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The Enderby Bark Shield: A New Model for the Ancient World

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A 2300 year old bark shield found in Enderby, Leicestershire, in 2015 is the only known example of its type. Made from the bark of a willow tree, it has a woven basket boss, a roundwood handle, and a rim of split roundwood edging and lime bast bindings. Pre-Roman shields made from organic materials rarely survive in Britain and Ireland and those without metal components are exceptionally rare. Contemporaneous wooden shields are known from anaerobic environments in Scandinavia but, unlike Enderby, none of these has a body of tree bark. The complexity of the design of the Enderby shield, the skill with which it was made, and the similarities between this and metal examples suggests it was a tried and tested design, rather than a one-off. With no other example against which to compare it, experiments in reproducing the shield have been used as a tool for interpretation and have proved vital to understanding the original design. As a result of this research, it is proposed that this single artefact represents a more commonly available form of shield in the 1st millennium BC *than does any metal enhanced version.*

Keywords: shield, experimental archaeology, organics, Iron Age

Shiny bronze facings, red coral and glass adornments, fine copper-alloy bindings and bosses, these are the details typically referenced and conjured to mind for shields from pre-Roman Iron Age Britain. Shields made entirely from organic materials rarely feature in the discourse, perhaps unsurprisingly given their infrequent discovery. Wooden shield boards and bosses, some covered with hide or leather, occasionally survive in damp environments such as at Littleton bog, Clonoura, Co. Tipperary (Raftery 1984, 129) and Hjortspring in Denmark (Kaul 2003). No example of the bark or wicker shields mentioned in Julius Caesar's *Gallic War* (*GW* 2.33) had been found until 2015 when this bark shield was discovered in Enderby, Leicestershire. This shield places a new design in mind: a shield made with a board of bark, a basketry boss, wooden handle, and narrow wood and bast edge binding, made with local materials and age-old craft techniques (Fig. 1). This rare survivor transforms perceptions of shield production and raises questions about seasonal practices and fighting in the 1st millennium BC. The absence of comparable examples and its incomplete condition mean the design and efficacy of the Enderby shield has been difficult to establish. To help understand the details recorded through scientific analysis, conservation, and scrutiny of the original, experiments were undertaken to reproduce a copy with the same materials and similar techniques. This paper follows the process of reproduction taking each element of the shield in turn to build a new model for shields in pre-Roman Britain.

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Fig. 1.
Front of the Enderby shield and back with handle and boss removed, after conservation (©Trustees of The British Museum)

THE SITE

The shield was found during excavations by the University of Leicester Archaeological Services (ULAS) on land south of Soar Valley Way, Enderby, Leicestershire (NGR: SP 554 998) (Kipling & Beamish 2019; Fig. 2). This 4th century BC to 3rd century AD agricultural site lies almost adjacent to the Roman road known as the Fosse Way. The eastern part of the site is just within the alluvium deposits of the River Soar floodplain. The river itself now meanders just beyond this eastern edge. The environmental archaeological remains indicated an open landscape of grassland and cultivated arable land. An Iron Age pit alignment occupied the northern and western side of the site and a ditch, partly parallel with the pit alignment, the southern. Debris discarded in open features suggests people were living not far away. The shield was discovered towards the base and edge of a large pit (probably a waterhole) located 4 m from the ditch. It was found face down with the handle uppermost (Figs 2 & 3). Its preservation was aided by the damp, anaerobic conditions but also an

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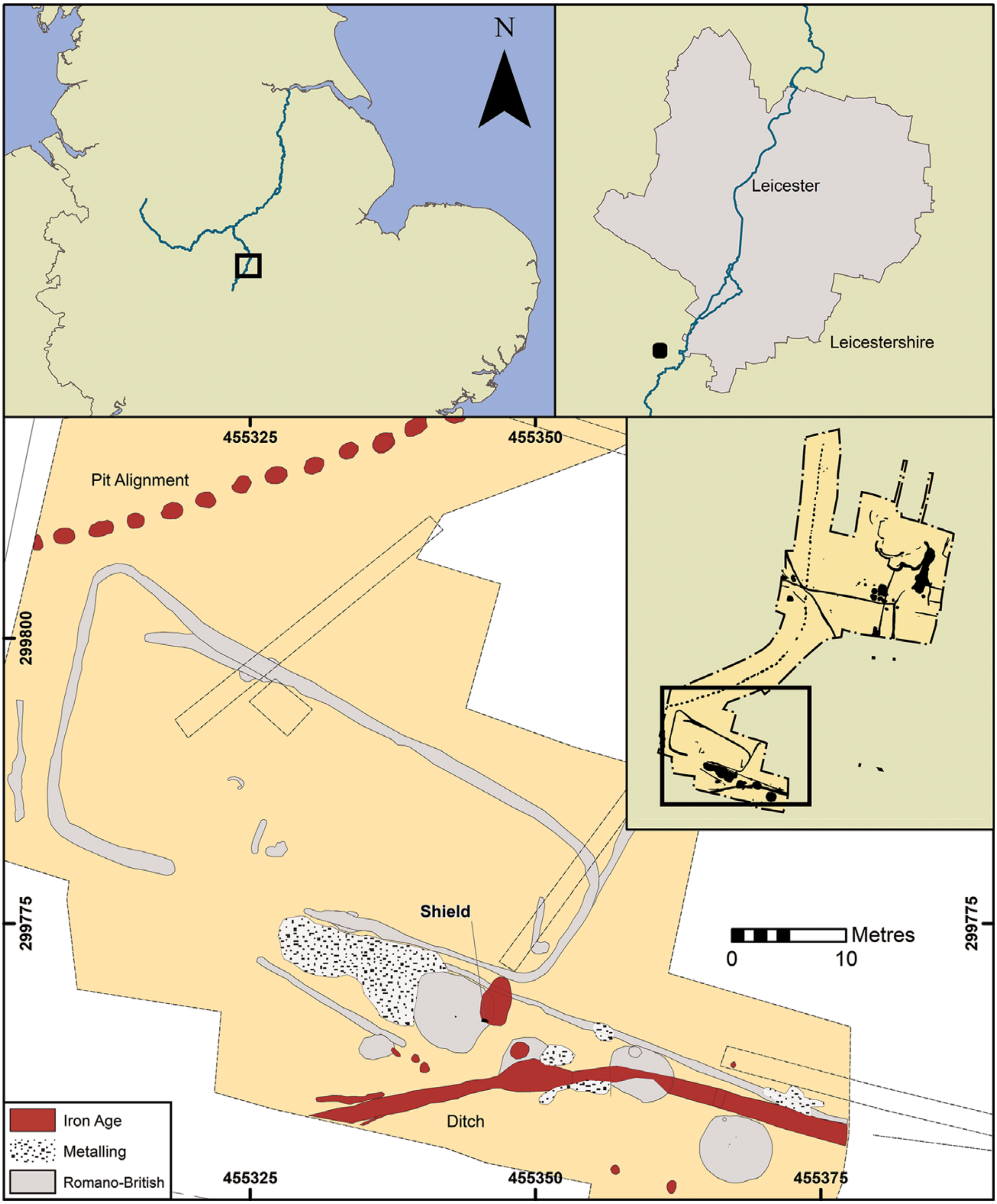

Fig. 2.
Site location and detail of site plan showing location of the shield in watering hole [772] Image: M. Beamish, ULAS)

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element of good fortune, since the backfilled pit had been truncated by a later Roman waterhole which cut away part of one end of the shield. The deposit containing the shield was devoid of other artefacts but did contain pieces of natural roundwood, some of which had been trimmed. No other artefacts were found within the layers above and below the shield in the pit. Limited evidence for woodland nearby indicates the potential source of the materials employed in making the shield, although it is also possible it was created some distance from where it was finally deposited.

CONSERVATION, PRESERVATION, AND IDENTIFICATION

When first uncovered it was not clear that this was a shield. Only the back was visible and the handle had been cut before burial so half of it was missing (Fig. 3). Careful excavation down the sides of the object revealed its extent and enabled it to be lifted as a block with the soil below still attached. The lifted remains separated into five main segments. Each segment was given a support of cling film, tin foil, and plaster bandage before turning over to enable careful excavation and removal of the soil adhering underneath. This work revealed the woven boss, which confirmed this to be a shield, plus surface decoration on the front and a short surviving section of half roundwood edging. Each segment was CT scanned in a body scanner by forensic pathologist Claire Robinson at Leicester Royal Infirmary (Kipling & Beamish 2019). The parts were sent to York Archaeological Trust for cleaning, stabilisation, conservation, and preservation by Mags Felter (*ibid*.). The excavated remains were cleaned when wet to remove debris. After cleaning, all the parts were immersed in baths of polyethylene glycol (PEG), increasing from 400 to 1500 to 4000 molecular weight, then freeze dried. Further strengthening was needed so surfaces were again treated by applying 10% PEG 6000 in 50:50 industrial methylated spirits (IMS) and water with a brush, followed by consolidation with 1% Klucel™ G (hydroxypropyl cellulose) in IMS (Kipling & Beamish 2019, 86). Some fragments were re-attached with cellulose nitrate.

Each component of the shield was recorded with the work co-ordinated by Michael Bamforth and Matthew Beamish (Bamforth & Beamish 2019). The shield survived to a length of 625 mm and width of 350 mm but it is damaged and degraded at both ends

Fig. 3.
The shield *in situ* (note the bottom of the shield in this image is the top as described and displayed; image: ULAS)

and has diminished slightly in size during post-excavation and preservation work to a length of 570 mm long and width of 340 mm. There were several holes through the board and only a short segment of the edging was intact. Most of the boss survived but it was squashed, distorted, and had a hole in the middle. Thick strips of wood (laths) were observed in gaps in the bark and inside the board with the aid of the CT scans. Preserved stitches were found on the flange of the boss and notch of the handle.

The shield was donated to The British Museum in 2019 by the landowners, Everards of Leicestershire (BM 2019,8021.1). On arrival at the museum further conservation work was carried out, led by Barbara Wills. Excess polyethylene glycol (where it was a white layer) was removed and the surface consolidated again with Klucel G. Separated pieces were brought together and stuck using 20% Klucel in IMS. To enable the

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shield to be displayed at an angle suitable for viewing while retaining its stability it required more strength. The cracks and losses were filled with a fine paper-based paste (Berlin tissue 2 g/m^2 mixed with Klucel G) that had been coloured to match the bark. Larger losses were filled by first lining the area with a pure cellulose paper, then applying a thin layer of paste made from Arbocel® BW40 powdered cellulose mixed with Klucel G. Further layers followed (including powder pigment to help match adjacent areas) until an artificial 'cardboard' was created that looked and, to a degree, functioned like the original preserved bark. These areas can be distinguished by a subtly smoother texture. No additional material was added at the ends or sides, these have been left in their incomplete condition as found. Holes from pre-deposition damage were left open. The detailed examination required to complete this work revealed further information about the shield design and manufacture.

DATING

Prior to PEG treatment, samples were taken for determination of radiocarbon age estimates. These came from the bark board of the shield, the plant fibres of the boss, and from two pieces of unworked wood in the same deposit in which the shield was found (Table 1). The samples were processed and analysed by Derek Hamilton at SUERC, University of Glasgow. The radiocarbon age estimates gave a calibrated date range of *c*. 390–200 cal BC for the manufacture and deposition of the shield. Using a Bayesian approach these estimates were modelled to ascertain when the shield was made and when it was deposited in the waterhole (Hamilton & Beamish 2019). On the assumption that the boss and body of the shield were made at the same time the results from these two samples were combined using the R_Combine function in OxCal giving a mean radiocarbon age of 2249±21 BP for the construction of the shield. The dates of the unworked wood in the deposit were interpreted as indicating the date when the deposit was laid down and the shield was buried. The modelling estimates the shield was made between *395–255 cal* BC (*95% probability*) and the deposit was laid down at some point in the period between *360–195 cal* BC (*95% probability*; Hamilton and Beamish 2019, 107, fig. 84). The overlap in these date ranges show that production

TABLE 1. RADIOCARBON DETERMINATIONS FROM THE ENDERBY SHIELD AND WOOD IN THE SAME DEPOSIT

Lab no.	*Context*	*Material*	*Species*	$\delta^{13}C$ *(‰)*	*Radiocarbon age* (BP)	*Calibrated date (95%)* BC
SUERC-66149	Shield body	Bark	*Salix* sp. (willow)	−28.2	2253±29	390–210
SUERC-66150	Shield boss	Plant fibres	*Tilia* sp. & *Salix* sp. (lime & willow)	−27.3	2245±29	390–200
SUERC-68963	(661)	Wood	*Acer campestre* (field maple)	−29.9	2272±27	400–210
SUERC-68967	(661)	Wood	*Prunus spinosa* (blackthorn/sloe)	−28.3	2212±27	380–200

After Hamilton & Beamish (2019). Conventional radiocarbon ages (Stuiver & Polach 1977) are quoted in accordance with the Trondheim convention (Stuiver & Kra 1986). Calibrated date ranges were calculated using the internationally agreed calibration curve IntCal20 and OxCal v4.4 (Bronk Ramsey 2009; Reimer *et al.* 2020). The date ranges have been calculated using the maximum intercept method (Stuiver & Reimer 1986) and quoted with the endpoints rounded outward to ten years. The probabilities were calculated using the probability method of Stuiver and Reimer (1993)

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TABLE 2. PLANT TAXA UTILISED IN EACH COMPONENT OF THE ENDERBY SHIELD

Shield component	*Taxon*	*Common name*	*Part of plant*
Board/body	*Salix* sp.	willow	bark
Rim/edge binding	*Corylus avellana*	hazel	split roundwood stick
Boss basket foundation rods	*Salix* sp.	willow	narrow rods/sticks (whole)
Boss basket stitches	*Tilia* sp. *&* *Salix* sp.	lime & willow	bast fibres
Handle	*Populus* sp.	poplar	roundwood
Laths	*Malus sylvestris*	crab apple	sliced narrow branches
Flat stitches for attaching rim	*Tilia* sp.	lime	bast fibres
Cord stitches on handle and boss	*Tilia* sp.	lime	bast fibres
Thorn stuck in boss	*Prunus spinosa*	blackthorn/sloe	thorn

Identifications by Caroline Cartwright, British Museum.

and deposition could have happened in quick succession or there may have been a passage of ten or more years between construction and deposition.

MATERIALS

The taxonomic identifications of the components of the shield were reviewed by Caroline Cartwright at The British Museum and cross-checked against an extensive reference collection. Very small samples were taken from all categories of material preserved in the shield: the bark board, the edging and associated stitches, the components of the basketry boss, the handle and the twine used to bind the handle to the shield, and the laths. A thorn found stuck in the side of the boss was examined separately in its entirety. Sampling protocols devised by Caroline Cartwright (1996; 2015), optical microscopy (OM) with the Leica Aristomet biological microscope, and variable pressure scanning electron microscopy Hitachi S-3700N (VP SEM) were used for the identification of the tiny samples. Because of the three-dimensional nature of wood anatomy, each bark/wood sample was sliced to show transverse, radial longitudinal, and tangential longitudinal sections. In-house reference collection specimens of all categories of botanical material provided comparative standards throughout. Ideally the scientific identification of the waterlogged wood is undertaken in its waterlogged state to avoid distortion or masking of cellular structure that can occur during certain conservation treatments but the circumstances of excavation in this instance necessitated conservation at an earlier stage; the procedures adopted at Enderby are outlined in Kipling and Beamish (2019). The combination of analytical techniques and Cartwright's extensive experience of the identification of waterlogged wood during and after conservation treatments (Cartwright 1996), has enabled a level of secure identification that was not possible for the initial unpublished report (Kipling & Beamish 2019). The taxonomic identifications published here and listed in Table 2 replace those of the site report. They have been identified as willow, lime, hazel, poplar, and crab apple, all of which could have been locally sourced (Table 2; Figs 4–6; eg, Evans & Hodder 2006; Wright *et al.* 2009).

EXPERIMENTS IN MAKING THE SHIELD

Identification and interpretation of the various components was hampered by the incomplete and damaged condition of the shield. Given the lack of other contemporary bark shields for comparison, experimental recreation of the object was utilised as a tool for understanding these remains. The process encouraged very close scrutiny of the original to fill in the gaps as authentically as possible. It has also produced new versions of the shield that may be held and handled for an experiential interaction with the object. Several versions were made from 2018 to 2022 by a team led by Matthew Beamish, each raising further questions and challenges. The last attempt, in June 2022, produced what we believe to be the closest form to the original design (Fig. 7). The process of making that final version has informed the discussion below about each component of the original design.

The bark board

The body or board of the shield is made from a single piece of willow bark (*Salix* sp.) originally cut into a narrow oval shape (Table 2). Classification to species level is problematic (see Karp *et al.* 2011). From the anatomical perspective, diagnostic features in the bark included groups of sieve tubes and collapsed sieve

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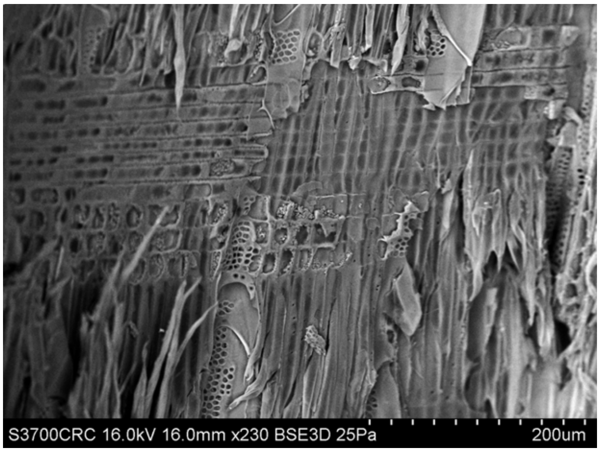

Fig. 4.
Variable pressure scanning electron microscope (VP-SEM) image of a radial longitudinal section of *Salix* sp. (willow), wood used for the coiled wicker core of the Enderby shield boss image: C.R. Cartwright © The Trustees of the British Museum)

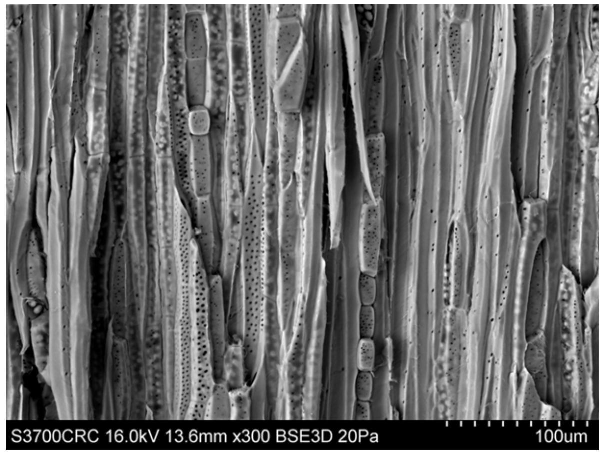

Fig. 6.
VP-SEM image of a tangential longitudinal section of *Corylus avellana* (hazel) wood used for edging of the shield body (image: C.R. Cartwright © The Trustees of the British Museum)

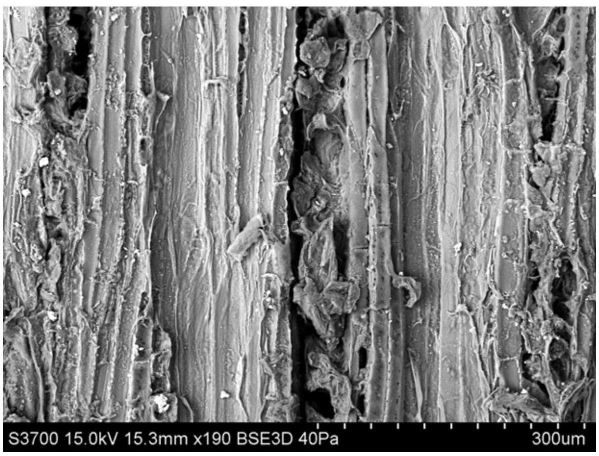

Fig. 5.
VP-SEM image of the twine used to bind the handle to the shield, identified as *Tilia* sp. (lime) bast (image: C.R. Cartwright © The Trustees of the British Museum)

tubes, sclerenchyma cells in the cortex and phloem, fibres in tangential rows, and dispersed sclereids (see Angyalossy *et al*. 2016). OM in polarised light showed a distinct epidermis, homogeneous phellem, and prismatic crystals.

The bark was used inside-out so the rough cork surface of the outer bark formed the back of the shield facing towards the bearer (Fig. 7). The smooth inner side of the bark formed the front of the shield with the boss in the centre. The whole board included the outer bark or periderm consisting of phellem, phellogen, and phelloderm and the inner bark (phloem) which had been peeled off the tree at the surface of the sapwood (vascular cambium). The bark was harvested during the spring to summer months of March to late June when the sap was still rising, so it easily separated from the moist sapwood. Out of this season the tree will not relinquish its bark so readily. To cut the bark from the tree without penetrating the sapwood beneath, an axe was hammered in and moved along the outline of the required piece of bark, a little wider than the planned shield shape to allow for errors. This cut was completed with a simple steel knife. A stick with the end cut at an oblique angle was then used to carefully lever the bark away from the trunk. The rectangular piece was cut to the required shape after it was removed from the tree. The original shield makers may have had the skills and experience to cut the exact shape needed direct from the tree. Iron axes and knives, like those found at contemporary sites such as Danebury hillfort, Hampshire (Cunliffe 1984, 349–54, fig. 7.12), would have been adequate to perform this task.

By harvesting less than half the circumference of the bark around a healthy tree, it can survive and thrive (Fig. 8). A year and more later, and the willow trees in

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Fig. 7.
Front and back of the 2022 reproduction of the Enderby shield (©Trustees of the British Museum)

Leicestershire from which the bark was harvested for the experiment are still standing. The bark has not grown over the scar but the sides of the scar have healed with new growth and the trees appear to have suffered no detrimental damage. It is possible that this sustainable method of harvesting the bark was utilised in the 4th–3rd centuries BC. Alternatively, an entire tree was felled and the shield was one of several items

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Fig. 8.
Willow tree one year after the bark has been harvested showing new growth down the sides of the scar (image: S. Adams)

made from the tree's resources. Other rare, preserved bark objects, such as the platter from Must Farm, Cambridgeshire *c*. 1000–800 BC, indicate the long history of exploiting bark resources and hint at the sustainability of the process (eg, Knight *et al.* 2024).

Initially it was estimated the shield was an oblong shape with parallel sides and round ends, taking inspiration from the boards of the Witham and Battersea shields and some of the wooden shields from Denmark including the 4th century BC examples from Hjortspring and 1st century BC shield from Vaedebro (Andersen 1957; Kaul 2003, 152–3; Warming *et al.* 2016, 159–60). An early attempt at recreating the shield in this shape, albeit with laths running fully across the board above and below the boss rather than diagonally, showed the sides bowed in slightly as the board dried. This produced the waisted effect seen on the Battersea shield. Re-evaluation of the shape, with the aid of the stitch evidence, suggested a sub-rectangular oval shape, narrower than the elliptical oval forms common in France and Germany but comparable to the shield on the brass warrior statue from Saint-Maur, Oise or the miniature shields from Dragonby, Lincolnshire and an unprovenanced example from Europe (Brunaux & Rapin 1988; Knowles & May 1996; Kaurin *et al.* 2017; BM 1989,0401.1). This shape, with diagonal laths described below, retains its form when drying because the sides do not shrink inwards more than the rest of the board. It is a symmetrical shape that does not have a top or a bottom. The original length was estimated from the position of the surviving stitches and the width from the surviving fragment of edging on one side to the finished edge of the board on the other. The reproduction has an overall length of 678 mm and width of 346 mm. The original shield board is 3–7 mm thick, thinning to the centre. It is estimated, from a compression indicator of 9–12% calculated from roundwood recovered from the same deposit, to have been closer to 3.5–8 mm when in use. The willow bark for the reproduction board was 12 mm thick when harvested but shrank to 7.35 mm as it dried.

The dimensions of the board are consistent with those of contemporary wooden shields from Hjortspring, Denmark which vary in length from 610 mm to 1020 mm and breadth 290–520 mm; the largest of these is 880 mm long and 500 mm wide and the smallest 660 mm long and only 290 mm wide (Kaul 2003). The leather covered wooden shield from Littleton bog, Clonoura, Co. Tipperary is 570 mm long and 350 mm wide (Raftery 1984, 129). The wooden boards also had a thickness close to that of the bark version. The Durrnberg shield had an alder wood (*Alnus*) board about 8 mm thick as indicated by the remnants preserved as mineralised remains in the iron components (Egg *et al.* 2009). Shields from Britain and Ireland are largely represented by their metal components. Recent research by Matthew Hitchcock concludes that the full dimensions of only seven out of 75 definite whole and incomplete shields from Britain, could be confirmed (Hitchcock 2022, 68). These show great variation with the Battersea shield at the smaller end at 777 mm long by 357 mm wide and the Witham shield at the larger end 1086 mm long and 345 mm wide, or the Chertsey shield at 856 mm long and 468 mm wide (Hitchcock 2022,

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317–29). The size of the Enderby shield is thus not unusual for the period and, although the shape is less typical, it is consistent with other examples.

The laths

Damage to the board has exposed parts of the four narrow strips, laths, of crab apple wood *(Malus sylvestris*) that were inserted into the shield board. CT scans confirmed the full extent of each and their position within the layers of bark (Fig. 9). Each lath is a different length and is individually positioned at a different angle: two inserted from the right side of the shield and two from the left. The two on the right side are slightly closer together, nearer the boss; the two on the left are further apart – creating a staggered positioning of the four. The top left and bottom right laths appear to be longer than the other two and were inserted at a steeper angle, the lower one reaching just across the midway point of the board. The shorter two laths have a more horizontal positioning. The surviving laths range from 5–16 mm wide and 1–3 mm thick. In experiments to reproduce the shield, different lath lengths and angles were tried. In the most successful replicas, the laths were positioned as near as possible to those in the original. These locations seem less about precise positioning and rather more about adding support or stiffening at approximate intervals so helping the board resist deformation as the shield dried. The experiments creating the same shield shape but without the laths confirmed their importance in stopping the bark curling back upon itself towards its original curvature as it dried. Initially the exposed parts of the laths were thought to be the result of weaving them through the board in a belt-loop format but it became apparent, through failed attempts, that the laths were only visible in these areas because the outer surface of the bark had degraded, flaked, or otherwise worn away.

To recreate this design, the point of a knife was inserted into the edge of the damp inner bark to cut a tunnel into which the laths could be tapped. Each lath was made a little thicker than the surviving pieces (3–4 mm thick) to allow for the effects of shrinkage and degradation of the remains. The laths were formed with a slight point at the end so that, with a gentle hammering action, each could be driven into the pre-cut tunnel and into the body of the shield where it stayed secure as the shield dried and shrank and helped prevent the bark from curling. No specialist tools were required, just a simple single edged knife blade and a piece of roundwood as a mallet (Fig. 10).

The edge binding

A short section of the edging of the shield survives (94 × 7 × 3 mm) on its left side. The indications of stitches and narrow stitch-holes elsewhere on the shield support the interpretation that originally there was an edge binding around the entire board (Figs 1 & 11). This was made from a thin rod of roundwood hazel (*Corylus avellana*) that has been split in two (Figs 6 & 11). The experimental version has a 10 mm wide hazel edging. The edge binding gave extra strength and support around the volatile edges of the bark board and prevented them from buckling and/or being torn, as well as adding to the defensive capabilities of the shield, just like the metal bindings.

Intermittent groups of lime bast (*Tilia* sp.) stitches are still preserved near the edge of the shield. On the right side they are evenly positioned about 100 mm apart but, on the left side, the evidence is less distinct and the groups appear haphazardly positioned, perhaps responding to the variations in the natural materials of bark board and hazel edging. At the bottom left, a pair of stitch slots cross the grain of the bark showing the board is almost complete here despite the absence of the edge. Each of the three groups on the right consist of four staggered slits cut at a slight angle across the grain of the bark. In the top and middle groups, remnants of the flat lime bast stitches can be seen, some emanating from the slits and reaching to the edge of the shield (Figs 9 & 12). The slots appear longer than is needed for each stitch. They may have increased in size through wear and tear or post-deposition processes, or by more than one stitch being passed through each slit. It was possible to pass the stitches through the very fine slits when the bark was still relatively damp and pliable. The bark tightened around the stitch as it dried and contracted.

In the reproduction the positioning of the groups of stitches was followed on the right-hand side around the whole of the board, adapting their position relative to where it was felt the edging would benefit from the support of the stitches. This intermittent design gave four groups of stitches on the right, five on the left,

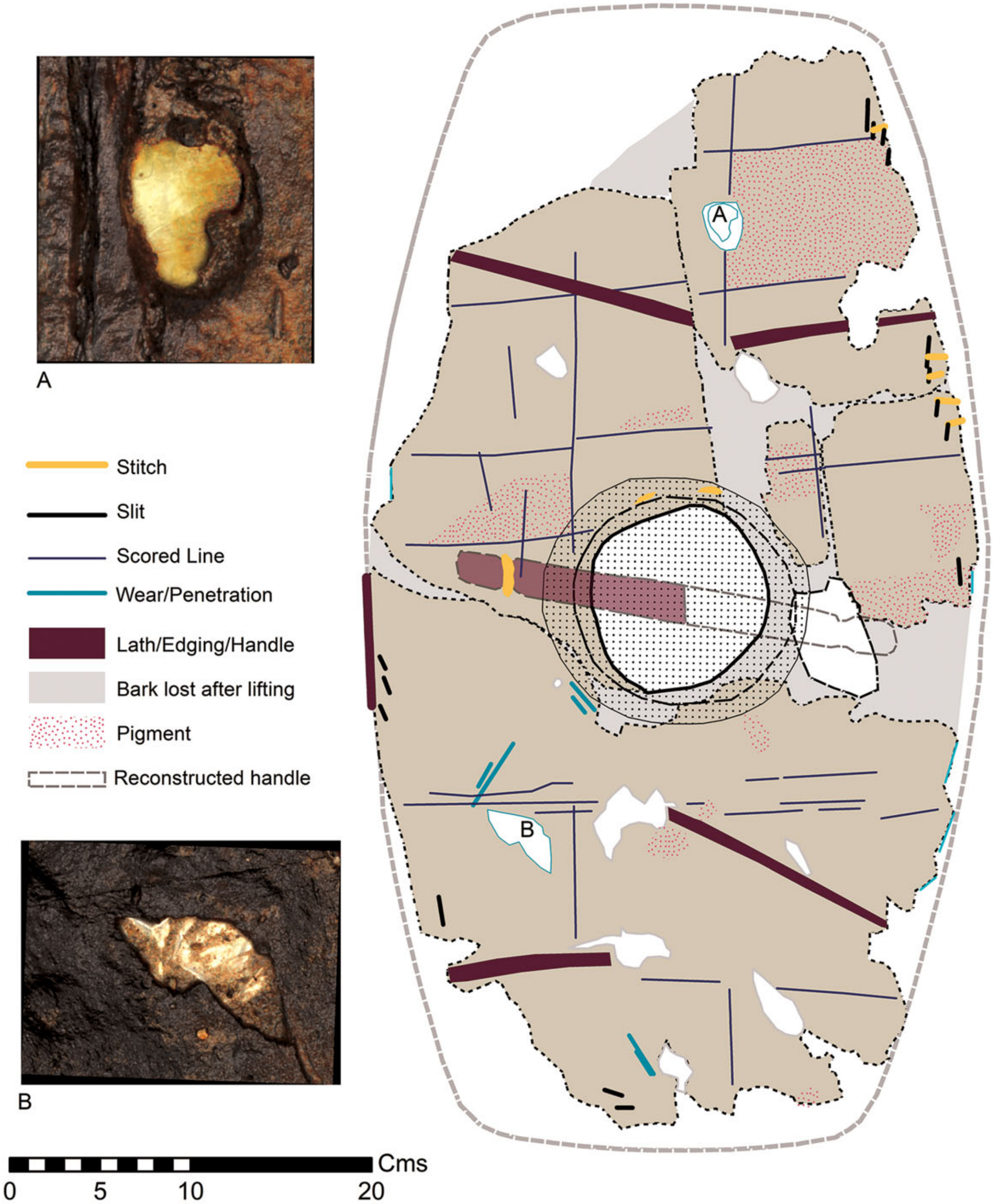

Fig. 9.
Diagram of the different components of the shield as viewed from the front, including the handle behind, and photographic details of the areas of damage: A and B (image: M. Beamish, ULAS)

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Fig. 10.
Diederik Pomstra, Paul Windridge, and Matthew Beamish inserting the laths into the 2022 reproduction shield (image: S. Adams)

and two across the top and bottom. These did not feel frequent enough to hold the edging tight to the board but any more risked creating a perforated line parallel with the rim that would have torn through the whole board. As the shield dried the edging separated from the board in several places, particularly at the corners, as a function of the shield board narrowing across its grain and the length of the edging being unchanged.

Fig. 11.
The section of split roundwood hazel edging still attached to the side of the shield (©Trustees of The British Museum)

The original piece of edging sits tight against the side of the board but is such a small section that it is not clear if anything else was used to hold it in place aside from the stitches. Improvising by tapping blackthorn thorns (*Prunus spinosa*) through the hazel edging into the side of the board, to act as pins or rivets, failed to provide much benefit. The tightening of the stitch-holes as the board dried indicates it is not possible to stitch a new edging on after the board has dried, suggesting the edging was made to fit before drying. Further research is needed to ascertain how the gapping between the side of the board and the roundwood edging was avoided or overcome.

No similar flat bast stitches have been identified on contemporary shields but the copper-alloy clamps for

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Fig. 12.
A group of lime bast stitches from the right side of the shield for binding the edging (©Trustees of The British Museum)

holding the edge binding on the hide shaped shield from Mill Hill, Deal are formed with a series of broad, shallow ridges that might be interpreted as metal skeuomorphs of bast stitches (Parfitt 1995, 68, fig. 22). In contrast, the stitches to attach the boiled leather cover on the Clonoura shield form a seam around (and beyond) the edge of the board holding the front and back cover together (Raftery 1984, 129–31, fig. 70).

The boss

In contrast to other contemporary organic shields made from wood, hide, and leather the Enderby boss is made from a basket woven from willow and lime bast, as opposed to carved wood or stitched leather or metal (Fig. 13). OM and VP SEM were used to characterise the components of the basketry boss. It is woven from the central peak of the dome in a circular shape out to the edge of the flange, using a method known as close coiling (Adovasio 2016, fig. 63; Walton Rogers 2019). The narrow, core foundation rods, identified as willow (Table 2; Fig. 4), were tightly coiled from the centre outwards and stitched over with flat lime bast stitches to fasten each coil to the next. This is an ancient technique following traditions of basketry production that reach back millennia (Anderson 2020). In micro-CT scans at The British Museum, the foundation appeared to be three twisted rods rather than a single rod. The Enderby boss basketry samples included lime and willow bast fibres comparable to basketry samples from the woven basket from Whitehorse Hill, Dartmoor *c.* 1750–1600 BC (Cartwright 2016; Cartwright *et al.* 2016).

For the reproduction, Diederik Pomstra made the boss at home in the Netherlands and brought it to the production site in Syston, Leicestershire, ready to attach to the shield (Fig. 14). This reproduction boss was made with willow rods and raw lime bast strips. It is not clear from the original whether the bast strips used were raw or retted. The willow rods were hammered with a pebble against a wooden block, both when harvested and when half dry. They remained supple enough to be twisted in a round foundation for coiling. The strips used had been in store for a couple of years and needed to be soaked before use to regain flexibility. It is possible that the original makers stored some of the necessary materials over several seasons before use. Narrow rods, *c.* 5 mm thick proved the easiest to use to meet the design of the boss which had a diameter of 142 mm made from a total of 14 circuits of the coil, three of which formed the flange (Walton Rogers 2019, 72). Approximately 8 m of lime bast and about 6–8 willow rods were used in making the boss.

The boss was attached to the board by means of a running stitch of twisted lime bast cord (*Tilia* sp.). Two stitches survive on the flange of the original, made from 2.5–3.0 mm thick thread. Each stitch is 15–20 mm long and set about 20 mm apart. The

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Fig. 13.
Side view of the boss showing the two extant twisted bast stitches on the flange on the left and damage to the holes and stitches of the basketry (©Trustees of The British Museum)

corresponding, round stitch-holes through the bark board are also extant on the original. To reproduce this, first a squared hole with rounded corners was cut through the board to create the gap for the shield bearer's fist. This was set at an angle about 30° from the vertical line of the shield. Next, the holes for the stitches were punched through the board with an awl; this had to be done while the board was wet to avoid splitting the bark. Finally, the prepared cord was threaded through the head of a bone needle and passed though the holes and the flange to stitch the boss in place (Fig. 15). In the experimental reproductions the boss was stitched on immediately while the bark was damp and flexible but it could potentially have been added later if the stitch-holes were already punched through.

Wooden shield bosses tend to be in spindle form with an elliptical centre extending to a point, often continuing into a spine (Kaul 2003). Made from carved wood, these can also be found with copper-alloy sheet covers, particularly in the Yorkshire Wolds, as at The Mile, Pocklington, or with copper-alloy or iron umbos bracketing the front, as is typical in graves in France (Brunaux & Rapin 1988, 31–53; Giles & Hitchcock 2022). Domed round bosses are less common but appear in bronze on both the Battersea and Wandsworth shields while copper-alloy conical bosses with broad, thin flanges are more familiar from early 1st century AD contexts in Britain, such as the three examples from the Polden Hill hoard (BM 1846,0322.114-116; Brailsford 1975, 228–9). The Enderby basketry boss is therefore a familiar shape; perhaps some of the metal examples developed from these organic forms. If we take the miniature shields in the Salisbury hoard as representative of full-sized versions, the boss and shield shapes could be used in different combinations (BM 1998,0401.1-22; Stead 1998). A domed, round wicker boss of 3rd

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Fig. 14.
Side and back views of the reproduction close-coiled boss (image: S. Adams)

century AD date was excavated from the Thorsberg Bog, Denmark in the 19th century and suggests longevity of this organic form (Engelhardt 1866; Matešić 2015, 161–2).

The handle

The handle was the last piece to be attached and formed the central force in the design. It was made from a round stick of poplar wood (*Populus* sp.) with the bark removed and chamfered at the end to an angle of about 14°. It was stitched to the board with the sloping edge against the body of the shield, thereby pulling the rest of the shield into a taut, shallow, curved shape around the body of the bearer (Kipling & Beamish 2019). This tension strengthened the shield.

Indications of charring on the surface of the surviving part of the handle and its absence on the tapered ends suggests it was run through a flame before shaping. This charring had two benefits: giving a smoother surface to the grip and protecting this piece of wood from decay. A shallow, rough notch was cut into either side of the surviving end of the handle. Within this notch remnants of the twisted lime bast cord that stitched the handle to the board were preserved (Figs 5 & 16). Where the opposite end of the handle would have been attached to the board there is a large, rounded hole suggesting the board was damaged when this part of the handle was pulled and cut away (Figs 1, 3, & 9). The broken end of the handle is cleanly cut so as to suggest it was removed with a saw.

The handle lay at an angle across the round-cornered hole. This compliments the positioning of the handle with the corners of the hole creating just enough space for the bearer's knuckles and fingers as they gripped the handle. The angle of the handle, about 30–45° off the horizontal, gives the shield a multi-directional utility whether it is held in the left or right hand. It enables the bearer to swing and rotate the shield to deflect and counteract a blow (Hitchcock 2022, 60). The handle, as it is attached across the back of the boss and the hole in the board, has a useable grip with a maximum width of 80 mm. To allow for a secure grasp the bearer's fist could be no bigger than this width. The copper-alloy handle cover from the Battersea shield indicates it had a similar sized maximum useable grip, up to 82 mm, while the handle of the Chertsey shield gives a useable grip up to 95 mm wide (British Museum 1857,0715.2; Stead 1985, 21; 1991b, 6–9). The diameter of the opening at the back of other metal bosses, including those from Wandsworth and Polden Hill, indicate these also allowed for a grip no larger than 80 mm wide (BM 1858,1116.2 and 3; BM 1846,0322.114–116; Brailsford 1975). This is not a wide grip but would be suitable for youths and adults with narrow or slender hands. Alternatively, it could be grasped with just the three middle fingers, the thumb, and little finger balancing the grip.

Osteoarchaeological evidence for injuries sustained through combat in the mid–late 1st millennium BC in Britain varies from region to region both in the scale and character of the combat and in the age and gender of the participants. Single or small group combat appears to dominate in the Yorkshire Wolds area in

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Fig. 15.
Diederik Pomstra using a bone needle to stitch the boss to the board on the 2021 reproduction (image: S. Adams)

the 4th–2nd centuries, in contrast to the larger scale slaughter seen at Maiden Castle a century or so later (Redfern 2011; Giles & Hitchcock 2022, 121). Adult men and women, young adults, and sub-adults exhibit evidence for injuries sustained during violent encounters. Individuals buried at Maiden Castle, with combat-like injuries, include a young man about 15 years old and adults who had survived injuries sustained at a younger age (Redfern 2011). André Rapin proposed, from evidence in France, that a rite of passage took place just before a young person reached adulthood between the ages of 14 and 18 when they would lose the local symbols of childhood, like the bronze torc, and take up weapons (Rapin 2006, 50). In that context, the 4th century BC burial of a teenage boy found at Barbey, France with a torc and narrow, unribbed, short sword is described as a young warrior who had not yet reached his military maturity (*ibid.*). Whether such an apprenticeship is accepted or not, there is growing evidence that teenagers and adults were involved in close combat for which this shield would be a useful piece of equipment. The size of the grip and boss, therefore, does not preclude it as a useful piece of equipment for an agile fighter.

Drying the shield

Once constructed the shield needed to dry and harden for use. It was not possible to recreate authentically this part of the process owing to time and space restrictions which bear no relationship to the making processes in the past. Drying of tree wood and other tree products is best carried out at a steady pace. The more the process is forced, for example by the application of heat, the greater the risk of distorting the materials and, therefore, the final product. Dry it too slowly or without enough airflow and the risk of the object going mouldy is increased. Both outcomes

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Fig. 16.
The incomplete shield handle with charred and bare areas, complete notched end, and opposite cut end (©Trustees of The British Museum)

Fig. 17.
Red colouring visible on the shield front when first exposed during cleaning (image: M. Beamish, ULAS)

were unintentionally achieved during attempts to recreate the shield. In the most successful reconstructions, a simple frame of split hazel poles was used to help clamp the final shield in shape while it dried but this was an insurance on our part rather than a representation of any evidence. It was noted, though, that once held in a frame the shield could be slung from a rafter to hang in the roof space of a roundhouse, above an open hearth. The smoke from the fire would aid preservation by deterring insects and reducing risk of mould. The ambient heat would provide the warmth to help the water evaporate from the bark and the air flow in the space would protect it from mould. This theory has yet to be tested.

Decoration and surface treatment

All known copper-alloy adorned shields are decorated, albeit to varying degrees. The Enderby bark shield was also decorated but instead of the swirling, curvilinear shapes and motifs familiar to the repertoire of Celtic or La Tène art, this has a simple rectilinear form. The front of the shield board retained a series of thin, horizontal scored lines at intervals with occasional further vertical scored lines. These are still visible on the conserved object. When this surface was first revealed during initial cleaning, a distinctive red colouring was visible in four of these squared areas but the visibility of the pigment rapidly declined after cleaning (Fig. 17). Raman spectroscopy by Konstantinos Chatzipanagis, University of York, revealed the presence of haematite, the coloured component of red ochre, in an area now located just to the right of the boss (Fig. 9; Kipling & Beamish 2019, 95). The resulting decoration appears to have been a pattern of alternating red painted rectangles as indicated on the reproduction shield (Fig. 7). Some of the scored lines on the original had been reiterated a couple of times perhaps indicative of a rough sketching technique or evidence for later rescoring of the lines (Kipling & Beamish 2019, 163).

Taking the evidence from *c*. 350 BC up to AD 1000 in southern Scandinavia, Rolf Fabricus Warming and colleagues propose that animal hide products covering both the front and back of wooden shield were a far more frequent and important defensive component of the design than has previously been imagined (Warming *et al.* 2016, 159–60). The possibility that the Enderby shield also had a hide covering was investigated but no traces of animal products were identified on either face or round the binding. A thin, silty deposit containing reddish-brown material was found between the flange of the boss and the board that was thought to be reminiscent of decayed animal products when preserved in acidic conditions. It was suspected this could be the remains of a hide layer held in place by the stitched flange of the boss. The thin silt

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was analysed by Luke Spindler at the University of York via ZooMS but this yielded a negative result suggesting an absence of animal products, although this may also have been impacted by the degradation of the material and conservation processes (Kipling & Beamish 2019, 98–9). The stitches around the edge also seem inadequate for securing a hide or leather covering because of their intermittent spacing and the flat, thin bast from which they were made. The decoration on the front of the Enderby shield implies it was not covered but it is worth bearing in mind that the 3rd century AD shield from Illerup Ådal, Denmark had red paint on the surface which is proposed to have been covered by a thin layer of 'leather or parchment' held in place by glue (Warming *et al*. 2016). Reference is also made to 'traces of red paint' on the face of the wooden shield from Vaedebro, Denmark (Kaul 2003, 171–2) but its potential as decoration is unclear given that half of the shield is also punctured by horizontal rows of small, rounded holes and stitches survive on one edge, possibly both for attaching a covering (Andersen 1957, 9).

DAMAGE TO THE SHIELD

Damage to the boss

A combination of the weight of the soil overlying the shield in the pit and its position in the ground has buckled the boss on one side. Part of the flange is also missing. Just off-centre at the domed top of the boss is a hole with a small stone stuck in it (Fig. 13). Around this hole the bast stitches and foundation rods are broken and blackened. It is proposed that this darkening is the effect of the exposure of the damaged parts to the burial environment and the absence of any of the missing material suggests the boss was damaged before it was buried. The small stone has become lodged in the hole during filling and settling of the deposit. Another area of blackening is visible in the foundation rods on one side where the bast stitches are missing. The dark areas on the exposed fibres indicate the damage occurred well before burial so the stitches may have been worn away or broken as the result of impact on this area. Perhaps the shield was buried or discarded because it was too damaged for use either through wear or from violence enacted on it and the bearer.

Two thorns were found stuck in the boss, pointed end inwards: one in the side near the broken section of flange and one just near the edge of the hole in the top. The former was easily extracted and identified as a blackthorn/sloe thorn (*Prunus spinosa*). The other was entangled with the stitches so has been left *in situ*. Perhaps the shield was used not only as protection against attack from a person but also against the hazards of the environment, in this case a thorny scrubland or woodland. The boss protected the bearer not only from the discomfort of a thorn pricking or sticking in their hand but also the risk of infection from such an injury. It is possible that the organic shield was as much about enabling the bearer to push through vicious scrub as it was about protecting them from assailants.

Damage to the board

Weaponry contemporary with the shield include iron-headed spears, spears with bone tips, iron bladed swords, and slingstones (eg, Sharples 1991, 232; Stead 1991a, 64–79; Stephens 2022) (Fig. 18). Holes in the body of the shield (Fig. 9A & B) were investigated during conservation using Reflectance Transformation Imaging (RTI) and with the aid of 3D prints the detail of the profile of each was revealed (Crellin 2019). Comparison of these with Rachel Crellin's work on Bronze Age shields show similarities between three of the holes and the shapes of holes produced by puncturing a shield with a socketed bronze spear but dedicated tests on the reproduction bark shields are needed to confirm or deny this possibility using more period appropriate weapons such as iron or bone spearheads (Crellin *et al*. 2018). A rudimentary test on a piece of dried willow bark and on a piece of recently harvested bark showed that a bone spearhead on a short wooden shaft could penetrate the bark when pushed against it with force while the bark was laid on the ground. This created a similar hole to that at the top right of the shield, 30 × 20 mm wide (Fig. 9A). Other finer marks on the board could be indicators of sword blade edge damage. There are two parallel incisions to the surface of the bark, *c*. 40 mm and 20 mm in length, in the lower left portion below the lath. The shape and nature of these incisions strongly resembles the marks made to the surfaces of shields through contact with the blade of a sword used in a slashing rather than thrusting manner. In experimental combat impact from the side of a bladed weapon leaves one long cut-mark and a second, smaller

Fig. 18.
Bone spearhead from The Mile, Pocklington (image: A. Jansen, courtesy of MAP Archaeological Practice)

rebound mark left as the weapon bounces off the board (O'Flaherty *et al.* 2011). Analytical and experimental research on Iron Age oval shields from La Tène, Switzerland reveals the value of their light and mobile qualities making them suitable for combat at close quarters with bladed weapons (Reich 2020). These qualities have been commented upon for the contemporary Hjortspring shields and may be further emphasised for the lighter and shorter bark shield which is potentially only 20–25% of the estimated weight of the 1.10 m long and 4–5 kg oak shield from La Tène with iron umbo, boss cover (Kaul 2003; Reich 2020, 22, 25, fig. 2, MAR-LT-17091). Future impact testing of the reproduction shield may reveal what forces the bark shield could withstand dependent on positioning and hold, and this can be compared with results from analytical and experimental combat using contemporary bladed weapons and wooden shields (eg Reich 2020; 2023).

PROTECTIVE ABILITY

There is a long history of the use of plant materials for creating protective equipment. On the near continent in France, the Gauls were described in Caesar's *Gallic Wars* (*GW* 2.33) as having 'shields made of bark or plaited osiers and hastily (as the shortness of time necessitated) spread over with hides' (Edwards 1917; '*partim scutis ex cortice factis aut viminibus intextis, quae subito, ut temporis exiguitas postulabat, pellibus induxerant*'). Plywood shields made from laminated layers of wood have been found from the 2nd century BC onwards, including the 2nd–1st century BC *scutum*, the Fayum shield, from Kasr El Harit, Egypt and the 1st century AD plywood shield found at Doncaster, England (Kimmig 1940; Buckland 1978). Shields made from wooden boards or planks are well attested in northern Europe, both as extant organic remains like the wooden shields from Hjortspring, or as mineralised organics preserved in the corrosion deposits of metal components, as on the bronze front plates from The Mile shield, Pocklington, East Yorkshire (Kaul 2003; Giles & Hitchcock 2022). The metal edge bindings from hide-shaped shields like those found at Spetisbury, Dorset (BM 1862,0627.3), Mill Hill, Deal, Kent (BM 1990,0102.6 to 21), and Burrough Hill, Leicestershire, are thought to have protected the edge of boards which were made from hide or emulated earlier hide examples in other organic materials (Gresham 1939; Stead 1991b; Parfitt 1995, 64–72; Thomas & Taylor 2016, 15; Warming *et al.* 2016; Hitchcock 2022, 85).

The reproduction shield is light and comfortable to hold. It weighs only 805 g. The charred poplar handle provides a smooth grip for twisting and turning the shield. The bark body is hard, it has stiffened and compressed as it dried. The bearer's arm is made larger and stronger with this protective layer. The shield was designed to deflect blows rather than provide full body protection. It could prevent injury but also inflict damage on an opponent. Turn the shield side on and the edging becomes a weapon and a defensive barrier against which the force of a blow

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would impact through the body of the shield from one side to the other, rather than penetrating it.

Some of the damage to the board and the boss suggest it was struck. This does not confirm it saw active combat but it suggests intentional damage either aimed at attacking the bearer or at destroying the shield or a combination of both. The direction of the impact appears to be from the front of the shield so must have occurred prior to deposition. If the shield had been pierced after it was placed face-down in the ground, the back would have been broken through first. The absence of most of the edging and destruction of the handle indicate potential deliberate decommissioning which would not be out of place in an Iron Age context. Evidence for the destruction or decommissioning of weapons by bending or folding until they were unusable is seen, for example, in the swords from North Bersted, Kent and Kelvedon, Essex, and possibly the copper-alloy fronted shield from Essendon, Hertfordshire deposited in a shallow pool or bog (BM 1994,0303.1; Hunter 2005; Sealey 2007; Hitchcock 2022, 252). A particular funerary practice recognised in the Yorkshire Wold cemeteries involved piercing the corpse with spears (eg, Stead 1991a, 33–5; Inall 2020, 69, fig. 5.2). On rare occasions wooden shield boards have been identified where the wood is preserved in the corrosion deposits on the iron spearheads that were thrust into the grave and pierced the shield in the process (Stephens 2022).

A NEW MODEL FOR IRON AGE SHIELDS?

The rough organic textures of the Enderby shield contrast with the sharp lines of the gleaming bronze fronted examples. It lies at one end of a spectrum of shields from completely organic to almost entirely metal. Close investigation of the condition of the metal enhanced shields has revealed the complex histories of many of these artefacts, including damage, repair, and potential repurposing of parts (Chittock 2021; Hitchcock 2022). There is no single story of use and no single design. Aside from the essential components of board, boss, handle, and edge binding, there is a great deal of variation. The Enderby shield is not out of place within this array of finds. Initial research suggests it was strong enough to provide protection against attack but not indestructible. Future analysis may confirm just what force it could withstand. It has been suggested that metal adorned shields like the Battersea shield were designed to create a powerful impression through ostentatious display, perhaps reinforced by apotropaic qualities that would in part protect by discouraging physical impact (Cunliffe 1991, 490; Fitzpatrick 2007; Giles 2008; Garrow & Gosden 2012). What does this mean for the plainer, lightweight Enderby shield? It is a skillfully crafted shield but one that could be produced with some speed from locally available, sustainable resources; from plants that would keep living, trees that would keep growing. It could be created with less investment than one with metal components. It would offer some protection in hand-to-hand combat but, if heavily damaged, it could be discarded and replaced with comparative ease and speed. The resources would have been readily to hand in many parts of Britain and Ireland but the bark could only be harvested and worked from spring to summer. This is an indication of seasonal production. Variability in the evidence for weapon inflicted injuries indicates the nature and processes of combat, as well as the participants, varied regionally and temporally from the 5th century BC to 1st century AD, perhaps so too did the season for combat. The evidence from Scandinavia and Germany suggests wood and hide shields were more common than examples with metal components. With organic versions so rarely preserved in Britain and Ireland, it is possible that the known exceptions may be the rule. Perhaps the bark shield was the norm in the 4th–3rd centuries BC and the better-preserved metal fronted examples are the exception.

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RÉSUMÉ

The bouclier en écorce d'Enderby: un nouveau modèle pour le monde ancien, par Sophia Adams, Matthew Beamish, Caroline Cartwright, et Barbara Wills

Un bouclier en écorce vieux de 2300 ans, découvert en 2015 à Enderby dans le Leicestershire, représente l'exemple le plus ancien de ce type. Fabriqué en écorce de saule, il présente une bosse en panier tressé, une poignée en bois rond et un rebord en bois rond fendu et liens en fibre de tilleul. Les boucliers en matériaux organiques datant d'avant l'époque romaine survivent rarement jusqu'à notre époque en Grande Bretagne et en Irlande, et ceux dépourvus de parties en métal sont extrêmement rares. D'autres boucliers en bois de cette période, provenant d'environnements anaérobiques en Scandinavie, sont connus ; toutefois, contrairement à Enderby, aucun n'est composé d'un corps en écorce d'arbre. La complexité de la conception du bouclier d'Enderby, l'habileté avec laquelle il a été fabriqué, et ses similarités avec les boucliers en métal indiquent qu'il s'agit d'un modèle éprouvé et non d'un cas isolé. En l'absence d'autres exemples avec lesquels le comparer, une expérience de reproduction du bouclier a été mise en place comme outil d'interprétation et s'est avérée vitale pour comprendre sa conception originale. Sur la base de cette recherche, nous proposons que cet objet unique représente une forme de bouclier qui, au 1er millénaire avant notre ère, était plus facilement disponible que les versions renforcées en métal.

ZUSAMMENFASSUNG

Der Rindenschild von Enderby: ein neues Modell für die alte Welt, von Sophia Adams, Matthew Beamish, Caroline Cartwright und Barbara Wills

Ein 2300 Jahre alter Rindenschild, der 2015 in Enderby, Leicestershire, gefunden wurde, ist das einzige Exemplar seiner Art. Der aus Weidenrinde hergestellte Schild hat einen geflochtenen Korbbuckel, einen Rundholzgriff und einen Rand aus gespaltenem Rundholz, der mit Lindenbast eingefasst ist. Aus organischen Materialien hergestellte Schilde der vorrömischen Zeit überleben nur selten in Großbritannien und Irland, und solche ganz ohne metallene Komponenten sind außerordentlich rar. Aus Skandinavien sind zeitgleiche hölzerne Schilde aus anaeroben Milieus bekannt, doch anders als in Enderby besitzt keines dieser Exemplare einen Korpus aus Baumrinde. Die Komplexität der Gestaltung des Schildes von Enderby, die Kunstfertigkeit, mit der er hergestellt wurde, und die Ähnlichkeiten zwischen diesem und Exemplaren aus Metall deuten darauf hin, dass es sich um ein erprobtes und bewährtes Design handelt und nicht um ein Einzelstück. Da es kein anderes Beispiel gibt, mit dem es verglichen werden kann, wurden Experimente zur Reproduktion des Schildes als Interpretationshilfe genutzt und haben sich als entscheidend für das Verständnis der ursprünglichen Gestaltung erwiesen. Als Ergebnis dieser Forschungen wird vorgeschlagen, dass dieses singuläre Artefakt eine im 1. Jahrtausend v. Chr. verbreitetere Form von Schilden darstellt als jede mit Metall verstärkte Version.

RESUMEN

El escudo de corteza de Enderby: un nuevo modelo para el mundo antiguo, por Sophia Adams, Matthew Beamish, Caroline Cartwright, y Barbara Wills

El escudo de corteza de hace 2300 encontrado en Enderby, Leicestershire en 2015, es el único ejemplo conocido de este tipo. Se encuentra fabricado a partir de corteza de sauce, tiene un pomo elaborado en forma de cesta, un mango redondeado de madera y un borde compuesto por madera redondeada y ataduras de corteza de tilo. Los

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escudos pre-romanos elaborados de materiales orgánicos raramente se han preservado en Gran Bretaña e Irlanda y aquéllos sin elementos metálicos son excepcionalmente raros. Escudos contemporáneos realizados en madera son conocidos en contextos anaeróbicos en Escandinavia, pero a diferencia del caso de Enderby, ninguno de ellos tiene un cuerpo elaborado en corteza de árbol. La complejidad del diseño del escudo de Enserby, la destreza con la fue fabricado y las similitudes que presenta con los ejemplos realizados en metal sugiere que se trata de un diseño probado y comprobado, más que una pieza única. Puesto que no existe otro ejemplo con el que compararlo, los experimentos para reproducir el escudo han sido empleados como herramienta interpretativa y han probado ser vitales para la comprensión del diseño original. Como resultado de esta investigación, se ha propuesto que este artefacto representa la forma de escudo comúnmente disponible en el I milenio BC por encima de cualquier versión realizada con metal.

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