5.5 Skuldelev 5

5.5.1 Excavation

Position in the barrier

The wreck Skuldelev 5 was situated along the northern edge of the *Peberrenden* channel, oriented with the bow pointing north-northwest, ca 60° offset in relation to the orientation of the main part of the barrier formed by Wrecks 1, 2 and 3 (Fig. 1). The ship had been pressed against the irregular contours of the channel's sloping bank, so it lay in a tilted position with its port planking downslope. This deposition had caused several of the stones inside the ship to roll out of the hull into the deeper part of the channel, and the planking itself to split open (Figs 2-3).

There would have been little use for the ship as part of the barrier in this position, since it was oriented along the course of the channel rather than across it. The ship would have been more useful if it had been positioned directly in line with Skuldelev 3 and 1, in order to close the northern passage over the threshold (cf Fig. 1). Consequently, it is likely that Skuldelev 5 with its load of stones had run aground at the highest part of the glacial core just before it was to be positioned for scuttling in line with the other wrecks. As the ship was old, weak, and heavily loaded, it could probably not be moved and consequently had to be left on the spot where it had run aground. The fact that the drain-plug was not found in position aft in the garboard strake indicates that the ship had eventually been abandoned here deliberately.

The slender hull of the ship had come to rest on the slope, with the midship part and the after end of the keel and the remaining parts of the starboard planking lying higher and more exposed, 0.5-1.0 m below the present sea level. The stem of the ship was found *in situ*, ca 1.5 m deeper, level with the strakes of the port planking (cf Fig. 2).

State of preservation

As found, the remains of the ship consisted of the keel and fore stem, most of the planking to port, almost all of the floor timbers, and several of the other framing elements, as well as a small segment of the starboard planking. Within the excavated area of the cofferdam, only a few loose parts of this ship were found outside the coherent part of the hull.

As a result of the ship's strong list to port after its sinking, the upper parts of the starboard side were entirely lost, having been exposed to currents and ice-drift as well as to

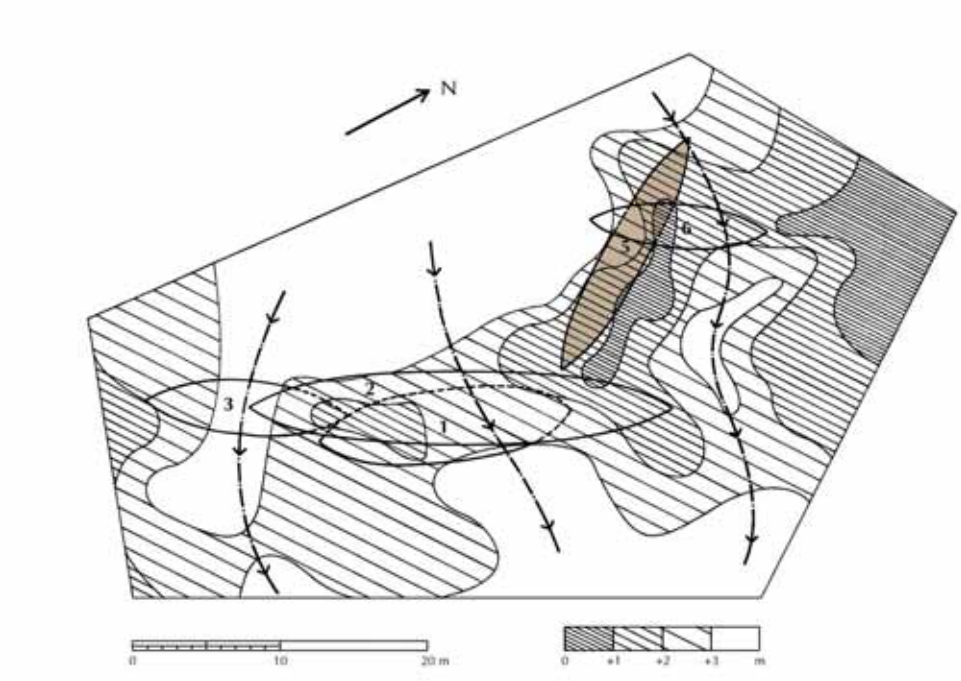


Fig. 1. The position of Skuldelev 5 in relation to the natural barrier (the shaded areas) rising as a threshold from the bottom of the Peberrenden *channel (the white area).*

possible salvaging activities, leading to their disintegration or removal at an early stage. Afterwards, sediments started building up in the lower part of the hull, leaving the remaining starboard planks and frames as well as the keelson protruding along the upper edge of the slope, exposed to biological decay and erosion (Fig. 4).

On the port side, the sheerstrake and other parts of the upper planking became the deepest part of the wreck. The forward part of these strakes broke off and probably drifted away at an early stage in the disintegration of the ship. This no doubt happened as the stone-filled ship settled on the slope and some of the stones rolled down and out of this area of the hull. During the excavation, as many as twelve boulders of sizes up to 60 cm across were recorded just below the ship in this area. These apparently came from the ship, as they were embedded in marine layers of sand and shells which otherwise contained no stones of this character (cf Figs 2-3).

The remaining upper planking of the port side of the ship did not break down initially, but continued to protrude from the sloping bank of the channel, ca 0.8 m below the level of the keel. Here the sixth and seventh strakes were affected by biological decay for some time before their fastenings eventually loosened and they lay flat, soon to be covered by sediments (Fig. 5). Before the iron fastenings corroded, the beams and knees were exposed to decay and they eventually also settled in the sediments collecting inside the wreck.

Some years after the sinking of Skuldelev 5, another vessel, Skuldelev 6, was scuttled in such a way that it covered a 3 m-broad part of Skuldelev 5 forward of amidships. In this way, the decay of the covered starboard planking of Skuldelev 5 was effectively stopped, but degradation continued in those areas of the planking that lay exposed, until these parts of the wreck were eventually covered by a thin layer of sediment.

Excavation, raising and documentation

Skuldelev 5 was found in 1959 during an attempt to determine the total area of the barrier. Two exploratory trenches were cut within the stone-filled area to the north of Skuldelev 1. Here, parts of a 'fifth' wreck (still considering 'Wreck 4' as a separate ship) were exposed, one section ca 2 m long aft at the frames 5A-7A and a depth of water of 1.0-1.5 m, and another small area amidships. Simultaneously, the orientation of the wreck in a strong list towards south-west was then known and a few parts of the framing system were removed. Before conservation they

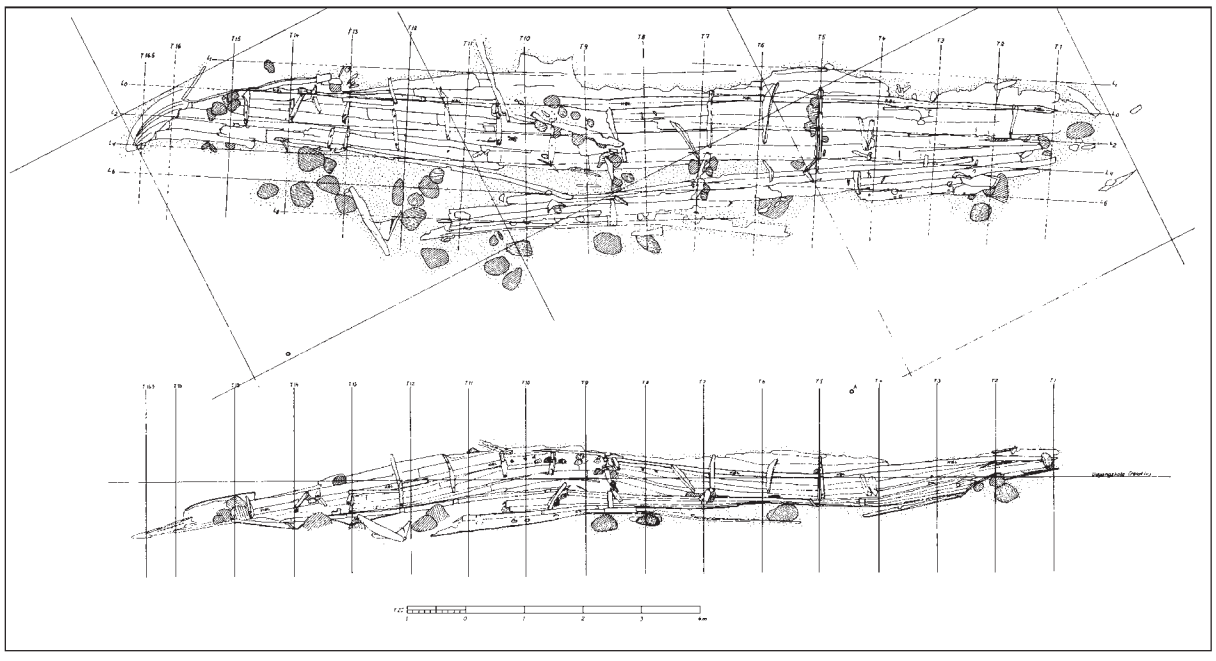


Fig. 2. Skuldelev 5. Photogrammetrically recorded plan of the excavated ship seen from above and from the channel-side

were recorded at a scale of 1:5 by Knud J. Krogh, but no further investigations were carried out prior to the excavation in 1962.

From the plan prepared in 1959 of all the observations from the investigations in 1957-59 (cf Chapter 2, Fig. 12), the hull of Skuldelev 5 was estimated to have extended no further than to some point below Skuldelev 6, as no traces of the ship were found in a small trench on the northern side of that ship. Fortunately, the 1962-cofferdam was constructed at a minimum distance of 5 m to the then-known position of the ships. Because of this, the excavation in 1962 could expose the full length of the hull including the stem, the forward edge of which was actually found 4.5 m to the north of the wreck Skuldelev 6 and covered by ca 1.5 m of sand.

The complete excavation of Skuldelev 5 began on 18 July and was completed on 25 August, 1962. During this period the wreck of Skuldelev 6, lying on top of Skuldelev 5, also had to be excavated and partly removed in order for the hull below to be fully exposed (cf Fig. 3). The photogrammetrical survey was then made on 25 August. Starting on 30 August, all parts of the ship were removed in seven working days, after they had been numbered from 2001 to 2124 and from 3001 to 3146. Several of the pieces were in many fragments and 270 units were collected in total.

In the conservation workshop in Brede, Skuldelev 5 was the first ship to have its planks and timbers documented. The basic recording standards at a scale of 1:1 (cf Chapter 3.1) were established at the very beginning of this task, but the drafting foil chosen soon proved to be unstable. Therefore, the tracings made of the greater part of the planks of Skuldelev 5 had to be re-traced onto the polythene foil chosen for the remaining documentation work. In this process some of the details recorded in the first instance, such as a few rivet holes, may have been left out unintentionally. The initial recording of the cross-sections of planks was done by a documentation technique different from that of tracing the features of the planks directly by eye and was done sporadically in this ship in contrast to the process employed in the ships recorded at a later stage.

Fig. 3. Skuldelev 5. The wreck fully exposed, seen from the north-west. The deepest part of the wreck (right) is the port gunwale. A segment of Skuldelev 6 is seen to the left with the keel still in position on top of Skuldelev 5.

Fig. 4. Skuldelev 5. Section of the midship part of the ship during excavation.

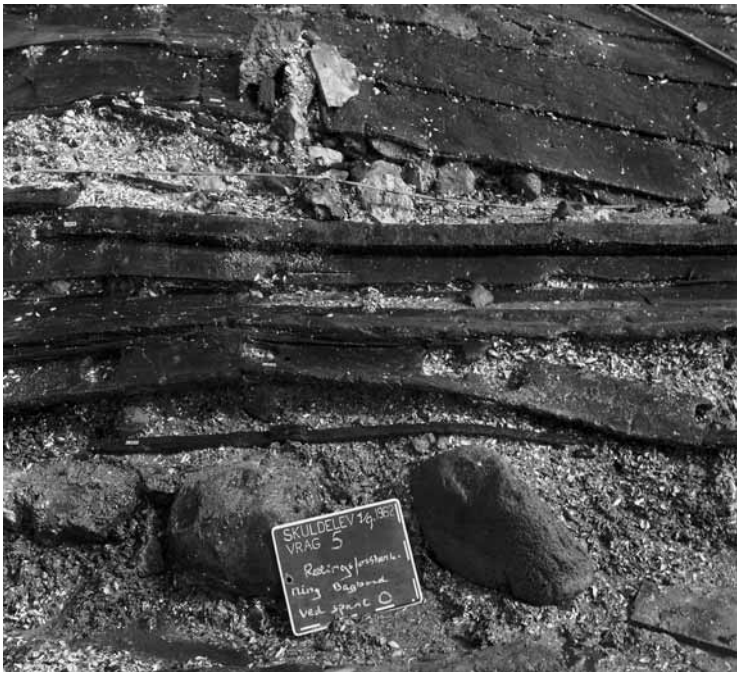


Fig. 5. Skuldelev 5. The midship section of the upper strakes in situ. *The planking is lying upside down on the slope with the sheerstrake and its shield-rack in the bottom of the picture, followed by the sixth and fifth strakes with their stringers.*

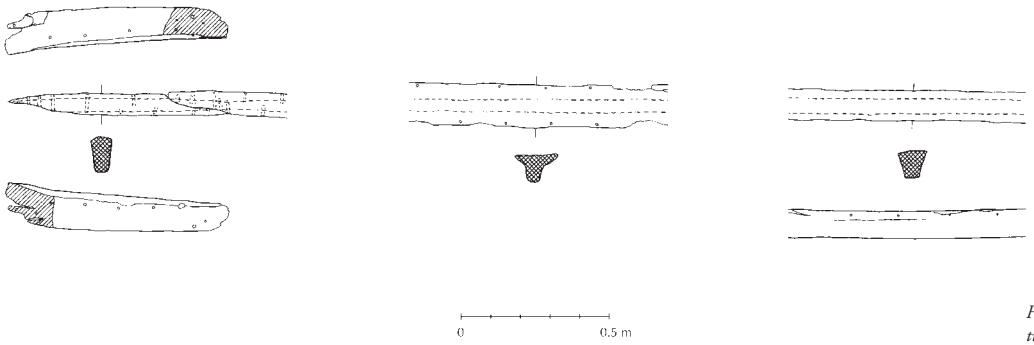


Fig. 6. Skuldelev 5. The lot *aft and two sections of other parts of the keel seen from above and from the side. Scale 1:20.*

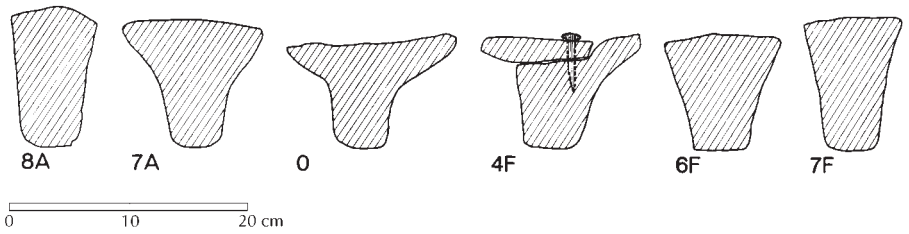


Fig. 7. Skuldelev 5. Cross-sections of the keel. Scale 1:5.

5.5.2 Description of the preserved parts of the ship

The keel

The keel is of oak and consists of three sections: an 11.87 m-long proper keel along the greater part of the length of the vessel, a 0.78 m-long *lot*, a curved intermediate piece to the after stem, and a 2.71 m-long combined keel-length and *lot* forward with scarf to the fore stem. The three lengths of keel are joined with vertical scarfs, 20-24 cm long, and the scarfs at the *lot* aft have slightly curved contact surfaces (Figs 6 and 10). When assembled, the total length of these three elements is 14.92 m.

The keel has no rabbet, and its cross-section is almost rectangular at each end but changes gradually over a Y-shape to a T-shape amidships with marked wings for fastening the garboard strakes (Fig. 7). The depth of the keel amidships is now ca 8 cm but was probably originally ca 10 cm, increasing towards the ends to 11-12 cm. The bottom of the keel is 4-5 cm wide and distinctly worn, except at the forward part, which looks strikingly new with no traces of wear along the edges. The top surface of the keel is 14-15 cm broad amidships, decreasing to 7-8 cm at each end. Amidships, this surface is plane or slightly concave, and the rivets for the first strakes are spaced at intervals of 13-16 cm. Towards the ends, the top surface of the keel changes from concave to convex and here the planks are fastened to the keel with nails at irregular intervals, averaging ca 15 cm.

At the forward end of the ship, the renewal of a length of the keel and several planks at a late stage in the active history of the ship had changed the original structure. At that stage, the old keel was evidently weak and decayed, and parts of the wings had crumbled away. This fact necessitated the use of a 1.8 m-long patch, let into the top of the two lengths of keel in order to provide a safe connection between the old and the new lengths of keel, probably replacing the forward part of the original keel as well as a shorter *lot*.

Stems

Nothing is left of the after stem, but the after scarf at the *lot* reveals that it had been connected to the keel in a similar manner as was the fore stem. Found *in situ* (Fig. 8), the fore stem was in contact with the keel and most of the hooding ends of starboard planking.

The stem (Fig. 9) is of oak with a V-shaped cross-section that is deeply hollowed out, and its general characteristics are similar to those of the stems found in Skuldelev 2 and 3. The stem is preserved to a length of 1.73 m and has a maximum breath of 0.44 m. Six steps for the planking were cut along the inner edge, and the run of the strake edges is carried onto and carved into the sides of the stem. The lines converge towards the vertical top of the stem which is now missing but originally was fastened by a number of nails or rivets at a scarf. Mounted at the keel, the stem projects ca 1.2 m beyond the keel-scarf.

The role of the stem in the construction process of this ship is discussed in Section 4 of this chapter.

Planking

The planking of Skuldelev 5 originally consisted of seven strakes on each side. To starboard, the first strake adjacent to the keel, the garboard strake, is preserved almost completely between the scarfs fore and aft, and fragments of the next two strakes also survive. The port-side planking is almost entirely preserved, except for the aftermost plank-ends that connect to the after stem and parts of the three upper strakes forward, as already mentioned (Fig. 10).

The general character of the planking as it appeared at the time of the excavation was very confusing. The strakes displayed a bewildering pattern of short and long lengths of planks, some evidently old and patched over with repairs, others quite new with sharp plank edges. In addition, damage inflicted upon parts of the planks after the scuttling by the rocks in the ship as well as by organic decay and subsequent erosion was clearly evident. The majority of the planks are of radially-split oak, but pine and ash are also present in the upper part of the planking, as well as alder for one of the stringers (Fig. 11). When compared with the homogeneous materials in Skuldelev 3, there is a remarkable difference in the quality of the materials used for the planking of this ship.

In this case, the bottom of the ship, defined as the area of the lower planking covered by the floor timbers, consists of the keel and the first three strakes on each side. The

Fig. 8. Skuldelev 5. The stem in situ.

planks in this area are in lengths between 0.5 m and 7.1 m, and they are all made of radially-split oak. The longest of these have an irregular grain structure indicating that these planks came from logs with large knots. The average tree-ring width is 1.03-2.1 mm in the oak planks from the construction phase and 2.39-3.2 mm in the repair planks.

In the bottom of the hull, it is possible to study the match between stem and planking at the forward end. The garboard strakes are fastened directly to the lower end of the stem, which seems to have been shortened in the repair process as the end of the keel was renewed. The second strake has its own step on the stem and it is followed here by the step for the fourth strake, as the third strake does not reach the stem. Instead, it lets into the upper edge of the second strake and ends ca 1 m from the stem. The after end of the third strake tapers markedly from 7A but it is not possible to see how it ended aft.

Like strake four, each of the next three strakes also has its own step on the stem so that only the third strake does not reach the stem. This situation is quite similar to that in Skuldelev 3, where the bottom consists of keel and the first five strakes each side, and where the fifth strake is the only one not to have its own step on the stem.

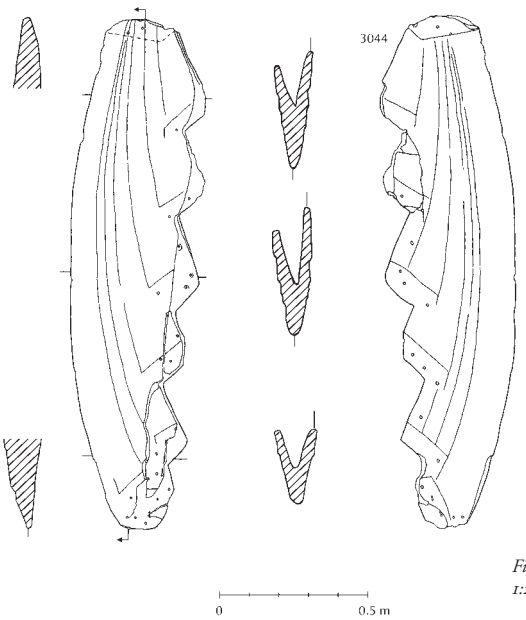
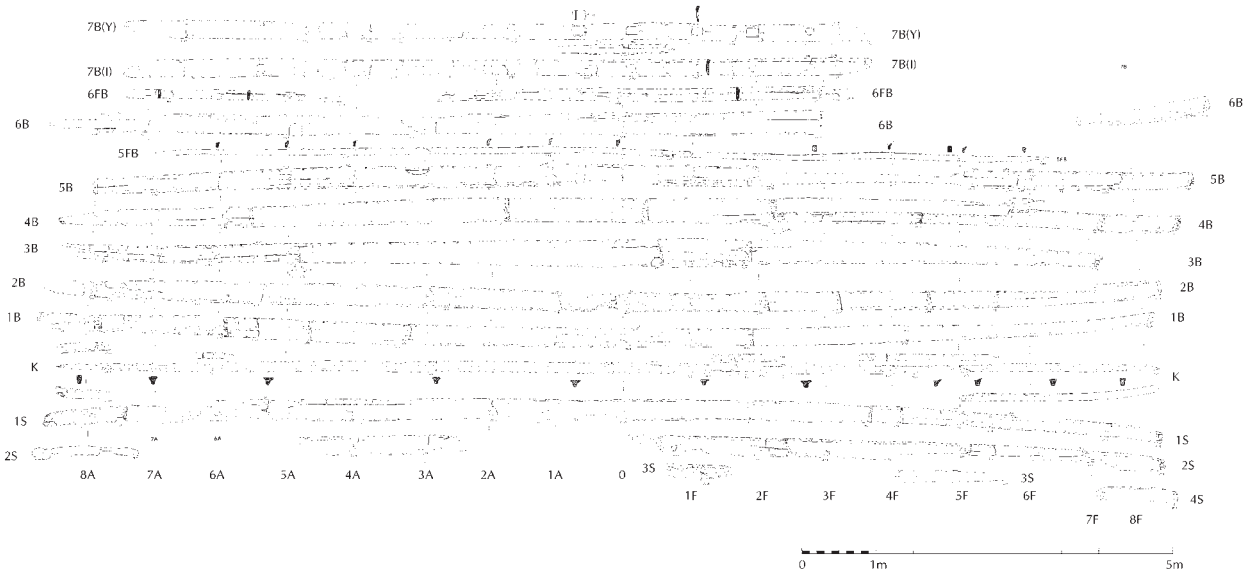


Fig. 9 Skuldelev 5. The stem. Scale 1:20.

Fig. 10. Skuldelev 5. Plan of all preserved parts of the keel, planking and stringers. The following parts have been drawn from two sides: the uppermost strake (7B) with its shield rack, and the forward and aftermost parts of the keel. Scale 1:80.



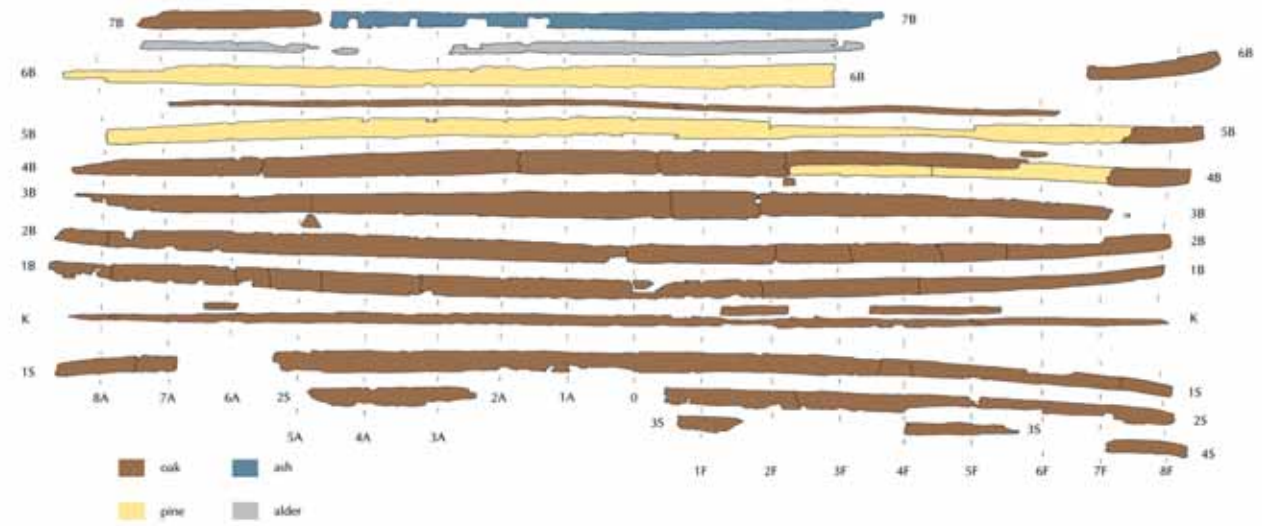


Fig. 11. Skuldelev 5. Wood species used in the planking and stringers.

The transitional fourth strake between the bottom and the side, as well as the fifth to seventh strakes forming the ship's side in Skuldelev 5, are only represented on the port side, and here they display a remarkable mixture of wood species: oak planks between 1.2 m and 3.6 m long, pine planks[1] between 2 m and 14 m long, and a single plank of ash, 7.7 m long (Fig. 11).

The individual lengths of planks are scarfed, often at oblique angles, with an overlap of 6-9 cm and with 2-4 rivets between the lines of rivets along the plank edges. The rivets, ca 0.6 cm in diameter, in the 3-6 cm-broad land are generally spaced 15-20 cm apart, with the exception of the land between the sixth and seventh strake. Here, the stringer on the inside of the sixth strake had been positioned before the sheerstrake was mounted, since this seventh strake is fastened with nails at intervals of 22-25 cm, driven through the two planks into the stringer.

Amidships the first two strakes are 25-28 cm broad, while the third strake is as much as 35 cm broad, with an inserted repair plank that is up to 38 cm wide. The fourth, fifth, and sixth strakes measure 30-32 cm and the seventh strake 27 cm in width amidships. The oak planks are almost rectangular in cross-section with a slight increase in thickness towards the middle. Most of the bottom planks are very worn, but they appear originally to have been 2.0-2.5 cm thick at the centre, decreasing to 1.5-2.0 cm at the edges. The long pine planks are 3.5 cm thick at the middle, flat on the inside and convex on the outside (Fig. 12). The sheerstrake plank of ash has a similar character, but a thickness of 4.0 cm in the middle and a 3.5 cm-wide upper edge with a characteristic cross-section (Fig. 13).

There are several repair patches mounted over plank scarfs and along the length of the keel, showing that the ship had been in active service for a long time before it sank. No doubt it would have needed much bailing to be kept reasonably dry in its last active phase. When the ship was drawn up on land, water could be drained through the drain plug hole, situated aft next to the keel in strake 1B between 7A and 8A.

There are faint traces of a decorative moulding along a few of the planks from the construction phase in the lower strakes, with two v-incisions following the upper edges of the planks and with an internal distance of ca 2.2 cm. In general, however, this feature has not been observed on most of the planks of the construction phase, even underneath the floor timbers where the surface of the plank would have been protected from wear. In contrast, the repair planks have similar mouldings intact, with a spacing between the two v-incisions of ca 2.0 cm. On a repair plank in strake 2B at 5F, a similar decoration is present along the outside lower edge. The fact that this feature has not been worn away in this exposed position confirms, in addition to other observations, that the repair to the keel and lower planking forward was carried out in the very last phase of the active period of the ship.

When the outside of the sixth strake was exposed during the cleaning process after the excavation, a carved acanthus tendril in the *Ringerike* style was revealed in the area

1. In the preliminary publication of the ship, the long planks were erroneously thought to be of ash. Olsen & Crumlin-Pedersen 1968: 136

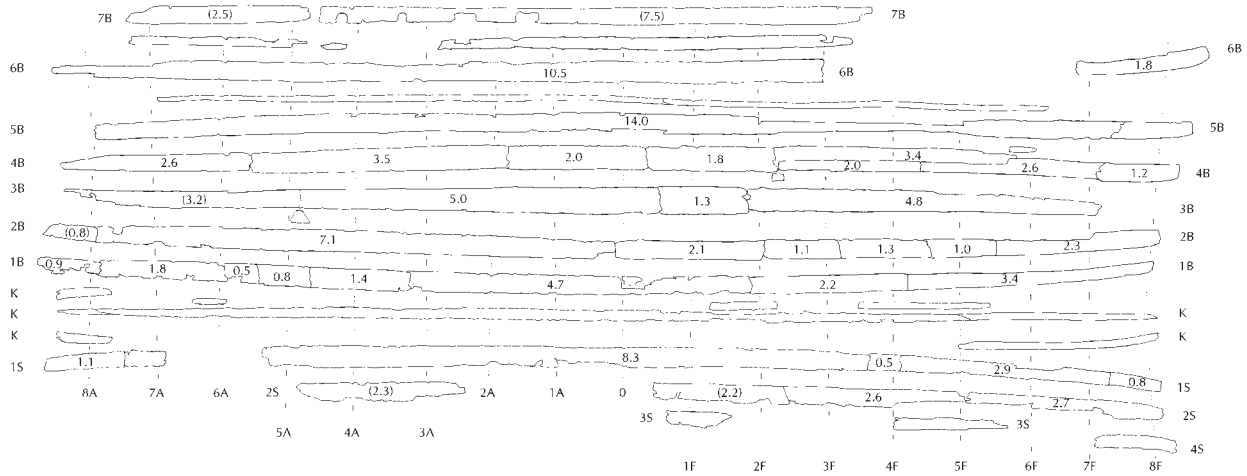


Fig. 12. Skuldelev 5. The individual plank lengths as found.

Fig. 13. Cross-sections of the sheerstrake (seventh strake) through a covered-over oarport at 1F and in the solid wood 17 cm further forward. The lower edge of the plank is worn away in this area. Scale 1:5.

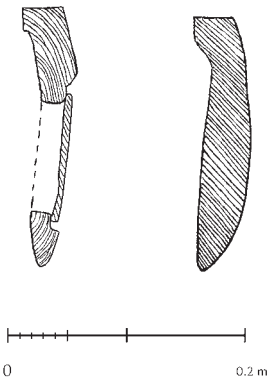


Fig. 14. Skuldelev 5. Carved acanthus tendril in the Ringerike *style, found on the outside of the sixth strake aft to port.*

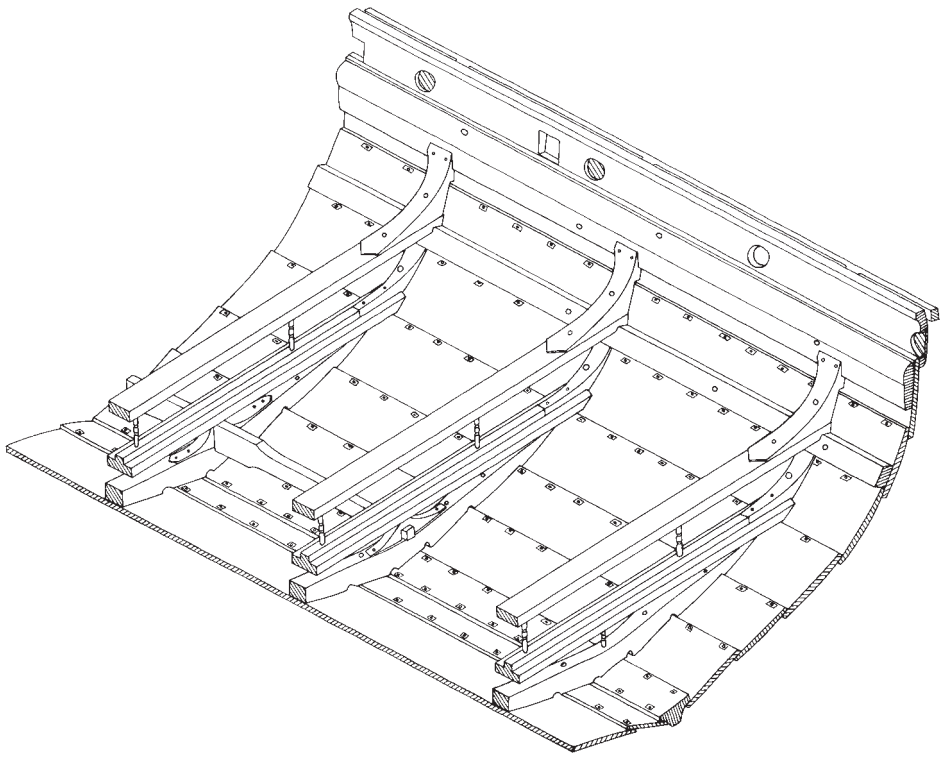


Fig. 15. Skuldelev 5. Reconstructed cross-section of the hull of Skuldelev 5 as built.

between frames 5A and 6A (Fig. 14). No similar decoration has been found on any other piece belonging to this or any of the other ships of the Skuldelev find.

A detailed analysis of the peculiarities of the planking is presented below in Section 4 of the present chapter.

Framing system

In spite of the differences in proportions and size between Skuldelev 5 and Skuldelev 3, the framing system of these two ships is similar in principle. It consists of regularly-spaced floor timbers, each with a *biti* on top carrying the loose deck boards, and a beam serving as a thwart[2] fastened with a knee at both ends (Fig. 15). In Skuldelev 5 there are stringers along the upper edge of the fifth and sixth strakes and the stringer-like upper edge of the sheerstrake continues across bow and stern with breast-hooks. In the bow, a *rong,* an inclined V-shaped timber, was placed at 8F to support the planking up to the sixth strake, serving the same function as the bulkhead in Skuldelev 3. The corresponding frame aft is missing but it must have been strong enough to take the strain from the side-rudder. One or two side timbers and a long knee at the mast-frame evidently provided the only support for the sheerstrake. The similarity between Skuldelev 5 and 3 is also found in the character, shape, and finish of the individual elements of the framing. They display such identical features in craftsmanship that the two ships are probably from the same local building tradition and they were probably built in the same region, although not from the same quality of materials.

The floor timbers

The floor timbers are of oak, as are the other parts of the framing system, with the exception of the V-shaped *rong* at 8F, which is of pine. They span the keel and the three lower strakes on each side (Fig. 16). They have the same characteristic shape as those found in Skuldelev 3, with a high part over the keel, only ca 5 cm wide, that widens to 7-9 cm over the next strakes and narrows again to 4-5 cm towards the wedge-shaped end. At the point of contact with the second strake, the height is 5-7 cm. The height of the floor timbers

2. Except at the cargo space in Skuldelev 3.

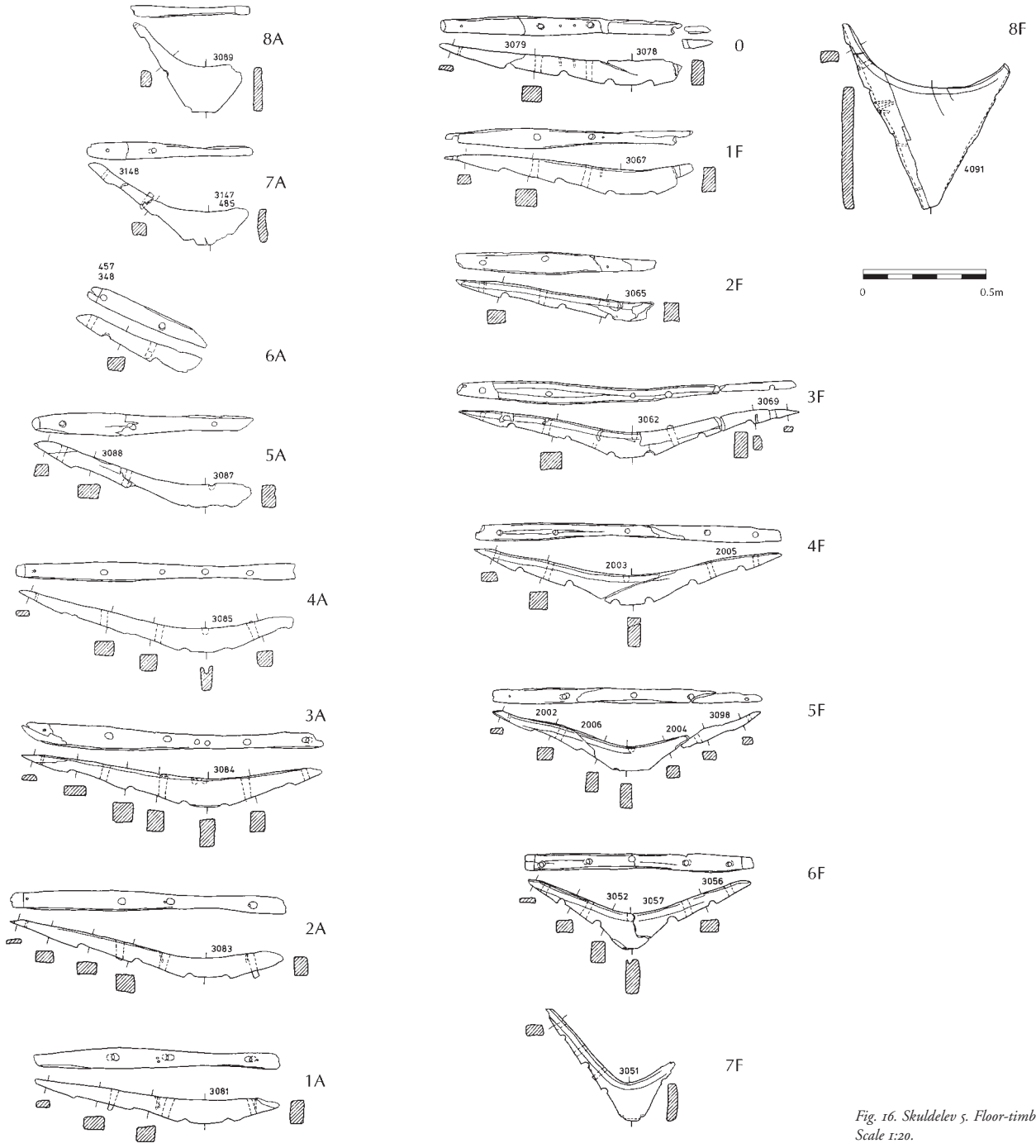


Fig. 16. Skuldelev 5. Floor-timbers. Scale 1:20.

Position	floor-timber	*biti*	stanchion holes upper/lower set	stanchion	*biti*-knee	beam-knee	horizontal knee
7F	3051		?/no				
6F	3052, 3056, 3057	3054	?/yes		3058		
5F	2002, 2004, 2006, 3098	3097	?/yes		2010, 3060		
4F	2003, 2005		?/yes	2009			
3F	3062, 3069		?/yes		2007		
2F	3065		?/no		2008		
1F	3067		?/no	3073	3066	3074	
0	3078, 3079		?/no			3076	3077
1A	3081		?/no		3105		
2A	3083	2014	yes/no		3082		
3A	3084		?/yes (2)		3034		
4A	3085	3086	yes/yes	3094	2094		
5A	3087, 3088	318	?/yes		3091		
6A	348, 457	P707	yes/yes				
7A	485, 3147, 3148		?/no		317	2097	
8A	3089		?/no				
unknown		2096, 3090		3053	334, 357, 2098, 3151		

Table 1. Skuldelev 5. Preserved parts of the framing system.

over the keel vary from 9-10 cm amidships to ca 15 cm towards the ends of the ship. The floor timbers between 7F and 7A are spaced over the keel at an average distance of 0.90 m, measured centre to centre.

In the midship part of Skuldelev 5, the floor timbers are fastened to the first two strakes on each side with treenails driven from the outside, and to the third strake with a rivet or nail. Fore and aft there are no fastenings to the first strake but treenails to the next two strakes on each side. The floor timbers reflect the relatively low deadrise in this ship, the angle between the keel strakes being 140° amidships. The floor timbers from the forward part of the ship have been the least exposed to erosion and decay after the sinking of the ship and they have clear traces of decorative mouldings preserved along their edges, with two v-incisions spaced ca 2.2 cm apart, with a shallow groove in between.

Sockets for the lower end of stanchions that support the *biti*s at their mid-point had been drilled in the floor timbers from 3A to 5A and from 3F to 6F. On the floor timbers in the midship area from 2A to 2F, traces were found of the nails used to fasten the keelson knees.

*Biti*s, beams, knees and stringers

Each of the floor timbers from 7F to 8A was originally fitted with a *biti*, positioned across the top-ends of the floor timber. They were held in position with a knee at each side that was fastened with a treenail to the fourth strake and wedged in under the stringer on the fifth strake. The knees were either cut from one piece of wood with the *biti*, or come from another piece and were nailed or riveted to the *biti*. None of the *biti*s are fully preserved, but substantial parts of these and their knees survive from several of the frame-stations between 6F and 7A (Fig. 17; Table 1).

All preserved *biti*s have a ⊥-shaped cross-section, in order for them to serve as deck beams for a through-deck of loose planks. The *biti*s that were found are all partially eroded so that their dimensions have been reduced, but the most extant parts measure 9-10 cm in width and 2.5-3 cm in thickness with an extra ca 3 x 3 cm ridge in the middle. This allowed a space of ca 3 cm as support for the deck planks, which were evidently ca 3 cm thick along the edges. None of these was found, however, as they were most likely removed before the sinking of the ship.

The *biti*-knees are all cut with a narrow, horizontal part, corresponding in size to the ridge on top of the *biti*s and replacing this ridge near its ends. This feature is a clear indication that even those *biti*s that are not preserved but are represented by their knees would have been similar in shape to the deck beams found, and consequently that a flush deck had been present along the length of the ship from 6F to 7A, following the upper edge of the third strake.

The ridge on top of the *biti* at 4A is missing in the midship part. The hole left by a rivet or spike shows that either a loose length of ridge or a central longitudinal plank, level with the deck, was originally fastened here.

In order to support the slender *biti*s in the middle, small stanchions were inserted forward and aft in the ship between the floor timbers[3] and the *biti*s, whereas the keelson and its knees provided support amidships for the *biti*s. Sockets exist in the ridge on top of the *biti*s for stanchions to support the beams or thwarts at the next level above. Table 1 lists each frame position and the presence or absence of such holes, as indicated by the available evidence, referring to the first statement to the use of stanchions between the *biti*s and the beams, and to the next to stanchions between floor timbers and *biti*s.

None of the slender beams or thwarts above the *biti*s, similar to those fore and aft in Skuldelev 3, has been preserved from this ship. However, the stanchion sockets in the *biti*s provide clear evidence for their presence at 2A, 4A, and 6A, and at 1F, 0, and 7A there are beam-knees. The fact that the stringer on the fifth strake has been cut along its full length with ca 8 cm-wide notches as saddles for such beams or their knees at all frame stations (cf Fig. 10) proves that beams or thwarts were originally present at all frames from 6F to 7A.

The beam-knees at 1F and 0 are notched on the side facing the planking to fit over the stringer on the sixth strake (Fig. 18). There are treenails from the beam-knee at

3. At 3A there are two holes, probably because the first-bored hole was not in the centre-line and the position of the stanchion had to be corrected.

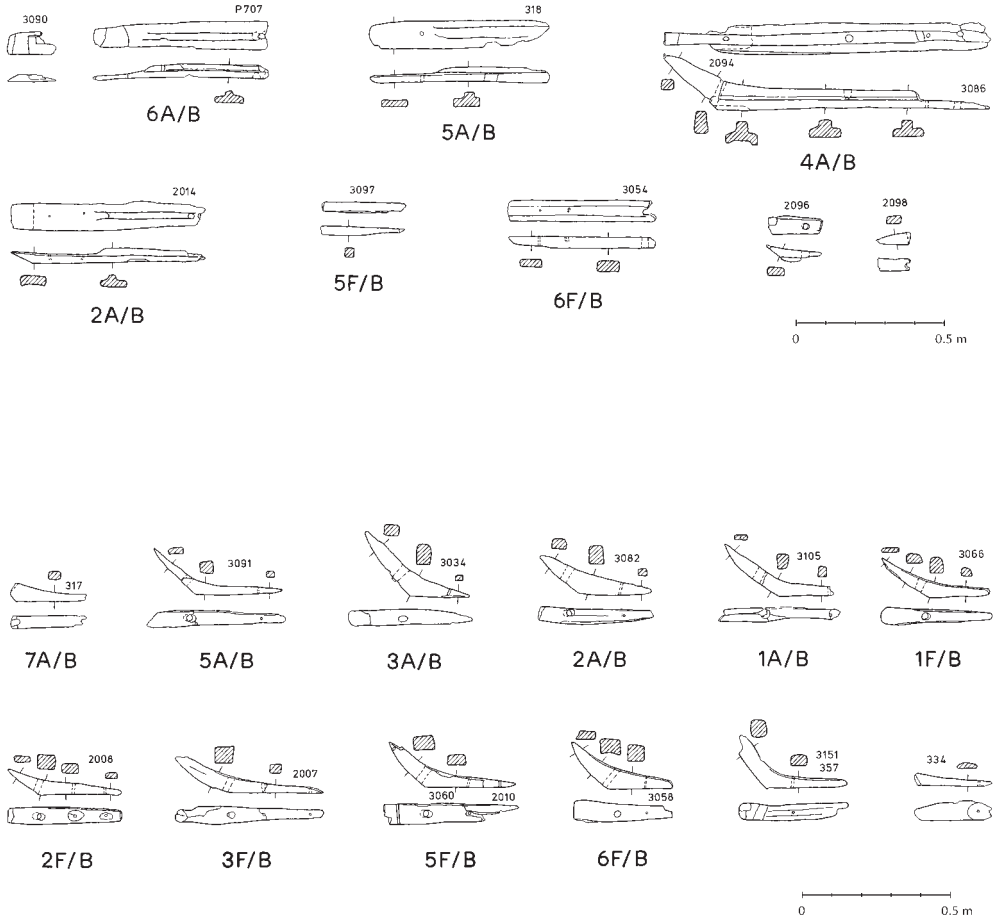


Fig. 17. Skuldelev 5. Bitis, biti-*knees and stanchions. Scale 1:20.*

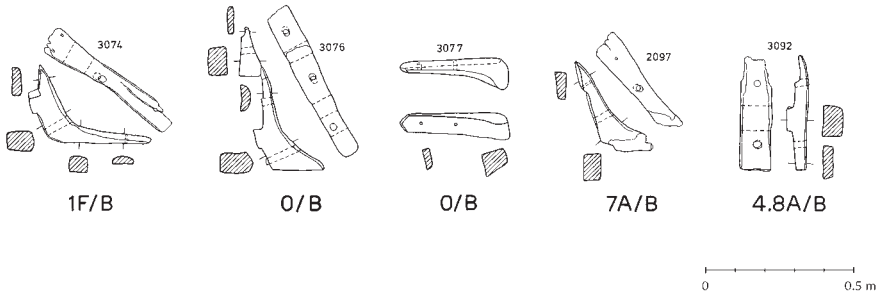


Fig. 18. Skuldelev 5. Beam-knees from 1F, 0 and 7A, and a side timber from port side at 4.8A. Scale 1:20.

the mast-frame to the fifth, sixth, and seventh strakes, and there is also here a horizontal knee, fastened to the stringer on the fifth strake to support the mast-beam from aft. It is not clear whether there was originally a similar knee on the other side of the beam. At 7A, the beam-knee is situated just off the up-curved end of the stringer on the fifth strake and ends below the stringer on the sixth strake.

The stringer on the fifth strake (5FB in Fig. 10) has a roughly rectangular cross-section of 5-6 x 8-9 cm amidships, decreasing slightly towards both ends. It is made of two slender laths of oak, scarfed between 0 and 1F, and at every frame station fastened with a treenail, 2.5 cm in diameter, and notched from above and below to accommodate the top ends of the *biti*-knees and serve as a saddle for the beams. Owing to these notches and nail holes, this stringer could only make a very limited contribution to the strength of the planking and its main purpose seems to have been to act as a beam-shelf and 'lock' for the upper ends of the *biti*-knees.

The stringer on the sixth strake is made of alder. It is badly decayed at the after end and broken off at the forward end at 3F (6FB on Fig. 10). The best preserved section, at midships, is 18 cm broad and 5 cm thick with a characteristic cross-section (Fig. 19). It is fastened with several irregularly-spaced treenails, 2 cm in diameter, and it covers a number of holes in the sixth strake that have no relation to any of the internal elements of the present ship.

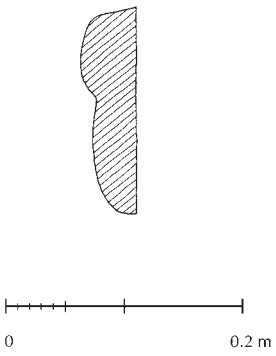


Fig. 19. Skuldelev 5. Cross-section of the stringer on the sixth strake at 1.5F. Scale 1:5.

Other parts of the framing system

A distinctive, slender timber shaped in a V, 4 cm thick and forming an angle of 30°, was found outside the after end of the wreck (Figs 20-21). One arm was fully preserved with holes for two rivets near the end. These are the only traces of fastenings and there are no steps for fitting the element to a clinker planking, leading to the conclusion that this was most probably the breast-hook aft in Skuldelev 5. When the lines of the hull were reconstructed (see Section 3 of the present chapter) this assumption was confirmed, as the shape of this element fitted perfectly to the extrapolated lines of the upper planking aft.

There are no regular side timbers in this ship positioned halfway between the frame-stations like those found in Skuldelev 1 and 2. However, just as in Skuldelev 2 and 3, there are a few sturdy side timbers positioned across the top-strakes outside the strict frame-module system that are undoubtedly primarily related to the handling of the rigging. In the present ship, they are represented by the timber at 4.8A (cf Fig. 18) which may have been fitted with a cleat for the rigging as are similar ones in Skuldelev 3.

Fig. 20. Skuldelev 5. The breast-hook in situ *outside the after end of Skuldelev 5.*

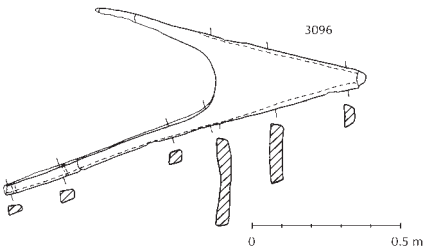


Fig. 21. Skuldelev 5. The breast-hook aft. Scale 1:20.

4. As shown by the stanchion sockets in the floor timber at 3A.

Hull parts related to propulsion, steering and equipment

Skuldelev 5 was a ship for the combined propulsion of rowing and sailing. In spite of the fact that all parts of the rudder, the oars, and the rigging of this ship are lost, there is still opportunity to study aspects of the propulsion and steering through various elements and traces of wear in the ship.

The rudder

The side rudder and its supporting structure aft are not preserved, but it is most likely that it was positioned at 8A, with the rudder osier taken through the starboard side at the fifth or sixth strake and fastened to a strong beam.

The keelson

The lower end of the mast was safely anchored in the middle of the keelson. The forward half of the keelson is preserved from 2F to 0, incorporating a section that has been added with a scarf over the first 0.6 m from 2F. The middle part of the keelson is partly eroded away and the after part is completely lost (Fig. 22, see also Fig. 4).

The original size and shape of the keelson, however, can be almost completely reconstructed, as the central part must have been wide enough to provide a safe base for the mast, and the keelson evidently stopped before it reached the floor timber at 3A.[4] The vertical sides of the central part of the keelson are preserved along a small extant part and documented by the character of the keelson-knees. At 2F, and probably at 2A as well, there is a chock, similar to those in Skuldelev 3. The chocks combined the functions of keelson-knees and stanchion in keeping the end of the keelson in position. Thus the position of the keelson was firmly fixed lengthways by the notches over the floor timbers, and sideways by the knees and the branch that probably stood upright in front of the mast-step. It is interesting to note that there were no direct fastenings between the keelson and the other parts of the structure, and these were probably left out in order to avoid local stress in the supple ship as it sailed through the waves or was under oars.

As the keelson evidently extended equally past both sides of the frame-position 0, this is where the mast-step

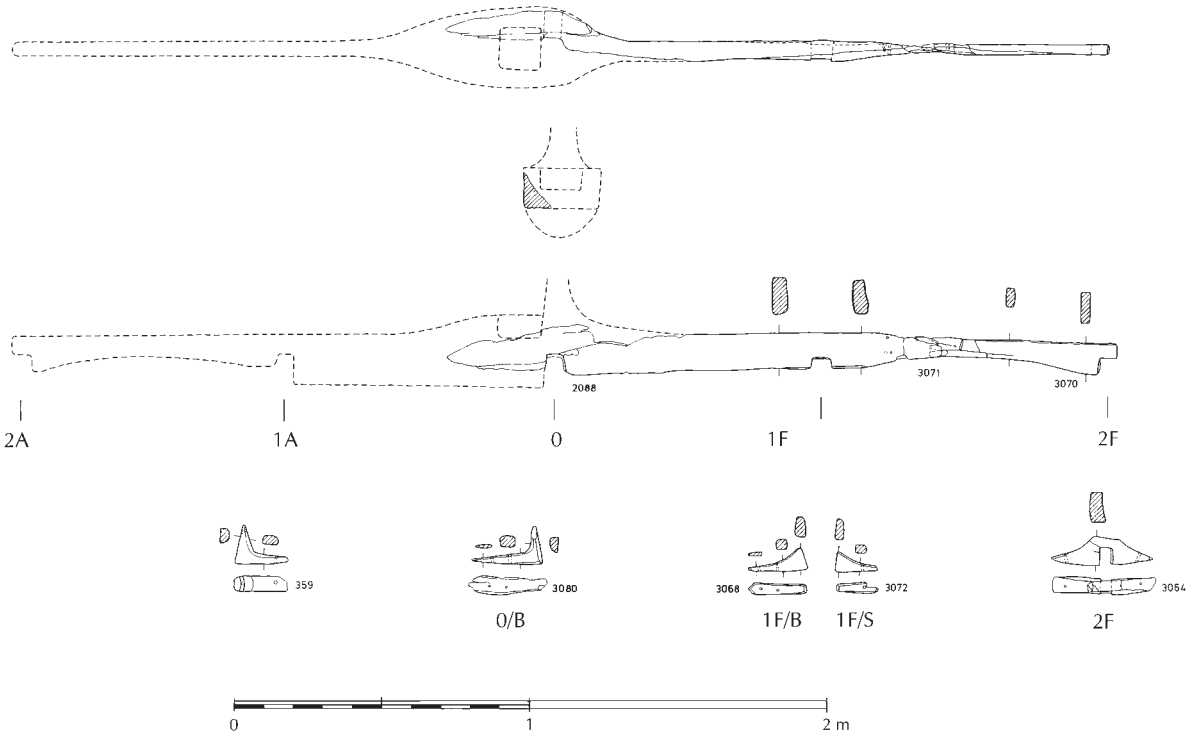


Fig. 22. Skuldelev 5. The preserved part of the keelson with an indication of the likely shape of the missing part, as well as the keelson-knees which have been found. Scale 1:20.