawley New Town, *A History of the County of Sussex* **6** (3): Bramber Rape (North-Eastern Part) including Crawley New Town (1987).

3 Unfortunately, the loss of the diagnostic pommel piece of the tang means that it is impossible to define the subtype. J. D. Cowen, The Hallstatt sword of bronze: On the continent and in Britain, *Proceedings of the Prehistoric Society* **33** (1967), 401–406.

4 The sword exhibits little evidence of corrosion, which may be a function of the anaerobic conditions in the river and/or the relatively high tin content in the alloy mix.

5 I. Colquhoun and C. B. Burgess, *The swords of Britain* (Munich: C. H. Beck, 1988), 112–121.

6 B. O'Connor, Llyn Fawr metalwork in Britain: a review, in C. Haselgrove (ed.), *The Earlier Iron Age in Britain and the near Continent* (Oxford: Oxbow Books, 2006), 54–79. The Gündlingen sword type was made only from bronze, while the contemporary Central European Mindelheim sword was made from both bronze and iron.

7 One shoulder was damaged during recovery. The 66mm is an extrapolation of the width from the centre line of the sword to the surviving shoulder (33mm).

8 The typology developed by Cowen (1967) includes variant a1 (no example of variant a1 has been found in Britain); variant a2, which can be distinguished from variant a1 because the sides of the terminal converge towards the top, rather than being square, and the rivet hole is towards the centre; variant b, in which the height of the pommel-piece is not more than half the width and variant c, characterised by a deep V or U-shaped notch at the terminal of the tang.

9 The deformation of the metal along the line of the gash indicates that the force was exerted from the direction of the ricasso towards the hilt.

10 This contrasts to the edge damage, which is a much fresher break with no patina.

11 This was achieved by riveting bronze side-plates to the tang, in the same way as side-plates made of wood, bone, antler or horn are riveted. Cowen (1967), 47, 1.

12 Colquhoun and Burgess (1988), 120.

13 The fragment weighing 29.1g was 47mm in length, 23.2mm wide and 8mm thick (PAS ID: CORN-F4CC17).

14 J. Waddell, *The prehistoric archaeology of Ireland* (Bray: Wordwell, 2000), Fig. 13.5.

15 Although how far this can be extrapolated to Gündlingen pommels in general is open to question.

16 S. Ó. Faolain, *Bronze artefact production in Late Bronze Age Ireland* (Oxford: British Archaeological Reports, Brit. Ser. **382,** 2004).

17 A handheld X-Met 500 portable X-Ray Fluorescence (pXRF) spectrometer was used to analyse seven areas of the metal on the blade and remaining section of the tang, but without any preparation or removal of corrosion products. While there are issues with such analyses, such as tin enrichment at the surface and composition distortions caused during corrosion, the results do broadly indicate low lead levels which are characteristic of the limited number of Gündlingen type swords which have been analysed. The analyses of the sections examined consistently reported an alloy content of approximately 80 percent copper, 16 percent tin, two percent lead, and antimony, arsenic, cobalt, nickel and zinc amounting to less than one percent in total. Percentage composition of the Crawley sword derived from pXRF analysis: (Cu) 80.29; (Sn) 16.03; (As) 0.24; (Sb) 0.41; (Pb) 2.61; (Co) 0.05; (Ni) 0.16; (Zn) 0.08.

18 Sources for Table 1: Colquhoun and Burgess (1988), 146 and Eogan (1965), 183.

19 There are Ewart Park swords outside of this range, which include the example from Shoebury (unclassified south-eastern), which appears to have had no lead added (0.096%) and the Penrhyndeudraeth (Western Step 3), which had 23 percent lead. Colquhoun and Burgess (1988), 144–5.

20 M. A. Smith and A. E. Blin-Stoyle. A sample analysis of British Middle Bronze Age materials using optical spectroscopy, *Proceedings of the Prehistoric Society* **25** (1959), 188–209.

21 No Gündlingen stone moulds have been recovered from Britain. For clay sword mould fragments *see* Eogan (1965), 176–179 and Fig. 95.

22 However, the wooden sword model recovered at Cappagh, Co. Kerry, appears not to have been a template for a sword. *See* B. P. C. Molloy, 'What's the bloody point: Swordsmanship in Bronze Age Ireland and Britain', in B. P. C Molloy (ed.), *The cutting edge: Archaeological studies in combat and weaponry* (Stroud: The History Press, 2007), Fig. 27.

23 The location of the find spot was confirmed in October 1965 by Robin M. Clarke, manager of the Crawley Development Corporation at the time of the discovery. Attempts in October 1965 by the Ministry of Works to elicit more information about the find location met with

little success because the workmen who had discovered the sword had long since moved out of the area. *See* 1:2500 Plan A.O. 2010.16/16 (Crawley Development Corporation).

[24] The fall between their source and the River Thames is approximately 95 metres. From its source to its confluence, the River Mole is about 80km long and has a catchment of 512km$^2$.

[25] The Weald Clays are a collection of slowly permeable clayey soils, with similar fine loamy, clayey soils that yield lower quality grade 3b agricultural land. The slow permeability often gives rise to seasonal waterlogging. See *British Geological Survey* **302**, Solid and Drift.

[26] *cf.* A. Ellison, The Bronze Age, in P. L. Drewett (ed.), *Archaeology in Sussex to AD1500* (London: Council for British Archaeology, 1978), 30–37; M. Gardiner, Archaeology of the Weald – a Survey and a Review, *Sussex Archaeological Collections* (hereafter *SAC*) **128** (1990), 33–54; R. B. Harris, *Crawley: Historic Character Assessment Report*, West Sussex County Council (2008).

[27] N. A. Wells, Excavation of a Late Bronze Age enclosure site at Gatwick Airport 2001, *SAC* **143 (**2005), 47–69.

[28] R. Scaife, 'Pollen', in N. A. Wells (ed.), Excavation of a Late Bronze Age enclosure site at Gatwick Airport 2001, *SAC* **143** (2005), 57–63.

[29] M. J. Allen, 'The Late Bronze Age Wealden landscape', in N. A. Wells, (ed.), Excavation of a Late Bronze Age enclosure site at Gatwick Airport 2001, *SAC* **143** (2005), 66–68.

[30] R. Bradley, *The passage of arms: An archaeological analysis of prehistoric hoards and votive deposits* (Oxbow: Oxford, 1998), 152; S. Hansen, *Studien zu den Metalldeponierungen während der älteren Urnenfelderzeit zwischen Rhônetal und Karpatenbecken* (Bonn: Habelt, 1994).

[31] T. Cowie and M. A. Hall, A new look at the Late Bronze Age metalwork from the Tay, in D. Strachan (ed.), *Carpow in context: A Late Bronze Age logboat from the Tay* (Edinburgh: Society of Antiquaries of Scotland, 2010), 151–162.

[32] G. Eogan, *Catalogue of Irish bronze swords* (Dublin: The Stationery Office, 1965), 13–15; B. Raftery, *Pagan Celtic Ireland* (London: Thames and Hudson, 1994).

[33] E. Howarth, *Catalogue of the Bateman Collection in the Sheffield Public Museum* (London: Dulau and Co, 1899), 65 and 77; Colquhoun and Burgess (1988), 117, Nos. 707 and 713.

[34] There are 11 Hallstatt C type chapes recorded in Ireland. Eogan (1965), 170.

[35] Bradley (1998); D. Yates and R. Bradley, Still water, hidden depths: The deposition of Bronze Age metalwork in the English Fenland, *Antiquity* **84** (2010a), 405–415; D. Yates and R. Bradley, The siting of metalwork hoards in the Bronze Age of South-East England, *The Antiquaries Journal* **90** (2010b), 41–72.

[36] A. P. Boyston, Bronze bracelet found at Hand Cross, Crawley, *SAC* **49** (1906), 172; P. Brewis, A 'Sussex Loop', *Proceedings of the Society of Antiquities of Newcastle-upon-Tyne* **8** (1917), 421–2; J. D. Cowen, The Crawhall Collection, *Archaeologia Aeliana* **43** (1965), 1–20.

[37] Yates and Bradley (2010b), Fig. 14.

[38] Allen (2005), 53, features 102622 and 102440.

[39] Described by Colquhoun and Burgess 1988 (No. 735) as being found four kilometres from Culloden Moor, Inverness.

[40] This site is referred to as 'Wilton' in Colquhoun and Burgess (No. 735) but was found at Witton (cf. A. J. Lawson*, The archaeology of Witton, near North Walsham, Norfolk,* East Anglian Archaeology Report 18 (1983), 30 and 35, Fig. 27).

[41] J. A Bell and M. D. Watson, Two prehistoric bronze weapons from Shropshire, S*hropshire History and Archaeology 68* (1993), 103–106.

[42] Many swords are found with rivets missing.

[43] This works in the same ways as a contemporary I-beam.

[44] I. Colquhoun, The Bronze Swords of Ireland, unpublished PhD thesis, Durham University (2015), 33.

[45] E. Howarth (1899), 65 and 77.

[46] PAS ID: NMS2464.

[47] The Gündlingen type blade fragment has a lenticular section with well-defined edge bevels. The 62.8g fragment is 60.6mm long, 36.3mm wide and 5.9mm thick (PAS ID: KENT-7C3863).