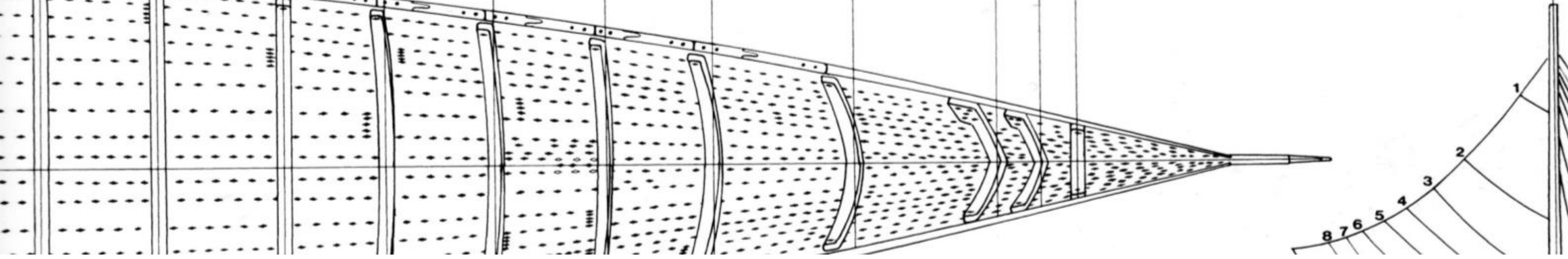


Materials for Fastenings on the Sutton Hoo ship

Joe Startin

Email: contact@saxonship.org
Website: www.saxonship.org

Abstract: The Sutton Hoo ship used many rivets, and a few similar fastenings. What the rivets were made of (probably wrought iron) and the material that they were used with (probably oak) would be important in any attempt at reconstruction. This paper examines the very limited evidence about the nature of those materials in the original ship. This leaves much scope for speculation. A decision to 'use oak' still raises a host of questions. The susceptibility of the iron to rusting could well shorten the life of a reconstruction. Alloys of copper or aluminium could be used for some or all of the rivets, but a range of issues would require consideration, and comparability could be compromised.

Keywords: Sutton Hoo ship, iron, oak, rivet, nail, rove, wrought.

1 Introduction

Very limited evidence remains regarding the fastenings which were used for the Sutton Hoo ship. This paper focuses first on what the evidence actually is. In particular, what kind of iron was used, and what kind of wood was being held together? Then follows a brief discussion of the issues that fastenings would raise in a reconstruction.

2 The 1938 story

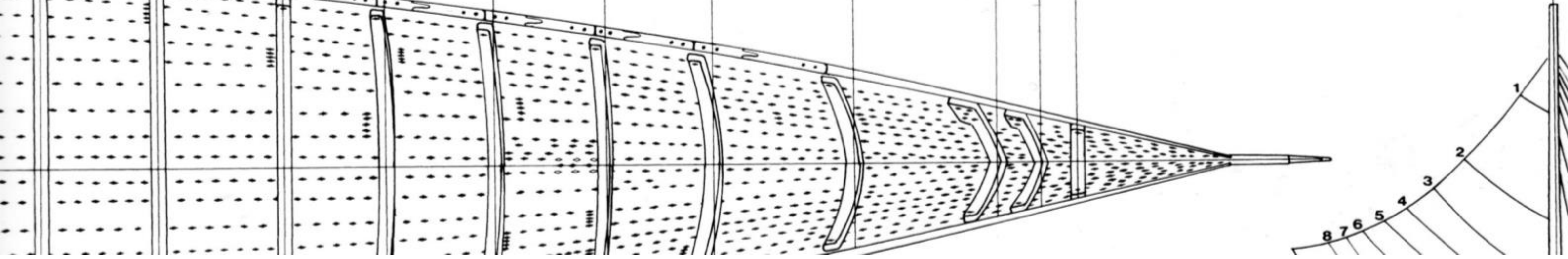
When Basil Brown excavated Mound 2 at Sutton Hoo in 1938, he had some idea of what to expect. A newspaper report (The Ipswich Journal, 1860) had mentioned some activity there. 'One of these mounds was opened recently when a considerable number (nearly 2 bushels) of iron screw bolts were found, all of which were sent to the local blacksmith to be converted into horseshoes!...These barrows were laid down in the Admiralty surveys by Captain Stanley during the stay of the Bluzer when taking the soundings of the [Deben] some few years since.'

Brown had already checked the 'iron' rivets at Aldeburgh Museum taken from the ship burial at Snape Common in 1862, and found similar in Mound 2. I imagine all the existing rivets from Snape Common and Mound 2 are heavily oxidised. There can be little doubt they were originally iron, but I am not aware of any useful analysis of their composition beyond that. How much success the blacksmith had in 1860 is unrecorded.

3 The 1939 story

Phillips (1940c, p. 24) says, 'All the nails were in an extreme state of rust and it is doubtful whether any metallic iron remained, though the form was readily recognizable and all the nails were exactly in their places except in the burial-chamber area, …' Phillips (1940b, p. 354) says of the clench nails, 'Very little or no iron remained in them, but the forms were well preserved.'

However, Crosley (1943) was more forthcoming – 'Some of the nails were so rusted that they could be broken across by hand, and were found to be hollow….Many of the nails were still solid, however, and one of them had to be sawn through with a hacksaw and appeared to be wrought iron of good quality.' Crosley, a member of the team who surveyed the ship in 1939, worked at the Science Museum, and was later vice-president of



the Newcomen Society. He would have been familiar with artefacts from the Industrial Revolution and was probably a good judge of iron.

The descriptions speculate about the use of wooden trenails in certain places, but no physical evidence was identified.

3.1 Riveted through oak?

Fastenings are only as good as the material the fastening passes through. Phillips is generally careful to mention 'wood' rather than 'oak', but in Phillips (1940a, p. 160) he says, 'At a later stage a piece of much decayed oak was found among the objects placed just inside the west end [of the burial chamber] which proved to have been of not less than seventy-five years growth (see Appendix III).' Appendix III on p. 200 is a 'Report on the timber from the Sutton Hoo Ship-burial', by Dr H. Godwin of the Botany School, Cambridge. This is a tree-ring analysis, and the sample is stated to be '… a moderately-sized piece of oak, *Quercus Robur* (sensu lato [in a broad sense])…' This is variously called common oak, pedunculate oak, European oak or English oak. The tree-ring analysis actually showed it was at least 150 years old when cut, from a tree at least 14 in. in diameter. The report is reproduced in Bruce-Mitford (1975, p. 680), who also says (p. 507) it may have been from a roof support, at least 8 inches square. At any rate, it was not from the hull.

Phillips (1940a, p. 184) says that 'An exception to the general disappearance of the wood of the hull was found on the bottom of the north-west part of the burial chamber, where a piece of strake 9 on the port side was found preserved in a recognizable condition to a length of 15½ ft.; seen under the ladder in pl. xxxii, *b.* It was not less than 18 in. broad, and appeared to be as much as 3 in. thick, though extreme decay made this figure uncertain.' Plate xxxii, *b* shows that strake 9, the gunwale, is *not* being referred to. In fact it is strake 1, the port garboard. This piece of wood is what is called plank G in Crosley (1943, fig. 9, p. 111), and also in Science Museum, 1939, and also in Bruce-Mitford (1975, fig. 186, p. 260). However, no-one suggests what kind of wood Plank G might be.

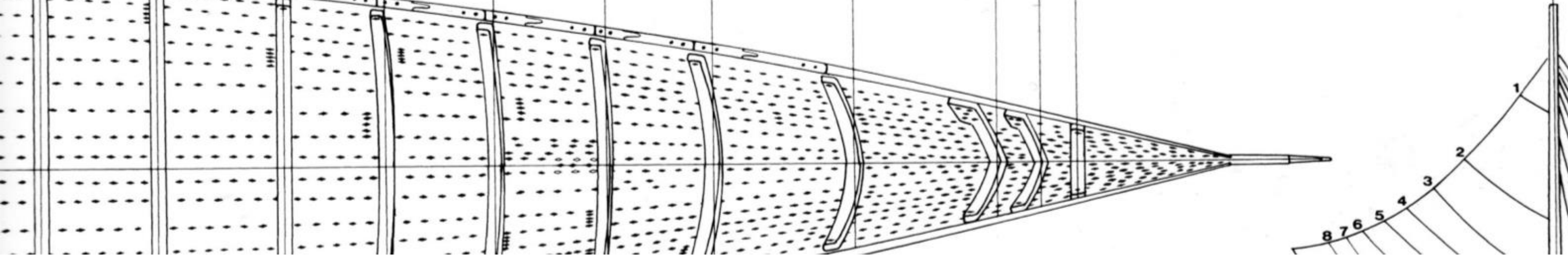
Crosley (1943, p. 109) says, 'The wooden strakes of the ship, probably oak, had disappeared almost completely…'

The direct evidence for an oak hull is scant. The general of assumption of oak is presumably based on the lack of plausible alternatives.

4 The 1966-7 investigation

Bruce-Mitford (1975, p. 451), for the British Museum inventory item Q 202, relating to the ship, says, '*Rivets*, numerous, with scarf and rib bolts, gunwale spikes, and one nail from the hull of the ship, numbering in all some 1560 items, all of iron heavily oxidised. Bolt, rivets etc. removed in 1939 by the Science Museum are included, also one plank-joint lifted intact in plaster in 1967.' There is no mention of any metallic iron having been found from the ship itself.

Bruce-Mitford, 1975 mentions lots of other ironwork from the burial artefacts and the construction of the burial chamber. The coat of mail, and the hanging chain, are obviously quite elaborate. The way iron objects in the burial chamber interacted with the textiles close to them yielded invaluable information. Even so there is no analysis into the nature of the iron.



Nothing is added to the question of what kind of wood was used for the hull. Regarding trenails, there is very little to go on. Bruce-Mitford (1975, p. 371) says, 'Despite intensive searching through contemporary photographs, only in three instances could faint traces in the sand of the ribs be convincingly interpreted as evidence for the former existence of the use of trenails.'

5 Some interpretation

Something of the nature of the iron can be inferred from the treatment that it must have been given. The roves had been hammered out. The nails had been clenched over the roves by hammering to form a burr over them. This does suggest wrought iron.

From Wikipedia:

- Wrought iron is an iron alloy with a very low carbon (less than 0.08%) content in contrast to cast iron (2.1% to 4%). It is a semi-fused mass of iron with fibrous slag inclusions (up to 2% by weight), which gives it a "grain" resembling wood that is visible when it is etched or bent to the point of failure. Wrought iron is tough, malleable, ductile, corrosion-resistant and easily welded. Before the development of effective methods of steelmaking and the availability of large quantities of steel, wrought iron was the most common form of malleable iron. It was given the name *wrought* because it was hammered, rolled or otherwise worked while hot enough to expel molten slag. The modern functional equivalent of wrought iron is mild or low-carbon steel. Neither wrought iron nor mild steel contains enough carbon to be hardenable by heating and quenching.
- Mild steel contains approximately 0.05–0.25% carbon making it malleable and ductile.

General reading suggests that the Anglo-Saxons at that time would have smelted the iron. This is heating up the ore with a chemical reducing agent to a temperature which is high enough to work, but not so high it produces molten metal. The result is that very little carbon then reacts with the iron.

When the source of the ore is bog iron (limonite), then 'bog' iron is produced.

Trying to reproduce the Anglo-Saxon smelting process would be difficult, slow and expensive, leading to a product of variable and uncertain properties.

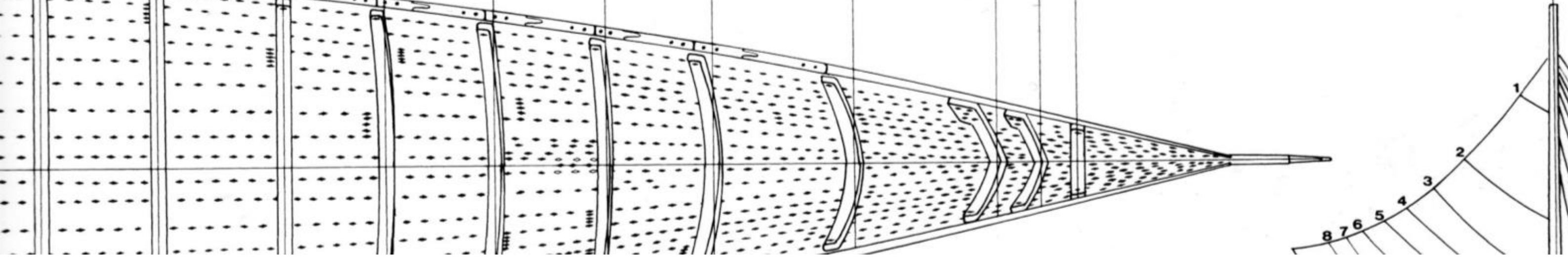
The iron-carbon system is exploited very widely today, but wrought iron is not produced on a commercial scale. The most suitable industrial alternative would probably be some sort of mild steel. As well as reducing cost, such product would have known properties, and be consistent. This is attractive from the point of view of safety.

5.1 What about other metals for the rivets?

Iron rusts, and over a period – say N years - the ship will fall apart, whether it is heavily used or not. The value of N is speculative, and obviously crucial. If N was 25 I could imagine the Anglo-Saxons accepting a ship falling apart, just as they did with their mead halls, because they could not see any better alternatives.

For a reconstruction, some or all of the rivets could use alternatives. For instance, suitable alloys of:

- Copper
- Aluminium



Compared to wrought iron, these materials have different densities, tensile strengths and shear properties. The size, and maybe spacing, of the rivets would need to be different to make a hull of comparable strength. How comparable the hull really was would always be open to question. The weights of the rivets would possibly be sufficiently different to raise questions about the impact on the weight distribution (a heavier/lighter hull with lighter/heavier ballast).

Apart from the practical difference there would be a perceptual and an aesthetic one. Without too much exaggeration, the iron rivets of the ship can be said to be iconic.

The actual gain in lifetime would be another matter for debate.

5.2 And the wood?

Oak already has a good reputation for strength and durability. It is difficult to imagine wood from any other kind of tree being a contender. For any given part of the hull, the species of oak, the size and age of the original tree, how green the wood was, and how it was split or cut, would all be up for debate.

6 Conclusions

Very limited evidence remains regarding the materials used to hold the Sutton Hoo ship together - definitely iron for the rivets, and probably wrought iron; and probably oak for the wood. This leaves much scope for speculation. A decision to 'use oak' still raises a host of questions. The susceptibility of the iron to rusting could well shorten the life of a reconstruction. Alloys of copper or aluminium could be used for some or all of the rivets, but a range of issues would require consideration, and comparability could be compromised.

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