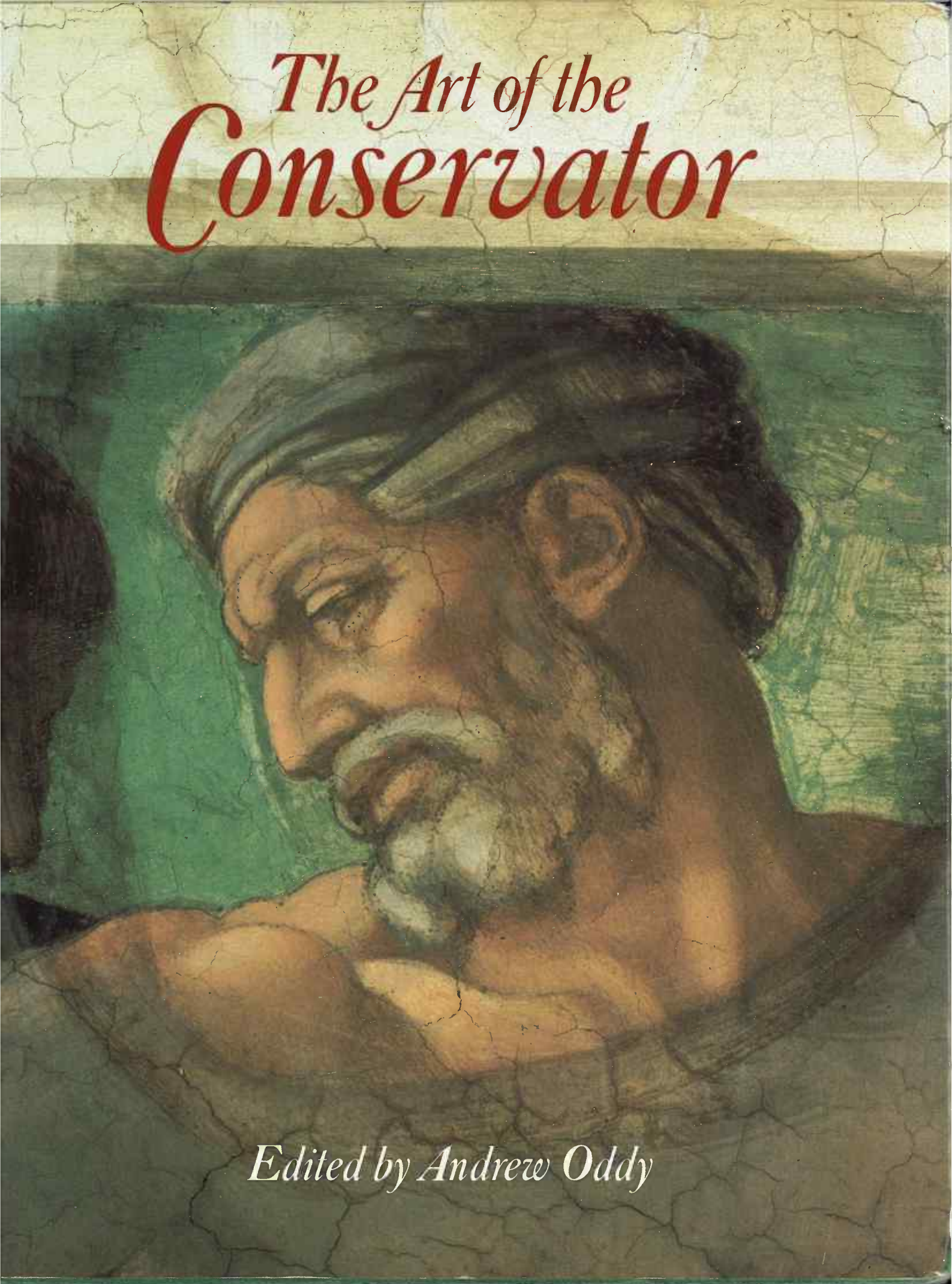
The Art of the Conservator



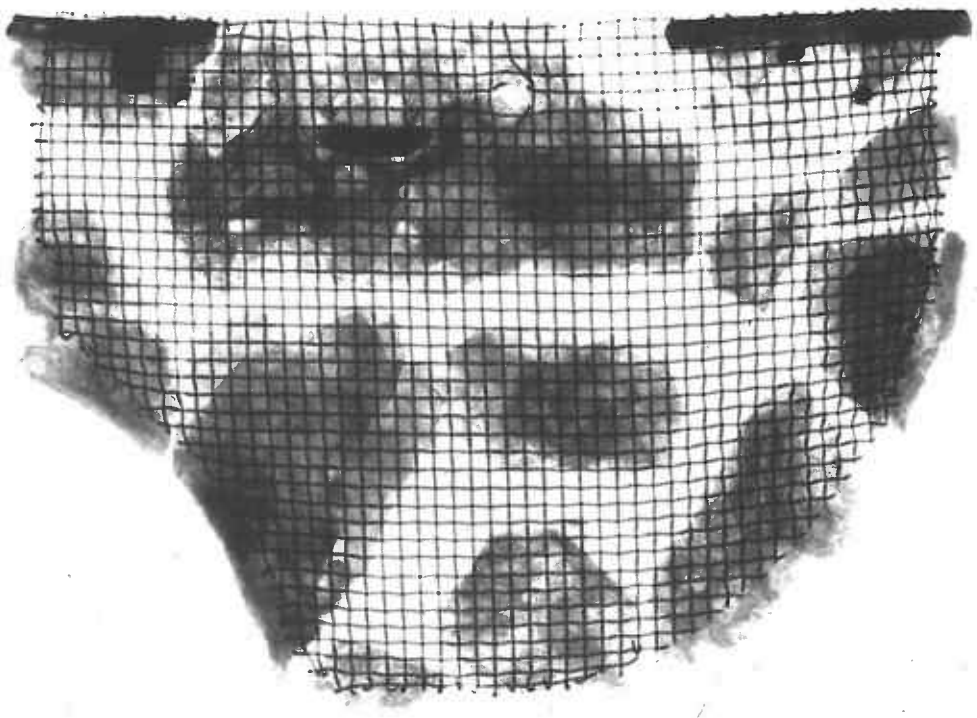
Edited by Andrew Oddy

4 The Sutton Hoo Helmet

Nigel Williams

In 1939 archaeologists excavated the largest of a group of burial mounds at Sutton Hoo, near Ipswich in Suffolk, and discovered what was to be called 'the richest find ever made on British soil' and 'the million pound grave'. The mound contained the remains of a 90-foot clinker-built boat. The boat had been the grave of a king, and it contained the domestic objects he would need in the next life: bronze bowls, buckets, bottles, cauldrons, drinking horns, silver bowls and dishes. Also in the grave were his weapons and personal possessions, including spears, a sword, a shield, a helmet, a lyre, a sceptre, gold and garnet jewellery and a purse full of coins which helped to date the grave to about AD 625, suggesting that it may have been that of Raedwald, an Anglo-Saxon king of East Anglia. Because of the impending war, the treasure was stored in the Underground railway tunnel at Aldwych until 1946. During the years that followed, many of the excavated objects were examined and conserved. The helmet, which was made of iron covered with bronze decorative
57 plates, was restored by Herbert Maryon, who spent nearly six months piecing together the hundreds of fragments that had been found.

57 The Sutton Hoo helmet as reconstructed by Herbert Maryon in 1949.



58 The 1949 reconstruction: X-ray of the removed ear flap, showing the individual fragments and the method of construction.

When the restored helmet was presented to the world it was generally acclaimed. Since it was at that time the only known example of a decorated Anglo-Saxon helmet, photographs of it found their way into every book on Anglo-Saxon art and archaeology. However, a few experts were unhappy with certain features of the reconstruction. They pointed out that the decorative bronze plates were haphazardly arranged, particularly those on the crown of the skull cap. The rigidly fixed neck guard was felt to be wrong, for it prevented the wearer from looking up without 'stabbing' himself in the back. The eye holes were so large that they would allow a sword to pass through. There was a hole at the junction between eyebrows and nose. The angle of the face mask looked strange, not least because it rendered the wearer's nose vulnerable in the event of a blow to the face; it also left the neck very exposed. The skull cap was so narrow that there was barely room for a normal-sized head, and certainly no space for the padding which would have been necessary inside the helmet.

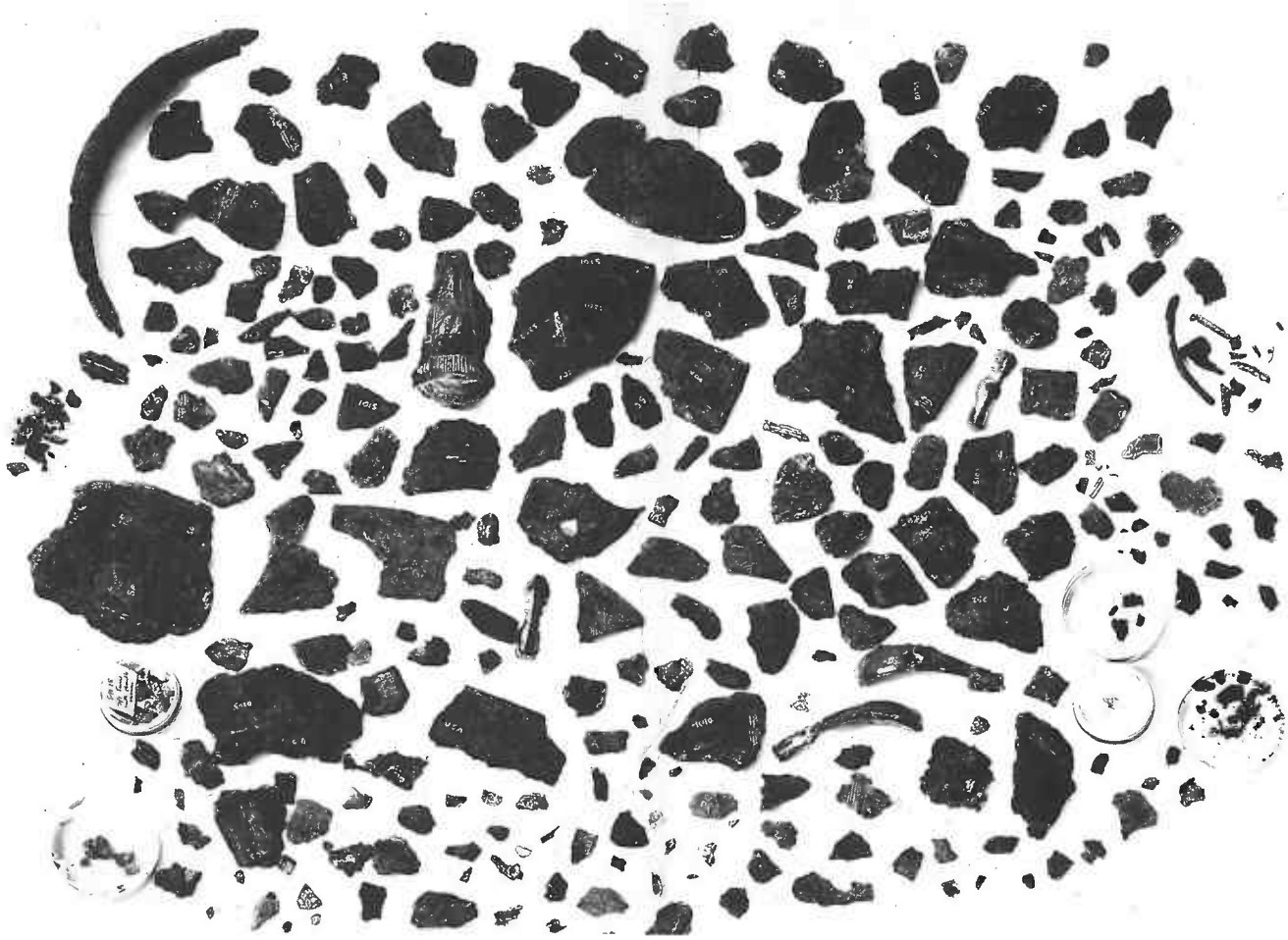
Despite these objections, the helmet remained on display for the next twenty years, becoming a very familiar item among the Anglo-Saxon objects in the British Museum. In 1968 Dr Rupert Bruce-Mitford, Keeper of Medieval and Later Antiquities, decided that the evidence for the reconstruction should be re-examined. After several months' consideration, the conclusion was reached that the only way to answer all the questions was to dismantle the helmet and reconstruct it anew.

Almost nothing was known about Maryon's reconstruction, apart from the fact that the iron fragments had been embedded in a solid block of plaster of Paris. An essential requirement of the proposed new restoration was of course that none of the fragments should be damaged during the dismantling. As a preliminary, an ear flap was removed by cutting through the holding screws with a small saw. An X-ray 58

showed that the flap was constructed in three layers, two of plaster and one of wire mesh. It appeared that the wire had been cut and shaped and then covered in plaster, on to which the helmet fragments had been placed, the missing areas being filled with more plaster. To dismantle the ear flap, the underlying layers, including the wire, were rolled back like a carpet. The fragments were then cut out, using the X-ray to plot possible saw lines. This process left the original iron sunk in a bed of plaster, which was chipped away using a scalpel and needles. As this proved successful, the same procedure was used on the other ear flap, the neck guard and the face mask.

The next problem concerned the skull cap. How could such a solid block be
59 removed without damaging the iron? The crest was an obvious weak point, and it was decided to undermine it with long pins until it could be removed. This produced a surprising revelation: the upper part of the cap was hollow. Contrary to Maryon's account of his restoration, the fragments surrounding the crest were not embedded in the plaster. Clearly, he had experienced some difficulty in fitting the fragments to the plaster head he had made, and had had to build it up rather differently from the way he had first planned. After removing the crest, it was possible to cut the

59 The 1949 reconstruction after removal of the lower sections.



60 (*Above*) The helmet fragments after dismantling.

61 (*Left*) The three gilded dragon heads. The small one had not been incorporated in the first reconstruction, but was later found among the reserve fragments.

plaster head into two halves. Once this had been done, it was clear, from the presence of a granular line running around the outside of the skull, that the iron fragments had been embedded in a second layer of plaster of Paris applied to the head after it had dried: the dry plaster had sucked water from the new layer, causing a line of weakness between the two. It was a comparatively simple matter to work along this line and remove the central core of plaster, leaving a thin skin of plaster and iron which could be treated in the same way as the ear flaps, neck guard and face mask.

After four months of painstaking work all the fragments had been removed. They
60 totalled 252, to which were added the numerous fragments that Maryon had not included in his reconstruction. These were mostly featureless pieces of iron, but one startling discovery was made: in a box marked 'head' was the jaw of a dragon-
61 head similar to those at either end of the crest. If this was part of the helmet, where did it belong? Over 500 fragments were now spread out on the work table, making an awesome and alarming sight. It was probably only at this point that the enormous difficulty of the venture was realised. One of only two known Anglo-Saxon helmets, an object illustrated in almost every book on the early medieval period, lay in pieces.

Where to begin? How could the fragments be stabilised? On what framework should the new helmet be built? What should it look like? These were some of the questions now facing the conservator. It was evident that the answers lay in the fragments themselves: they would dictate how the helmet should be reconstructed. Maryon's mistake had been to impose his ideas on the fragments.

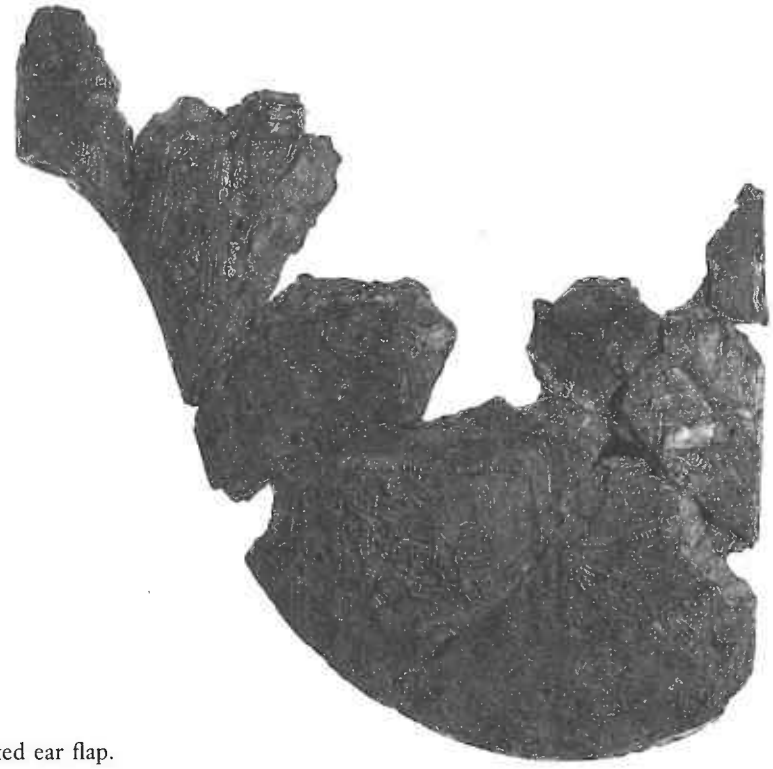
The first step was to get to know each fragment intimately. Every fragment which had any significant characteristics or markings was individually numbered. There

62 The back of a complex of fragments, showing the wrinkled appearance which helped to verify the joins.

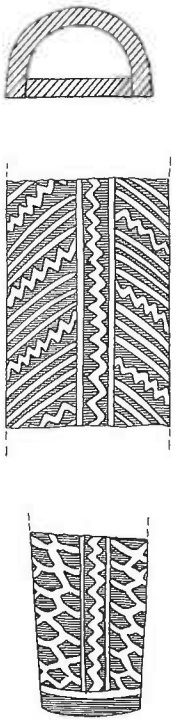
were 198 such pieces, and these fell into two groups, those with a pattern and those without. A life-size drawing was made of each patterned piece, with painstaking care for detail, including its thickness and any curvature. Each piece was handled and examined in sequence over and over again, so that matching features could be noted. This process of familiarisation took two months, but no real progress was made in fitting the pieces together. However, a number of general features had become obvious. The backs of many of the fragments had a very strange appearance, 62
wrinkled like screwed-up paper and very black in colour. This was unlike any iron corrosion in the conservator's previous experience. There were also three noticeably different thicknesses. Finally, the edge pieces were finished with a U-shaped strip of bronze: where this was missing, the marks it had left were clearly visible.

The decorated bronze plates could, at this stage, be divided into two broad categories, those with animal interlace pattern and those with figural scenes. It was obvious that there were two kinds of interlace pattern, one forming a squarish rectangle and the other a narrow rectangle. The figural scenes were more complex, however: there could have been two or three. Common to all of them was a narrow dividing strip of bronze with three fluted lines cut into it.

By now the work had been in progress for six months, but none of the fundamental questions had been answered, nor had any of the fragments been reassembled. Doubts were setting in; pressure was mounting from every quarter. Then came the first breakthrough. It was discovered that the separate pieces of the crest, which Maryon had joined together with plaster inserts, actually formed a continuous component. The removal of the plaster infills made the crest more than five centimetres (2 in) shorter than on Maryon's reconstruction. It also proved to be hollow.



63 The newly constructed ear flap.

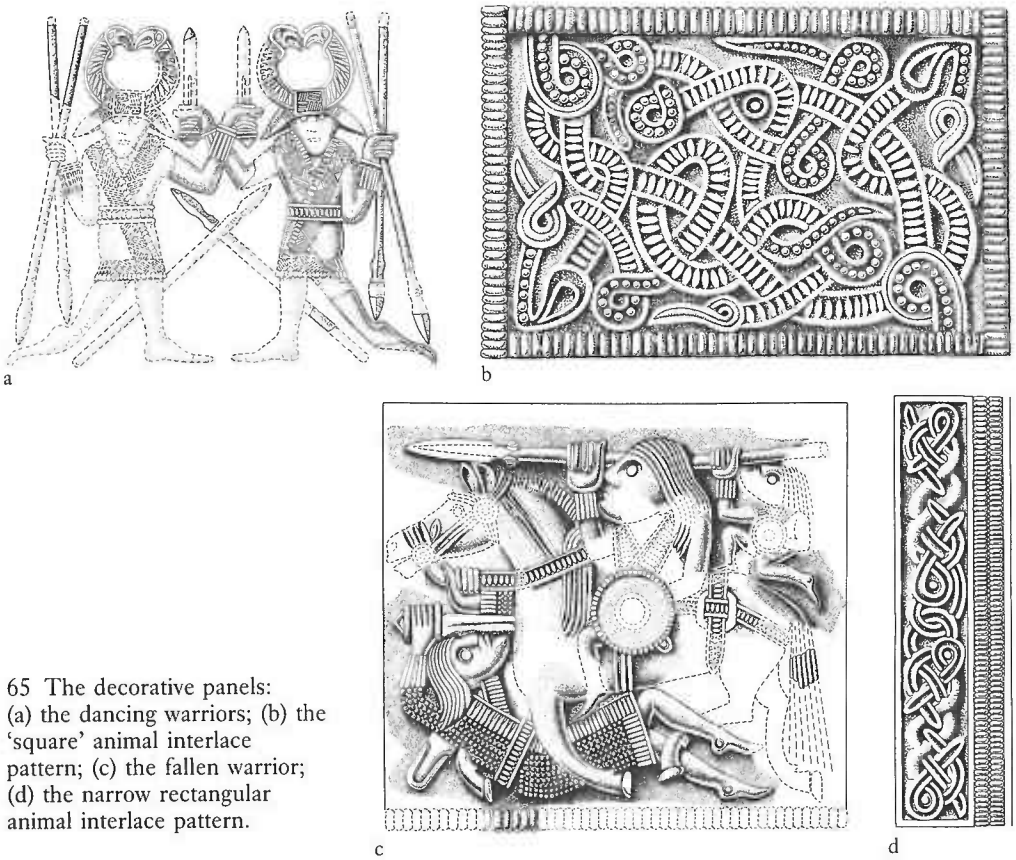


64 The crest: cross-section and decoration.

X-rays confirmed that it was inlaid with silver wires in a recurring pattern of three
64 straight lines and a zigzag. At either end this changed to a scale pattern. A section through the crest appeared to show that it had two bases. The first fitted inside the crest and was clearly part of it; the second, which was present only in small areas, had the same wrinkled appearance noted elsewhere. Could this be part of the skull cap, and could other iron fragments be joined to it? X-rays had been taken of all the patterned and the apparently featureless fragments. They revealed many rivet holes, but no lines to indicate that the skull cap had originally been constructed in sections. The only three fragments which showed joins under the corrosion did not appear to come from the cap area: in fact, two of them were corner pieces.

Another significant discovery came when examining the fragments that had been removed from Maryon's ear flaps. These fragments, which were very thin and had a concave curvature, formed a very distinctive group. The bottom curve of the left flap on Maryon's helmet had been made up of two fragments. It became clear that three large fragments from the other flap joined them, making the whole thing
63 considerably longer, though still incomplete. When this was shown to Dr Bruce-Mitford, he was at first unconvinced, coming back again and again to check the new joins. Another surprise awaited him a few days later.

From an examination of the layout of the pattern, it was obvious that the original maker had used offcuts from the animal interlace panels to decorate the flap, for none of the panels was complete. The layout was indeed very haphazard, as had been pointed out by one of the original critics, but this appeared to be the fault of



65 The decorative panels: (a) the dancing warriors; (b) the 'square' animal interlace pattern; (c) the fallen warrior; (d) the narrow rectangular animal interlace pattern.

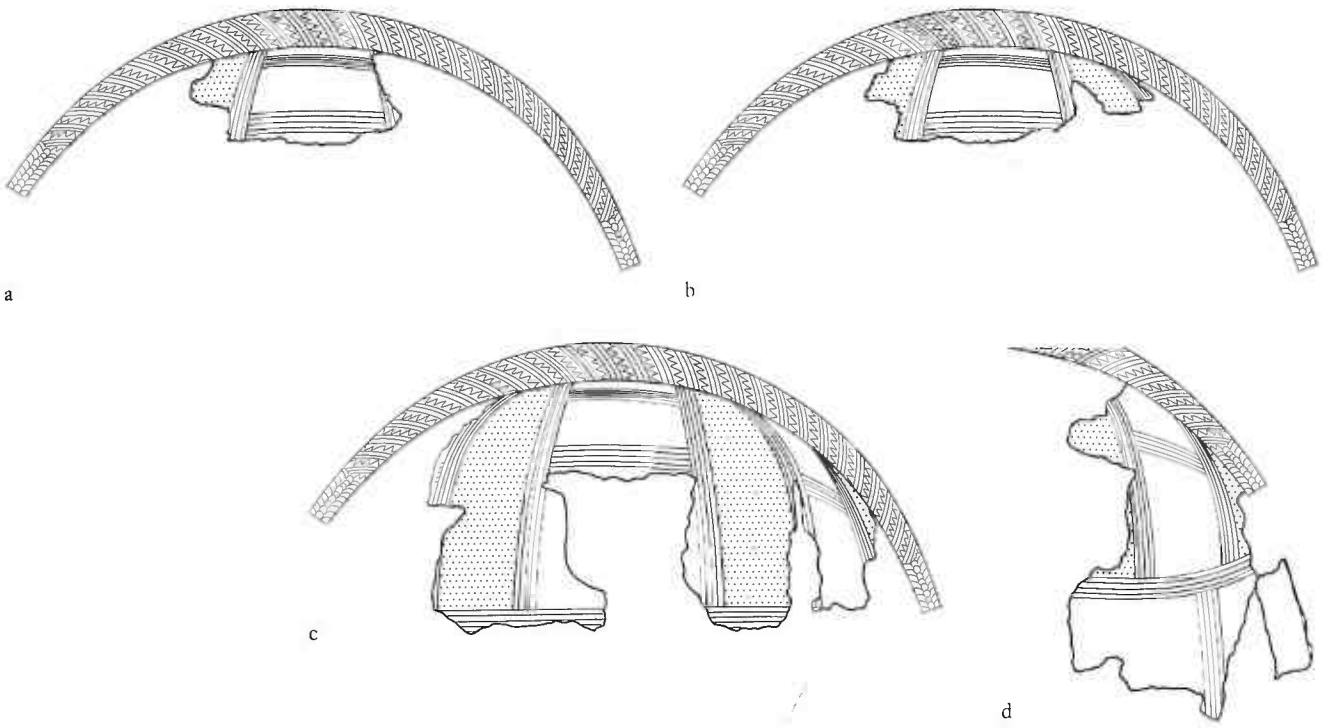
the maker rather than an error on Maryon's part. There were ten other fragments which resembled those from the ear flap, but only four had any pattern. Two were corners, one contained some kind of hinge, which was not yet fully understood, and the fourth was an edge piece showing part of a human leg and foot, which had been positioned by Maryon in the skull cap. The hinged piece proved, unlike any of the other ear-flap fragments, to be made of two layers of iron. It did not appear to come from either flap. The surprise was the foot fragment, for which a perfect join was found. It was part of a figural scene known as the 'dancing warriors', and proved that there had been a figural scene (not present in the old reconstruction) on one of the ear flaps. For days Dr Bruce-Mitford kept returning to examine this join, for its implications were quite unexpected.

Meanwhile work had continued on identifying fragments of the decorative panels. 65
It was fairly easy to identify the two interlacing animal panels, as several were complete or nearly so. The figural scenes proved much more difficult, as these had to be made up from a large number of fragments. Eventually two scenes were identified: the 'fallen warrior' and the 'dancing warriors' already mentioned.

The extra layer of iron on the base of the crest had always been borne in mind, but the finds on the ear flap had tended to push it into the background. As always, after weeks of fruitless effort progress came in a flood. No sooner had the ear flap been completed than a fragment was found which seemed to join on to the crest. Even though this fragment was almost five centimetres (2 in) long, it joined at only two points of no more than six millimetres (¼ in) in all. Microscopic examination showed, however, that the lines of the wrinkles matched perfectly, proving that the join was correct. The fragment was highly decorated: in the centre was a rectangular panel of animal interlace surrounded by lined strips; to one side of this panel was 66a
a badly corroded area which partly obscured the decoration. The fragment was sent for further X-raying, and another discovery was made: the fluted bronze strip next to the crest had traces of gilding. Using both manual and chemical treatments it was possible to clean this strip and expose more of the gold. No gilding was found on any of the other strips on this fragment. Was it therefore possible that only the bronze strip next to the crest was gilded? If so, this would reduce the number of fragments that could be joined to the crest.

All the fragments with strips were examined for gilding, and five more came to light. The last of these proved to be the one that was wanted, for it and another small fragment which joined on to it came from the area next to the first crest join. It was now possible for the first time to see a pattern forming. Radiating down from the centre of the crest, and at right angles to it, was a line of decorated panels. On either side of this was a space, which the new X-ray had shown to be undecorated, and then the beginning of a line of differently decorated panels coming from the 66b
crest at a more acute angle. This pattern was completely different from Maryon's design, which had panels encircling the cap in rows. Such was the excitement created by all these developments that visits to the laboratory had to be restricted, with entry by invitation only.

A substantial part of one side of the skull cap had now been identified, but what of the other side? Did it have a different pattern, or did the two sides mirror one another? One of the fragments with traces of gold on its strip was found to join the



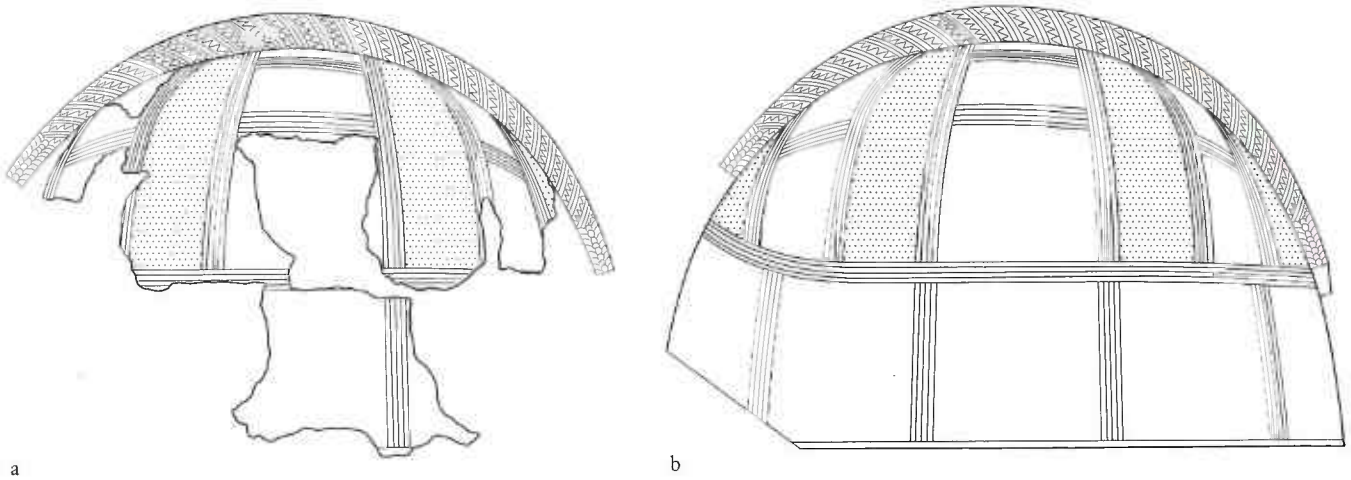
66 The reconstruction of the skull cap: (a–c) the right side; (d) a complex from the left side.

crest directly opposite the fragments already in position. Its pattern – a small square of animal interlace with part of a fallen warrior below it – matched the corresponding panel on the other side of the crest.

An idea of the helmet's eventual appearance was beginning to emerge, but it was important to remember not to try to impose this idea on the fragments. Sometimes an apparent join would be found, but there would be something worrying about it: the feel or the look of it was not quite right. Sometimes other members of the team studying the objects found in the Sutton Hoo ship would be asked to look at a join: one particular join had four members of the team arguing over it. It would be put aside to see if other joins could be found either to confirm or to disprove it.

During the next few days three more very important joins were found. The first two pieces fitted on either side of the central complex of the skull cap and completed
66c the diagonally radiating strips of animal interlace panels. The third piece fitted on to the bottom of the central strip, continuing the line of fallen warrior panels; however, this was clearly not the bottom of the skull cap, for a fluted strip was visible at the bottom of the panel, rather than the bronze U-shaped band noted elsewhere.

As work progressed on the joins to the crest, other pieces were being found which at the same time could be neither positioned nor fully comprehended. The most
66d baffling was the group relating to one of the dancing warrior panels. Two fragments which joined each other had parts of both warriors on them. This made sense, but the fluted strip above them rose at a very sharp angle instead of lying horizontally. Why? Above this strip things became even more complex, for there was evidence of two interlace panels and an area of undecorated iron. Until now, not much account had been taken of thickness, but this complex was clearly much thicker than the restored ear flap, the only other place on the helmet where a fallen warrior panel



a b

67 The nearly completed skull cap (a) made it possible to work out the overall design (b).

was known to belong. Its thickness did, however, match that of the rest of the skull cap. Three more fragments were eventually joined to this complex, with a fluted strip marking the edge of the warrior panel but with no other features.

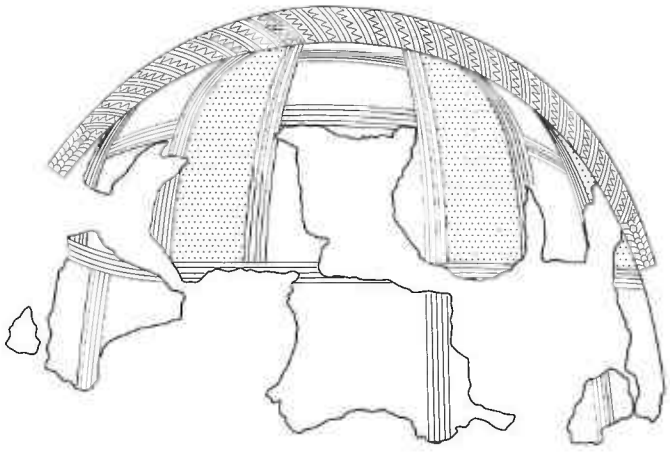
The complex was now too long to fit into the right side; it must therefore come from the left. Under a × 20 microscope small traces of gold were seen on the fluted strip above the interlace panel, and the complex was therefore placed alongside the crest. No edge-to-edge join could be found, but it seemed to sit naturally in one particular position. A join like this may not be seen so much as felt; the two pieces seemed to lock together under the fingers. The complex sat next to the only other fragment associated with this side of the cap, but it did not join it conclusively. However, some weeks later a fragment about the size of a fingernail was found to link these two fragments together, and any lingering doubts were removed.

In the meantime, a second complex was emerging. It contained the last fluted strip with traces of gold on it, though it did not actually join any part of the crest. Even more importantly, it had on one edge the bronze tube which was known to run along the bottom edge of the cap. This bottom edge was defined when a large piece was found to join the vertical decorated strip in the centre. At this point, above the ears of the wearer, the cap was four panels deep, comprising three fallen warrior panels and one of animal interlace. As both sides of the skull cap had proved to be identical, by using information from each it was possible to work out the complete design. 67a 67b

Combining knowledge of the overall design with other features such as thickness, curvature and pattern, it was possible to work out the position of some of the other fragments. For example, a piece which had on it a dancing warrior and a fallen warrior separated by a fluted strip was distinguished by the fact that the fluted strip curved upwards just like that in the large complex. Even though the reason for this curve was not known, its position was certain and the fragment could be placed with confidence. 68

After eight months' work the main parts of the skull cap and one ear flap were complete. There remained two outstanding problems: the three dragon heads and the unexplained curvature of some of the fluted strips. There had almost certainly been a dragon on each end of the crest: the question was, which ones? The two

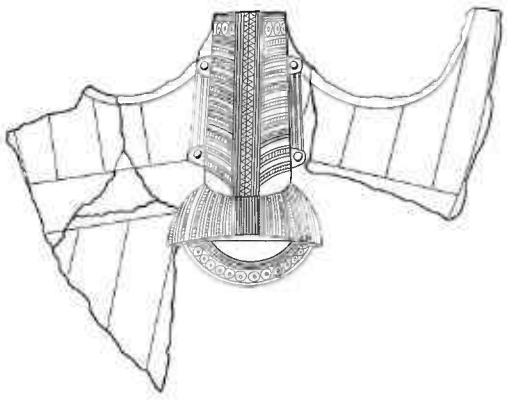
68 The completed skull cap (right side).



from Maryon's helmet were both of gilt bronze, but were very different in shape. One had a long jaw and head, with the eyes set high, but the neck was missing. The other had a shorter head and jaw, and the underside of its neck had a hollow, as though a bite had been taken out of it. The third one was made of a grey, putty-like material, which on analysis proved to be a corroded high-tin bronze. Unfortunately the only part remaining was its jaw. Traces of this grey material had been found on the back end of the crest, and suggested that this dragon belonged there. However, only one of the other two heads could belong to the front end of the crest. Could it be that one of them came from another object altogether? For the time being this question could not be answered.

The next section to be reconstructed was the face mask. Here there were five
69 important pieces: a large gilt bronze nose, cast in one piece with moustache and mouth, two bronze eyebrows inlaid with silver wires and garnets and with gilt bronze boar heads at either end, and two iron fragments covered with the animal interlace pattern found on the rectangular panels. These two fragments had been correctly joined to either side of the nose and had created the eye holes. Their thickness was greater than that of the ear flaps, but not as great as that of the skull cap. Using this thickness as a yardstick, it had been possible to add three other fragments to the mask during work on the skull cap. These were easily joined to their partners, enabling the face mask to be completed. The eyebrows sat neatly on top of the nose;

69 The face-mask fragments: only the narrow rectangular animal interlace panels were used as decoration.



there was even a small cut-out in the inner edge of the eyebrows to accommodate the tang at the top of the nose. The only problem was that a large space was left between the eyebrows.

The number of unplaced fragments was by now much reduced, and it had become possible to allocate each one provisionally to a particular area: the cap, the second ear flap, or the section which was still a total mystery – the neck guard. It soon became obvious that very little remained of the second ear flap. The most substantial fragments were a corner piece and one large piece from the middle; both had traces of animal interlace and fluted strips. The other pieces consisted of four small fragments and part of the U-strip which enclosed all the edges of the helmet. Even though only a small percentage of the flap remained, it was possible to reconstruct it by combining knowledge of this and the more complete one.

During work on the other components, it became apparent that the rectangular interlace panels occurred mainly, though not exclusively, on the face mask and the neck guard. The fragments differed from each other in one important respect: those from the face mask were almost twice as thick as the others. Working on this principle it was possible to narrow down to seventeen the number of fragments that belonged to the neck guard. These could in turn be assigned either to the square or to the rectangular animal interlace panels. After some days' work, a small complex had been built up from seven of these fragments. It proved to be a corner piece, the upper part of which was covered in square panels, with rectangular panels set vertically below them. The complex showed a general curve, and in addition a very sharp bend in the upper corner, with the lower panels fanning out at an angle to the upper ones. An X-ray of one large fragment covered in square panels revealed that the neck guard was not a single piece of iron but had been made in two sections. This matched the piece containing the hinge, excluded from the ear flap at an earlier stage. The hinge was clearly the means of attaching the neck guard to the skull cap, and the X-ray showed it to consist of two rivets and a bronze bar. A second complex proved to have the remains of two rectangular panels one above the other, each surrounded by fluted strips, with an area of undecorated iron to either side. The basic design on the neck guard was therefore made up of a square panel with two rectangular panels end to end below, all divided by fluted strips. It was not clear at this stage how many times this design was repeated across the top of the neck guard.

After more than nine months' work it was now possible to form a reasonable picture of the original helmet, though what actually existed was several complexes and single fragments which now needed to be brought together. A featureless plaster dome was made, considerably smaller than the helmet. This was thoroughly dried in a kiln to make sure that it did not contain any moisture which could cause the iron to rust. Once dry, it was placed centrally on a wooden board under a movable plumb bob.

The crest was placed along the centre line of the dome and checked against the plumb bob. As the dome was smaller than the helmet, it was necessary to lift the crest on a cushion of oil-free plasticine. The initial joins had been stuck with a soft adhesive, but as the complexes became larger and heavier there was a danger that they might break. Some of them had therefore been left unjoined until they could be supported on the dome. This was true in particular of all the fragments that

70 The fragment complexes being brought together on the plasticine dome and held in position with long pins.

joined on to the crest. Each piece or complex was positioned on the dome and
70 supported by long pins sticking into the plasticine. Slowly, for the first time, the skull cap was recreated in its original form. This was a time for reflection: all the evidence for what was being done was considered and reconsidered, and only when no doubt remained was a piece finally positioned. After several more weeks all the fragments were in place. During this process it at last became clear that the fluted strips which turned upwards did so because the dancing warrior panel had to be raised in order to allow the eyebrow to be positioned below the panel without obscuring the warrior's legs. It was therefore possible to say that this panel came from the front of the helmet.

It was now necessary to replace the missing areas in order both to strengthen the cap for handling and to prepare it for display. A light but strong textile of jute stiffened with adhesive was cut into long strips: these strips were heated so that they could be shaped into the correct profile and then stuck to the edges of the iron fragments with soft adhesive. A very thin layer of plaster of Paris was spread over the jute to bring the fill level with the outer surface of the helmet and to give it a smooth appearance. The finished cap was now strong enough to be removed from its plaster and plasticine support.

At this stage the face mask and the ear flaps could be added. The mask was placed vertically under the front of the cap. There were none of the plaster inserts which Maryon had needed to add, so the eye holes were much smaller. The ear flaps were placed with the cut-away edges nearest to the face mask, as on Maryon's reconstruction, though they did not look right in this position, as the sides of the neck were left exposed. An expert on arms and armour advised that the ear flaps

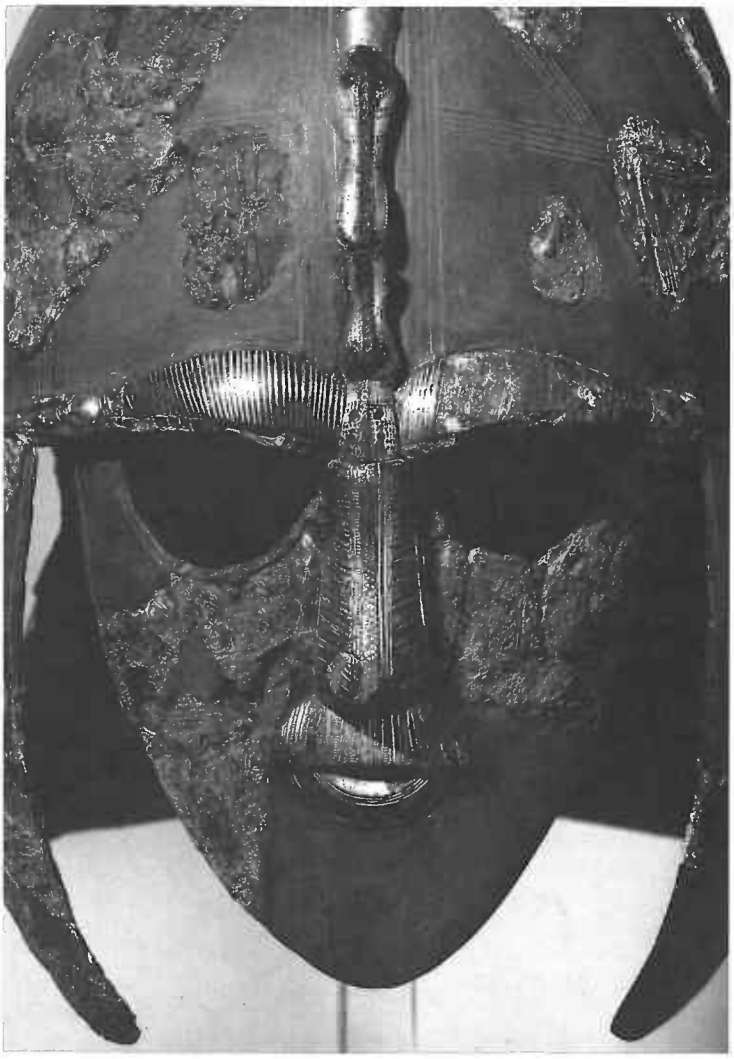
should change places so that their cut-away sections combined with those of the neck guard to form a curve large enough to enable the wearer to raise his arm. With the ear flaps in place, the correct width of the top of the neck guard was evident. It proved to correspond exactly to five of the square interlace panels.

During the rebuilding process, the problem of the remaining dragon head had been constantly in mind. The solution came like a bolt from the blue: one of the eyebrows and the smaller dragon were being handled together when it was noticed that the curve cut into the dragon's neck fitted the convex shape of the eyebrow. When the two eyebrows, the dragon head and the nose were put together they formed the shape of a flying bird, with the eyebrows as its wings, the nose as its body and the moustache as its tail. Now the other head could be placed on the free end of the crest, forming a snake-like dragon coming down to meet the bird flying upwards. This confrontation now became the central and most dramatic feature of 73
the entire helmet.

Once all the sections were fitted together, the infills were painted brown to match the corroded iron, and lines painted in to show the position of the missing panels.

71 (*Left*) The helmet as it would have been seen by the Anglo-Saxons: a replica made by staff of the British Museum and the Royal Armouries.

72 (*Opposite*) The Sutton Hoo helmet after reconstruction. British Museum. The front view is illustrated opposite the title page (p. 2).



73 The newly reconstructed face mask, showing the bird formed by the eyebrows, nose and moustache and the dragon's head on the end of the crest coming down to meet it.

After more than a year, the helmet was now complete. It appeared brown only because the iron had rusted: originally, because the surface was tinned, it would have been a bright silvery colour. A replica produced later in collaboration with the Royal Armouries at the Tower of London gives a striking impression of how it would have looked when first worn, about 1,400 years ago. 72 71

Acknowledgements

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Further Reading

H. Maryon, 'The Sutton Hoo Helmet', *Antiquity* 21 (1947), pp. 137–44.

R. Bruce-Mitford, *The Sutton Hoo Ship-Burial: Vol. 2, Arms, Armour and Regalia*, London 1978, chapter 3, 'The Helmet', pp. 138–231.

A. C. Evans, *The Sutton Hoo Ship Burial*, London 1986.