

## Viking Age Buildings

by HOLGER SCHMIDT

Extensive excavations during the last 15 years in Denmark have proved that the change from the prehistoric longhouse-farm to the much more scattered medieval farm gradually took place during the Viking Age (i.e. about 800–1100 A.D.). In the same period also the modes of building-construction were drastically changed, as the traditional and stable two- or three- aisled bay-structure was given up in most buildings, and the medieval timberframed system with sillbeams and trussed rafter roofs developed. As apparently the general development of the house-structure also took place very gradually, if not more or less accidentally, and as moreover the principles of

different building-constructions are often mixed up in the houses, the typology of Viking Age houses is in many respects uncertain. The director of the Hedeby excavations, Kurt Schietzel, even describes the houses as being apparently never quite like each other and classification for that reason very difficult (Schietzel & Eckstein 1981 p. 43). In this period, therefore, most houses must simply be characterized as typological hybrids. So the theory of general evolution is then probably the best approach to an understanding of the many problems ensued.

In the Iron Age longhouse (fig. 1) man and cattle lived together under the same roof. The farmer and his family

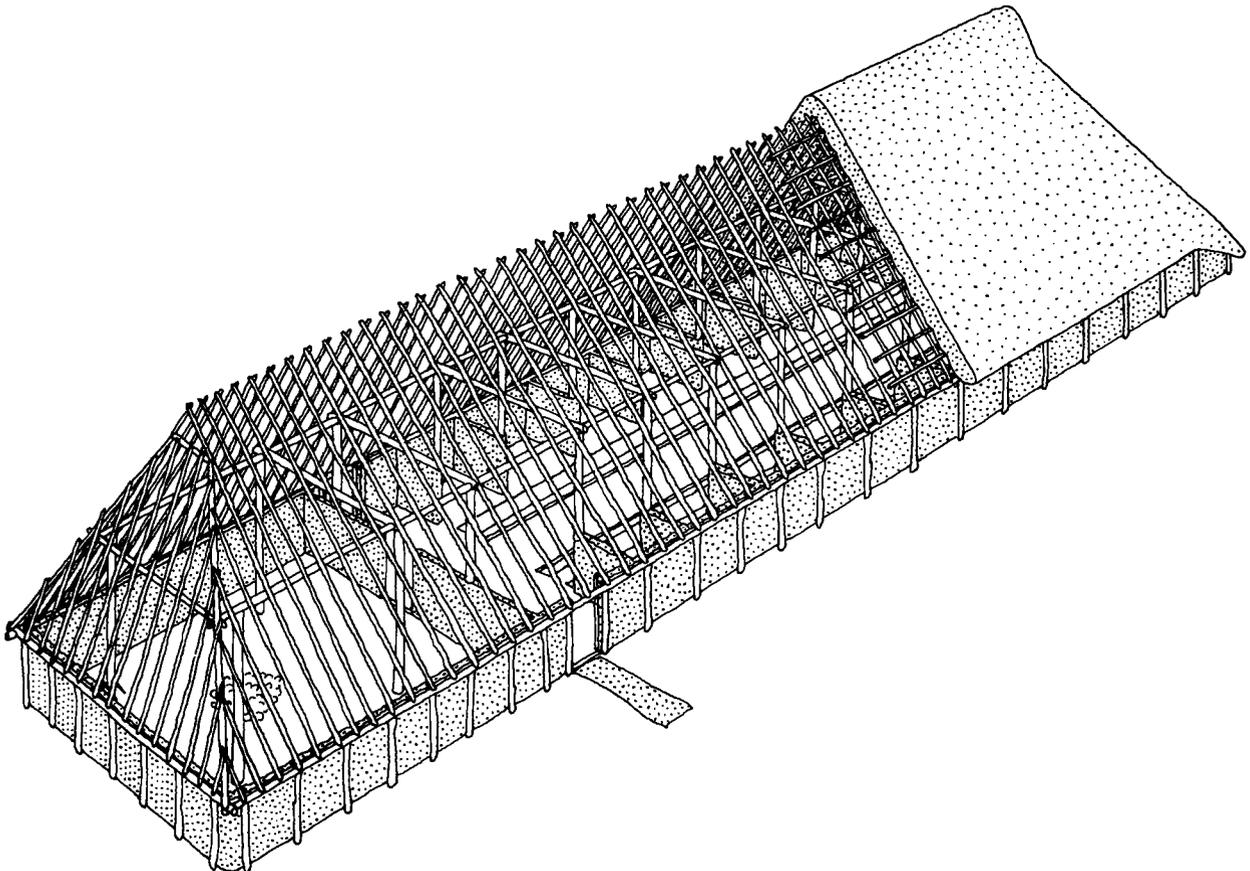


Fig. 1. Reconstruction of a longhouse from the Roman Iron Age. The roof, the walls, and the stalls are supported by the internal framesystem. H. S. 1984.

dwelt around the hearth in the middle of the floor in the west end of the house, while during the winter the cattle was stalled in the east end. The building was made to measure in the sense that the number of cattle belonging to the farm more or less determined the length of the house (the dwelling-part varied less in size), and the width of c. 5 metres was also very appropriate for the byre. The structure made it easy to add more bays if necessary. Certainly these houses for cattle-breeders were improved during the many centuries when they were the ruling type in NW-Europe. This development has been proved by excavations in Vorbasse and in many other deserted villages (Hvass 1983). But the flexible and stable structure remained amazingly unchanged until the Danish rural society during the Viking Age was changed – apparently in very much the same way as society had been changed centuries before in Central Europe (Donat 1980).

The main elements of the structure were the internal roof-supports. In the Old Norse texts these posts are called *suler* (Jensen 1915 and Stoklund 1969 p. 38), and archaeology has proved that they were often of triangular section, as a consequence of the splitting-technique used on the oak-trunks. In which case they were always put up with their bark-sides against the middle of the house and the sharp edge against the long-sides (Trier 1969, p. 126). Accordingly the biggest dimension of the posts was across the house. For this reason, and also because they were usually put up in pairs, one must assume that the *suler* were joined together at the top by horizontal timbers across the house, i.e. tie-beams. As the inner uprights were also put up in rows lengthwise in the house, they must also have carried horizontal timbers lengthwise (above or at the same level as the tie-beams), so-called *åse* (side-purlins), which again carried the light rafter roof. This internal rigid frame-system was crucial for the stability of the Iron Age longhouse, especially during the erection.

Usually the bay in which the hearth is placed is slightly bigger than the other bays in order to obtain as much free space as possible in the central part of the dwelling. During the Viking Age we shall see that the builders' aim was to get rid of all the free standing inner uprights in the dwelling, although for some time they remained part of the structure of partition-walls, gables, and stalls – if these were still part of the house. The good stable traditional structure was thus partly abandoned to oblige the demands of function.

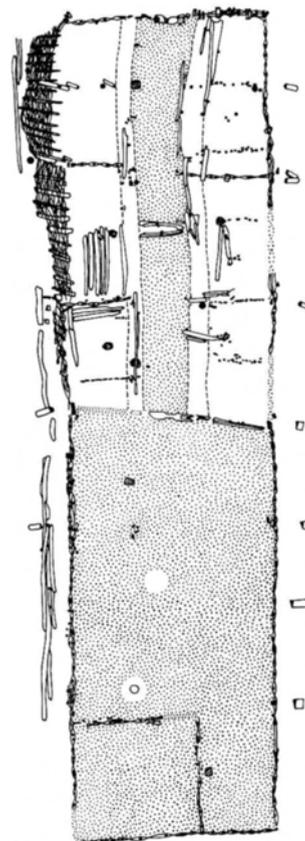


Fig. 2. Longhouse from the marchvillage Elisenhof, 9th century. The byre was extended when the number of cattle increased. Plan, scale 1:200. H. S. 1980.

Traditional longhouses were still in use in most early Viking Age villages. The extremely well preserved 9th century houses in the marshvillage Elisenhof are for instance of this type (fig. 2). This is easy to explain by the fact that the economy here totally depended on the breeding of cattle, but even in the town of Hedeby, where the economy did certainly not depend on the breeding of cattle but on trade, small “longhouses” have been excavated. However these houses are less characteristic, as for instance in the example shown (fig. 3, top) the single cow had to pass through the dwelling in order to be stalled – great quantities of preserved cow-dung in the small gable room leaves no doubt at all as to its function (Schietzel & Eckstein 1981, p. 44).

Another Hedeby house (fig. 3, bottom) was even better preserved than the small longhouse. Besides the post ends in the ground also the wattle panels were preserved, re-

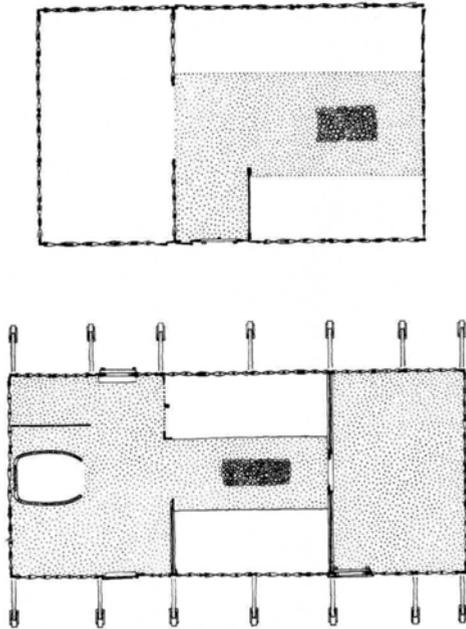


Fig. 3. 9th century houses from Hedeby. Plans, scale 1:200. H. S. 1984.

used as filling in the wet soil for the next house on the site (in Hedeby it has been proved by dendrochronology that houses were in use for only a very short period, they were then replaced by others built on top of the old ones). The house has been dated by dendrochronology to A.D. 870, and it is by far the oldest example of the later so well-known medieval *salshus* (dwelling-house) which was used practically unchanged until the stonebuilt chimney in the 17th century became common in rural buildings. In these houses *stuen* (the living-room) – with the hearth or an oven – is situated in the middle, *herberget* (the unheated room) in one end – mostly used as a magazine but also often as a lobby or workshop (or both), while *stegerset* (the service room) with the bake-oven etc. is in the other end. The Danish plantype is thus closely related to the medieval English house. In this Hedeby house the service room was apparently more or less consequently separated from the living-room. The partition between these two rooms was less substantial than the partition-wall which separated the other gable room from the living-room. Anyway, the functional separation was from the beginning evident in the house. It is therefore very interesting, as well as also a bit confusing, typologically speaking, that the excavator, Kurt Schietzel, states that after 12 years the service room was apparently converted into a small byre, as the bake-oven was demolished and a wooden manger (dated A.D.

982) was put into the room instead (Schietzel & Eckstein 1981, p. 44). The dwelling-house thus became a “long-house” – almost without any change of the planscheme. If this was the case it has been demonstrated that in this period the dwelling-house with well defined and separated functions, in great contrast to the later houses, could be changed into a completely different house-type.

However, apparently the construction of the house has also been changed. Judging from the preserved wattle-panels of the gable, the relatively low-pitched roof had originally a ridge-piece. It was supported by kingposts placed on top of the gable-wall-plates, and presumably also by kingposts placed on the tie-beams over the partition-walls (fig. 4). Theoretically a ridge-piece roof produces no horizontal thrust whatsoever or very little, but apparently the structure proved to be so unstable that it became necessary to support it with heavy buttresses (proved by dendrochronology to be secondary to the house, Schietzel & Eckstein 1977, p. 153 and 1981, p. 64).

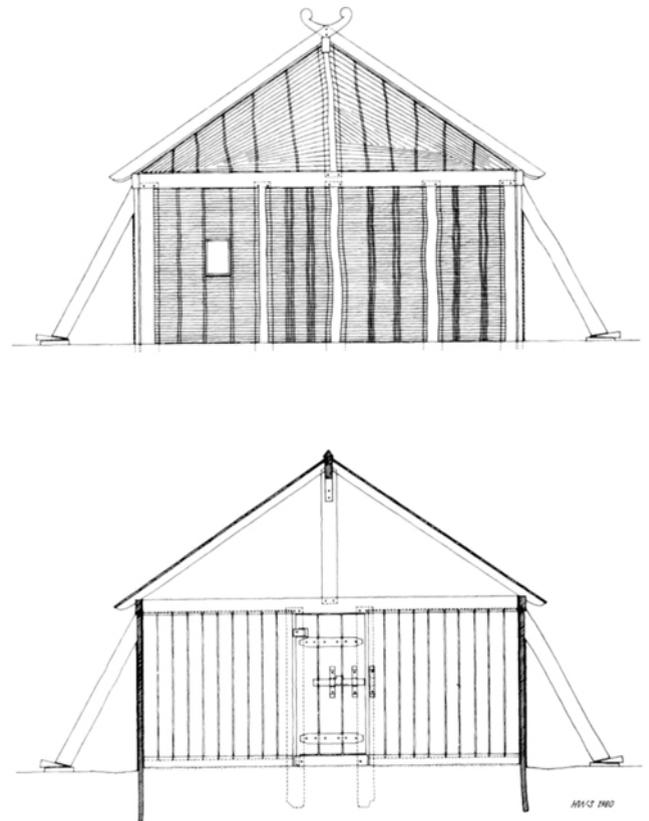


Fig. 4. Reconstruction of a Hedeby house built A.D. 870. A window-frame was preserved with the wattle-panels of the gable. Elevation and section, scale 1:100. H.S. 1980.

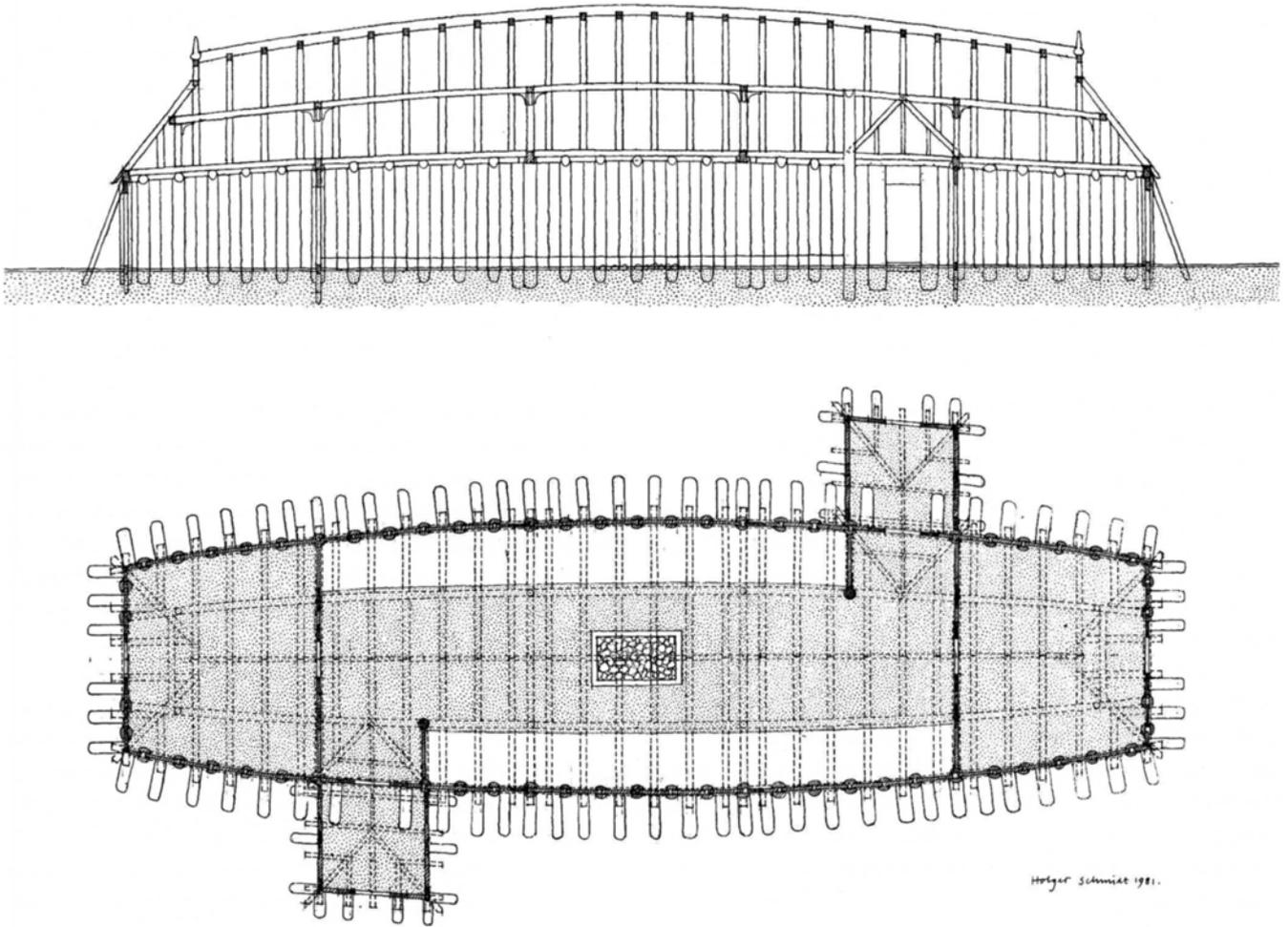


Fig. 5. Reconstruction of a house from the Fyrkat fortress built about A.D. 980. Section and plan, 1:200. H.S. 1981–82.

A stabilisation of the relatively light structure by means of braces or struts is unlikely. At such an early date the lateral stability in the houses could only be obtained by external buttresses, by the overdimensioning of the timber, or by the traditional *sule* structure. In any case it is evident that it was of little use to the upper part of the Hedeby house that all the wall-posts were firmly stuck into the ground – unless the (unlikely) explanation of the added buttresses simply is that already after a few years the house suffered from dry rot where the posts met the ground (below this level the timbers were preserved when excavated). Moreover, it is evident that this Hedeby house proves that the presence of buttresses (or postholes from buttresses) outside the walls of a houstomb does not necessarily mean that the roof can be typologically classified as a trussed rafter roof.

Caution against a heavy-handed typology concerning Viking Age houses is also justified by the very mixed up wall-construction in this and in many other Hedeby houses. As has already been stated, the walls were made of post-and-wattle dug into the ground, while the staves of the partition-walls were put on sills, as in some of the contemporary houses from Elisenhof. From the evidence of these houses it may therefore well be claimed that the introduction of the sillbeams was no “revolution” really in house structures, but rather an evolution which started inside the early Viking Age houses. The screenwall inside the door of the small Hedeby longhouse (fig. 3, top) was built of horizontal boards mortised into uprights (bole technique), while the other walls were made from post-and-wattle, except one of the gables which was made from coarse split staves well dug into the ground. But in all

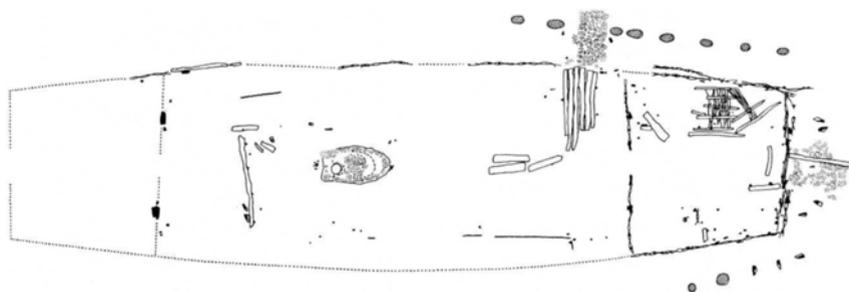


Fig. 6. House from Lund built about 1020. Plan, scale 1:200. H.S. 1984.

probability very little of this mess was clearly visible when the houses were still in use. At that time all the walls (except the bole- or stavebuilt partitions?) must have been heavily daubed with clay and cow-dung etc.

The houses from Elisenhof (fig. 2) more or less tell the same story (Bantelmann 1975). According to the fact that some of the houses have internal uprights as well as external buttresses, also here the roofs must have been typological hybrids. It is characteristic, although, that in these houses the *suler* have been more or less consequently replaced by external buttresses in the dwelling part, while they were preferably preserved in the byre, where they served also as stabilizers for the stalls. The traditional *sule* structure, which was so stable also because the uprights were stuck deeply into the ground, was now gradually given up in order to obtain a post-free living-room. The removal of the *suler* may well have been a useful improvement in the houses, however, the construction was very much weakened and therefore much more unstable until the trussed rafterroof with uniform scantling (and tie-beams for each pair of rafters) was introduced.

During the 10th and the 11th centuries large dwelling-houses detached from the byres gradually replaced the longhouses in the middle of the village tofts, while the byres were put up close to the barns by the fences (Hvass 1980). At the same time the quality of the houses generally improved, and the unique convex house shape, which had certainly started much earlier, flourished to a climax and became more or less universally used. Since such houses became known from the excavation of the great Trelleborg fortress (Nørlund 1948) much speculation has been put into words to explain why this complication to the structure, which must have been a great challenge to the carpenters, was introduced. Probably it became popular in use because the passing of the fireplace, which was now placed exactly in the middle of the houses, became

much easier, but primarily the reason must have been to give the houses an aerodynamic shape which made them stronger and more resistant to the high winds – also the vikings' taste for the convex shape may have been of some influence (Schmidt 1973, p. 60). The greater number of the excavated houses of this convex shape are represented only by the evidence given by the ghosts of the timbers which were once dug into the ground. However, it is evident that during the two centuries an increasing number of solid oak timber became part of the wall construction (Nielsen 1980). Actually some of the houses were entirely timber built as it has been attempted to show in the two stave built modelhouses at the fortress of Trelleborg and the similar fortress of Fyrkat (fig. 5) (Schultz 1942 and Schmidt 1981, 1985). Recently both fortresses have been dated by dendrochronology to about A.D. 980.

In the large houses of the fortresses the hall has no free-standing posts. And as it was much bigger than the humble three-room house from Hedeby, it was certainly impossible to span the length without some support from small (queen-)posts placed on tie-beams. The presence of purlins is indicated by the gigantic postholes for the *suler*, which were incorporated in the partition-walls, as well as by the postholes inside the main entrances, which were part of a screen wall in the Trelleborg- and Fyrkathouses. Some of the houses outside the circular rampart of Trelleborg, which were not used as dwellings, even had ghosts from the traditional inner uprights, but in all other respects they were similar to the other houses at the fortress. So it must be assumed that in the houses used as dwellings the framesystem was "lifted up" and partly carried by two tie-beams spanning across the hall. The thrust from the roof was then – by way of the tie-beams – transmitted to the substantial timberwalls, which thus became the most important element of the housestructure, while the purlins were now primarily kept to give

longitudinal stiffness to the roof (Olsen & Schmidt 1977, p. 126). This roof, presumably without any great number of braces or studs, was anyway so unstable that from the beginning it was necessary to add a great number of buttresses to the structure. Judging from the observed strengthening of the longwalls in certain points, as well as from the *sule* postholes in the houses outside Trelleborg, the houses from the fortresses, and many similar houses, consisted of five bays of which three in the middle formed the hall.

As did the Hedeby house, these dwelling-houses consisted of three rooms – and sometimes one or two porches in front of the main entrances – but only the hall could be heated. The two gablerooms probably served as *herberger* (magazines and lobbies) – in a gableroom in one of the Fyrkathouses carbonized rye grain was found (Olsen & Schmidt 1977, p. 189). The great hall had a passage in the middle where also the hearth was situated, and an area of residence, which was slightly raised, towards the sides. This is probably valid for most of the barracks of the fortresses as well as for the *salshuse* (dwelling-houses) of the farms (cf. Vorbasse), but curiously enough similar three-room houses were used as workshops, and in 11th century three houses on the main farm in the Vorbasse village, which were almost identical in size, form, and room-arrangement, were used as 1) dwelling-house, 2) workshop and byre (the latter in one of the gablerooms) and, 3) byre (in the big room in the middle of the house) (Hvass 1980). From this example it may be seen that in the late Viking Age “boatshaped” houses with three rooms were used almost universally, in fact, they became a fashion, even if this housetype was originally created to comply with new demands to the dwelling. It might, therefore, rather be called a new building-system.

It is interesting to note that also in the rising towns this housetype was used in the 11th century. Examples have been excavated in Viborg and in Lund (Nielsen 1968 and Mårtensson 1976). The very lightly constructed house from Lund, built at about A.D. 1020 (fig. 6), had a hearth – which was later on replaced by an oven – not exactly in the middle as usual, but placed so that it indicates a “medieval” screen-passage inside the entrance close to the partition-wall.

Besides the more developed houses the traditional type survived in a more or less rudimentary state. A fine example of inner uprights of “prehistoric” plankshape may be seen in a barn built as late as 1629 on the farm Biskops in Gotland, Sweden (fig. 7) (now in Bungemuseet). But the

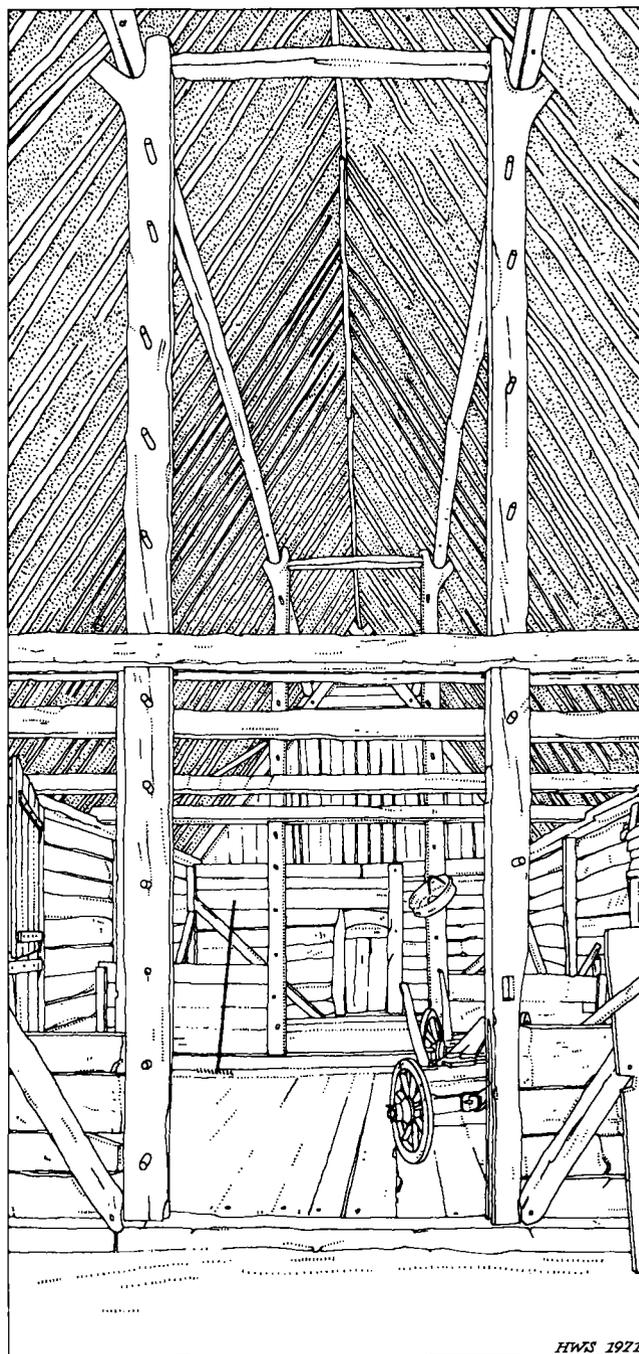


Fig. 7. A barn built 1629 on the Biskops farm in Gotland, Sweden. The *sule* structure is closely related to the structure of the Iron Age long-house. H.S. 1971.

general development of the Danish roof is quite different. As far as may be judged now the structural problems of the viking houses (without *suler*) were solved only when the trussed rafter roof of uniform scantling was intro-

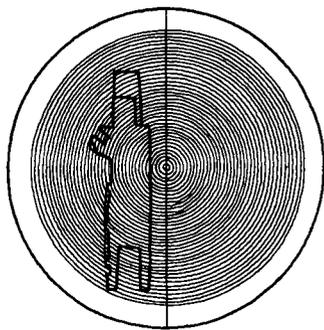


Fig. 8. Wall-plate from the stave-church at Nr. Hørning built near the end of the 11th century. Two wall-plates of this type could be made from the same oak trunk. The upright stave planks were secured in a groove in the underside of the wall-plate. The edge of the roof was finished by a horizontal board fixed to the groove at the top of the wall-plate. The trenched tie-beams ride over the top of the wall-plate. Scale of the section 1:20. H.S. 1977.

duced. This type became dominant in traditional Danish house-building forever after, and in this roof all trusses – usually placed at an interval of about 90 cm – form a stable triangle and therefore produce only a vertical thrust on the wallstructure below. It is very tempting indeed to see the termination of the curved houseshape as closely connected with the introduction of the trussed rafter roof with uniform scantling. The new roofconstruction came to Denmark from the South, and the oldest example, of which we have evidence, belongs to the stave-church of Hørning – built near the end of the 11th century. The wall-plate has been partly preserved (fig. 8), and traces show that the trenched tie-beams (being part of the rafter trusses) ride over the top of the wall-plate. However, it is in the more or less preserved original roofs of the stonebuilt Romanesque churches that the technique of the early medieval carpenters may still be studied

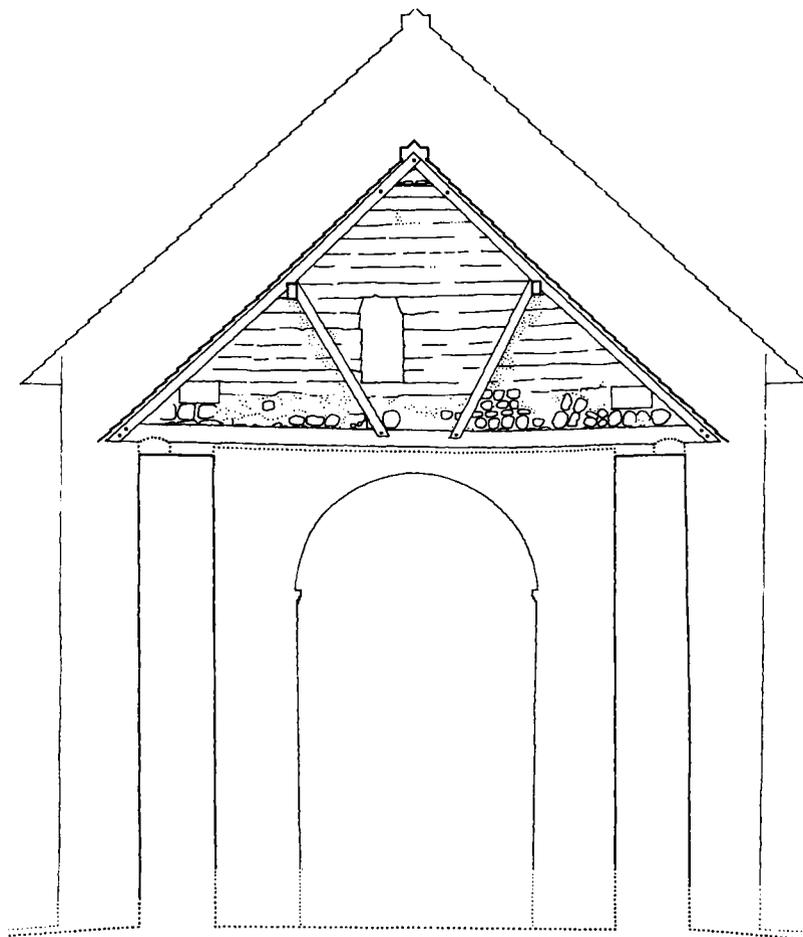


Fig. 9. Reconstruction of the original chancel-roof in Horbelev church, built in the late 12th century. Two purlins, which reach between the two stonebuilt gables, were used to provide the lengthwise stability for the Romanesque roof trusses. Section, scale 1:100. H.S. 1984.

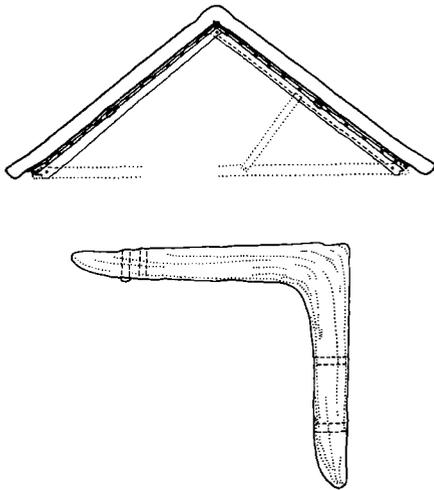


Fig. 10. Reconstruction of a reused Romanesque roof truss from the 14th century Hedegård farm by Halkær. Wind-braces on the upper side of the rafters provided lengthwise stability to the roof. Section, scale 1:100. Naturally grown brace from the reused Hedegård timbers, closely related to the "knees" in the Viking ships. Scale 1:20. H.S. 1984.

(Møller 1953). In a few examples, which characteristically belong to the oldest churches of the respective local groups, purlins were still used to provide the longitudinal stability for the trussed rafter roofs (fig. 9) (Roussell & Norn 1951, p. 1435 and 1570). Even if such hybrid roofs are very rare they may suggest that the new principles of construction in a way also constitute a continuation of the tradition, i.e. a development, or at least that a mixture of

structural types still remained acceptable. But in most Danish Romanesque roofs the lengthwise stability was provided by wind braces only, exactly as it is today in traditional carpentry.

The excavation of Hedegård farm by Halkær, built in the 14th century, revealed a quantity of building-timbers re-used as filling in the wet ground (Roussell 1939, 1947). Among these were rafters made from pine wood comparable to those made from oak wood in the Romanesque church roofs (fig. 10) (unpublished). The struts support the middle of the rafters, and are themselves supported by the tie-beam. At the same time the triangle becomes more stiff. On the upper side of the Hedegård rafter there is a scarfed joint where the wind-brace passed. The pitch of the roof is low (about  $38^\circ$ ), but the dowels for laths have such a varied spacing that a thatched roof is clearly indicated. Also a naturally grown brace has been found at Hedegård, much like the "knees" used in Viking ships (fig. 10, bottom).

Summing up: The development of the house structure during the Viking Age and the Middle Ages in Denmark by no means meant that the traditional types were entirely given up, and many houses and building-constructions must be classified as typological hybrids. Presumably the development took place primarily in the architecture for the upper classes (and for the church), while the vernacular buildings remained much more conservative. An outline of the general development of the house structure may be suggested as follows (fig. 11):

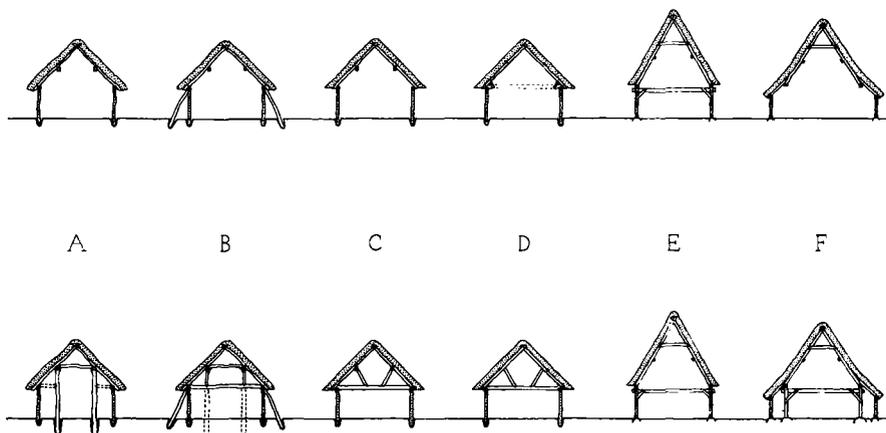


Fig. 11. Suggested general development of the house structure in Denmark during the Iron Age, the Viking Age, and the Middle Ages. A: building with *sula* structure. B: building with queenpost-structure. C: building with trussed rafter roof combined with purlins. D: building with trussed rafter roof. E: timberframed building with collar rafter roof. F: timberframed building with collar rafter roof and outshorts (*højremhouse* related to the Saxon house). Sections (top), trusses (bottom), scale about 1:500. H.S. 1984.

In the *sulehouse* (A) the internal frame-system gave support and stability to the roof as well as to the walls and stalls – also during the building of the house.

When the inner uprights were lifted up upon the tie-beams (B), the “frame” was still providing some support and stability to the roof. But the walls, which now had to carry the entire thrust, needed strengthening and the structure needed stability, even if, in theory, there was little or no lateral thrust. Therefore the added external buttresses and the stronger aerodynamic shape.

The rigid trussed rafter roof was a solution to the problems of lateral stability. At the beginning the lengthwise stiffening was provided by purlins (C). Windbraces on the upper or, more often, on the lower side of the rafters were introduced later on (D). At about the same time the convex shape of the house was given up.

The further development consisted in putting up the posts on stones or sill-beams (E). By then it became necessary in most houses to brace the wall structure, as the wall-posts were no longer fixed into the ground. Firstly it was done by long braces at the inner side, later on with struts properly worked into the structure, which now also included *løsholter* (horizontal timbers between the posts about halfway up the walls). The uniform scantling of the timber-framing made it possible to join the tie-beams directly into the wall-posts, while the simple collar-rafter above the wall-plates were fixed to the tenons in the upper ends of the respective wall-posts. In this way a complete transversal frame could be joined together on the ground before the erection. It might be argued that the principle of the trussed rafter roof with uniform scantling was by then carried through right to the sill. The traditional Danish timberframed house was a reality.

If more space was needed outshots or lean-to-extensions were added to one or two sides of the house (F). When the house was consistently made wider in this way, a structure with a nave and one or two aisles emerged. The traditional timberframed structure remained inside the house and became the principal part of the so-called *højrems*-construction (which is closely related to the structure of the Saxon house) while the walls were quite simply moved outwards and the roof extended in an equally uncomplicated way. This new structure was almost as nice and effective as the good old *sulehouse*.

Holger Schmidt, Tranemosevej 4, DK-2600 Glostrup.

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