

Radiographic and Forensic Aspects of the Female Huldremose Body

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INTRODUCTION

Though the region is renowned for its bog bodies, no well preserved prehistoric corpses have been found in Danish or north German peat bogs since 1950. The recent discovery of the Lindow body in England is a reminder that such finds can still occur (Stead *et al.* ed. 1986; Brothwell 1986). While waiting we can be usefully occupied making sure that sufficiently full and accurate information is available about the older discoveries, as Fischer already has done with the Elling body (Fischer 1980) and the Borremose 1948 and Vester Torsted finds (Andersen and Geertinger 1984).

A quite considerable number of skeletons and bodies have been found in north European bogs (map of Danish finds in Fischer (1980), fig. 2), but radiographic and forensic examinations made at the time of discovery are only available in a few cases, i.e. Grauballe (Glob 1956; Krebs and Ratjen 1956), Windeby I (Schlabow *et al.* 1958), and Dätgen (Struve 1969). As the possibilities for forensic research increase, old finds can be taken out and re-examined (Andersen and Geertinger 1984; Fischer 1980). There are also good archaeological accounts without expert forensic participation, i.e. Borremose 1 (K. Thorvildsen 1947), Borremose 2 (E. Thorvildsen 1952), and Tollund (K. Thorvildsen 1951; Fischer 1980). As well as this a great deal of scattered information is available about other bodies which for one reason or another could not be professionally examined and may not have been particularly well preserved. Much information on these is collected by Dieck (1965), can be gleaned from Hald's work on textiles (1950), or is available in semi-popular surveys such as Glob (1965), Lund (1976), or Ebbesen (1986), with many references to primary sources.

Here yet another old find will be taken out and examined forensically. It was made in 1879, but escaped attention owing to being transferred in 1905 from the National Museum to the anatomical institute of Copenhagen University without accompanying information. It was identi-

fied some years ago as the body to which the famous Huldremose clothing belonged (Liversage 1974 and 1985). The clothing, which is one of the most complete such finds, has been described fully by Hald (1950) and dealt with on a number of other occasions. The primary examination reported on here was made by one of the authors (D.B.) in 1986, and as far as the scalp hair is concerned in 1988. The examination was completely non-destructive except for the taking of a few hairs, and consisted of visual examination and radiography. Here we will present the results of this examination together with the information about the find circumstances contained in old letters. The clothing will only be mentioned so far as it enters into these. It has already been described. As controversy and speculation persists about the significance of the prehistoric bog bodies (Fischer 1980; Andersen and Geertinger 1984), it is important to have as many full and correct facts available as possible.

THE CIRCUMSTANCES OF DISCOVERY

The body was discovered in May 1879 during peat cutting in Huldremose bog, Ørum parish, in Djursland, eastern Jutland. The find was dealt with by the local authorities according to the rules and practice of the times, but with a combination of official correctness and private enthusiasm that has given us a unique series of documents on the clothing of what was probably a fairly well-to-do woman in Denmark near the time of Christ, and about the manner of her death. No authorized archaeologist was directly involved. This was probably a good thing, considering the contempt later shown by the archaeological establishment for this remarkable find, describing her to the Normal-Anatomisk Institute as "a Tartar woman clothed in skins". It seems that the archaeologists of the day had no use for anything so outlandish as an undated body.

All the information not obtained by direct examination

of the surviving remains comes from a series of letters in the archives of the National Museum in Copenhagen.

The first is dated May 22nd, 1879, and is a quite informal letter from Dr. Steenberg, the district doctor in Grenå, to *Justitsråd* (Legal Counsellor) Herbst. Clearly Steenberg saw himself as a personal friend of Herbst's, for he begins the letter with "Dear Friend", and uses the familiar form of address. This letter is rather picturesque and breathless with excitement. It loses a good deal in translation, but we will do our best.

"Only a few lines to tell you that I was yesterday called upon by the Police to be present at the digging up of a body out in Ramten bog, two (Danish) miles from town, where a body had been found during peat cutting, but instead of finding a fresh newly buried body we found a very old one of a woman wrapped in a skin garment, well conserved, and in a plaid skirt of woven cloth and a neck scarf of the same material. The body was of a woman, it was completely like a mummy, almost the whole musculature was reduced and the skin dried in like parchment with the appearance of an old smoked ham and greatly shrunken. Adipocere formation was beginning in the knees. I succeeded in getting the clothes off her nearly complete, and they are now hanging in my yard to dry after being cleaned. Everything has been recovered and will soon be sent. The body has been put in a coffin and laid in the ground in the churchyard, but can be taken up again if wanted by the museum. An official report will follow together with the finds. In haste. Your faithful Steenberg."

The museum replied by telegramming that it also wanted the body. One shudders at the thought of the original clothing from the time of Christ hanging on the line in the doctor's back-yard, but it seems not to have suffered much in the process. The description of the clothing in this letter is much simplified. The official report followed three days later and is more detailed and accurate. It is headed "Report on the discovery of a mummified female corpse in Ramten Fen near Grenå, dug up the 21st of May, 1879", and signed by Christian Siersten, chief police officer, and S.A. Steenberg, chief medical officer in the market-town of Grenå, about 18 km away, together with apothecary F. Hoffmeyer, who was "assisting". The report appears from its style to have been written by Steenberg, but was no doubt checked and approved by the police chief. The site was close north of the village of Ramten and is a separate narrow bog 2–300 m long separated by a narrow strip of dry land from what is now

a somewhat larger lake and perhaps earlier was a bog.

After a few introductory remarks about the legal and administrative background for the investigation the report goes on:

"The workman had struck a hard object with his spade, and this on examination showed itself to be a human body. Its upper surface lay 3 feet below the surface of the ground, which had already been dug away. The peat in the brink beside where the body still lay had the remarkable feature that the peat formed different clearly recognizable layers or courses, so that it appeared probable that the place had been dug up and put back again, so as to form a compact layer. The different layers were so loosely joined that they fell apart upon a light pressure. Immediately over the body there were still unrotted stems of heather, and other plant remains in a partially rotted state. The body itself lay in a yellowish fibrous mass, that was said to occur regularly under the proper peat and resembled half rotted long grass and moss. It was observed that the peat walls beside the place described here showed no trace of the above-mentioned layers".

Steenberg's account is almost as good as a palynological report! He was obviously a keen observer and his opinion that the body had been buried deserves a good deal of respect, particularly the observation that the same stratigraphy was not seen anywhere else on the working faces. However there is no actual documentation, and eyewitness accounts are notoriously uncertain. If Steenberg believed that the body had been buried, his recollection could easily have been influenced thereby. Moreover the description does not quite tally with a backfill, which would be an amorphous mixture of different kinds of peat rather than a layered deposit. When Steenberg writes "tørvejorden dannede forskjellige let kjendlige lag eller skifter" it sounds like a sequence of different kinds of peat that formed one above the other. A little of the "yellowish fibrous mass" is preserved in corners of the body, and a sample was identified by David Robinson of the National Museum's Scientific Department as sphagnum. Unfortunately Steenberg's account cannot be regarded as definite evidence that the body was buried, but tends if anything to point in the opposite direction.

The report continues, "The body lay on its back with the left hip somewhat raised and both thighs drawn up towards the body. The head lay to the west, the legs to the east. Crossing the chest obliquely from NW to SE was a fencing stake of willow, fragile, somewhat rotten, about 3 feet long and 1½ to 2 inches thick. It had been broken

into several pieces during peat digging. The right arm was broken off, and its hand was found cut through by the spade, which had also caused a hole in the right knee". This arm is specifically mentioned both here and in another letter as already separated from the body. The examination of the body (see below) showed that it had been cut off before burial.

There follows, "The entire body was covered with clothing, shaggy and woollen, penetrated and covered by the mire where she lay. With all due care the body was laid complete on a barrow and brought out of the bog to a farm in Ramten, where, after pouring water over it, the investigation continued".

This rather cavalier treatment contrasts with what one would do today, compare the Lindow investigation, but the investigation of the Huldremose body was far ahead of all earlier and many later studies. Though in the absence of previous experience or knowledge of bog bodies, the investigation amounted only to removing the clothing and later writing down what was observed and remembered, Steenberg was fortunately both a keen observer and a vivid writer.

"The outermost item of clothing was the shaggy skin" (it was really a sheepskin cape of the finest workmanship) "that covered the entire upper part of the body except the right arm, which was broken off between shoulder and elbow and lay extended towards the southeast. Around the body outside the sheepskin was tied a narrow leather strap that bound the left arm fast to the body under the outer, but over the inner cape". This was a thick rawhide strap 1/2 to 3/4 cm wide, a decidedly efficient means of binding. One end was doubled back and sewn to itself as a loop. There is no more exact information as to how the arm was tied, and the strap is now incomplete and in three pieces. The description is contradictory, as the strap is described both as outside and inside the outer cape. The surviving position of the left arm of the body shows clearly that it had been bound (figs. 2a,b). We continue: -

"There was a scarf around her neck, an end of which was tucked under the left arm. The lower part of her body was wrapped in a voluminous plaid skirt of woollen cloth, that was supported around her waist by a leather cord passed in and out through holes in the textile". This is all described more fully by Hald (1950) and Liversage (1985).

"Nearest the skin of the upper part of her body was a second cape, rather similar in design to the first, but light and made of lambskin". This was the inner cape which



Fig. 1. General frontal view of the Huldremose body, showing the dried but good state of the body. Photo, Lennart Larsen.

her left arm was described as bound to the body outside of. Steenberg writes, "In removing the clothes it had to be cut open on one side". We can detect an impatient use of the penknife whenever the clothing gave difficulty. In fact both capes, not just the inner, were cut at the shoulder and were originally closed at the neck so they had to be put on over the head.

"The long red hair lay stretched out backwards and was tied around with a cord, which was also wound

several times around her neck”. The question of the hair is a problem, and it is obvious that the field observations on this point were not sufficiently exact. Though nothing in the letters suggests that there was anything unusual about the hair, the examination of the body suggested rather strongly that the woman’s head had been carefully shaved (see below). Here in the police report we are only told that a cord was wound around her neck. The surviving cord is 1.10 m long and of wool or other animal hair, twisted like a rope of two strands. It seems unlikely that it can have got around her neck except as a deliberate act. Later, in a letter from Nissen, we are told that also a lock of hair was wound around her neck, and that there had been two amber beads on the cord.

“On opening the mouth, which was closed, the tongue was found to be loose. There was adipocere in the hole in the knee. The body was placed in a coffin and buried in Ørum churchyard, from which it was taken up again on May 24th as the Museum for Nordic Antiquities wished it surrendered”.

This is the main document in the case, which lays out the facts in a careful and considered manner. There followed a small number of further letters, some in a more familiar tone. They give a few supplementary details, but the main circumstances had already been laid out. These letters need not be cited at length, but a few new points can be extracted from them.

On May 25th (the same day as the police report is dated) Steenberg wrote to Herbst, saying that they were going to pack the things together and send them with the steamer. Herbst is advised to negotiate a price with the company, as transport of bodies was rather expensive. There was no smell or anything unpleasant about this one and Steenberg thought it should go cheaper.

On the 26th J.V. Nissen, teacher and owner of the piece of bog where the find was made, wrote, “The accompanying woollen cord with two amber beads were yesterday or on Thursday found at Rasmus Jensen’s farm by a little boy. After speaking to him there seems to be some assurance that this cord accompanied the lock of hair, that together with the cord was wound around the neck, was placed on the wheelbarrow.... one of the breaks in the cord was made by the boy, but the knots are certainly original. The smaller bead has been off the cord, but the larger one is in its original place. There were no other beads on the cord, and none can be expected, as I have very carefully searched the cartshed and that side of the farmyard”.

This is interesting – for, as we have seen, in the official report only the cord, not the lock of hair, was mentioned as wound around the neck. When the cord was entered in the museum register in Herbst’s handwriting, no mention was made of the two amber beads. In all events it is clear that they did not after all accompany Nissen’s letter, for later Steenberg wrote that he was sending them himself.

The next letter is from Steenberg and is dated May 27th. It confirms a number of points, and is Steenberg’s most specific statement about the hair at all. The body and accompanying objects had been expedited that morning with the steamer, and he wrote,

“It should be noted that the cord in the box is the one that as well as being wound around the hair was twisted several times around her neck. The broken off right arm was that way when she was found, but the cut off hand and the hole in the knee are the turf spade.... Unfortunately we forgot to bring with us the stave that lay across the body.... My wife has secured the head or neck scarf with a couple of pins the way it was before we took it off and had to cut it”. The scarf looks torn rather than cut! “The hair was so full of mud and fine peat fibres that it was impossible to loosen these from it without it coming off. It has been put in the box together with the cord. There are also some teeth, which fell out when the body was being cleaned.”

This confirms that the hair was sent to the museum. What happened to it after that is a mystery. It is not now to be found either at the museum nor the Anatomic Laboratory. It must be supposed that it was from its normal place on the head that the hair came off when being cleaned, for otherwise Steenberg would certainly have said so. This means that if it was already cut off, as appears to be the case, it must have been replaced in the head region when the woman was finally disposed of, as well as being wound around her neck. Also the loose teeth have been lost.

This letter also confirms that the woman was found with the right arm already amputated, but that the cut through the hand was made during peat digging and that there was a stave over the body. It also emerges that the cord was not sent by Nissen, as said in his letter, but was put in the box.

Apparently it was now without the amber beads, for in Steenberg’s next letter, which is dated May 29th, he writes, “I think I ought to send these two amber beads, which were found at the place where we unclothed the body. It is regrettable that they escaped our attention, but



Fig. 2. a) Surface view of the left arm, showing the post-mortem deformity and curvature. Photo, Lennart Larsen. — b) X-ray detail of the deformed left forearm. No evidence of healed fracturing is present.

in all the mire and mud we, or more truthfully I, were messing around in, that sort of thing can easily happen.” Presumably they were enclosed, but it is curious that they were not catalogued by Herbst.

That is the last letter with information about the discovery and investigation of the Huldremose body. A final letter dated June 3rd will not detain us here, but might be of interest to students of the history of attitudes to archaeology. Steenberg, it seems, is hurt by a newspaper article criticising his proceeding at once with the investigation instead of waiting for an expert from the National Museum; he defends himself.

The experts, it seems, despatched the body on its arrival to the Normal-Anatomic Institute, whence one by name G. Schmidt returned a letter of extreme conciseness and precision dated June 3rd.

“.. I have found no sign from which with even reasonable assurance can be drawn any conclusion regarding the question whether the body is of a “Tater woman” (may be understood as indicating a gipsy – the inverted commas are Schmidt’s) or not. It would not on anatomical grounds be possible to raise any objection to the result to which the study of the clothing, etc., might lead. I take the liberty of asking that the body be taken back by the Museum for Nordic Antiquities; it will be given out by Svensen”.

It seems that the experts at the museum had rather inflated hopes of what could be learned from anatomical science but were quite unobservant of the wonderful and unique clothing!

THE EXAMINATION OF THE CORPSE

Fig. 1 is a photograph of the corpse in its present condition. No special conservation was undertaken, and the body seems simply to have dried. Surprisingly perhaps it seems to have remained stable over the seasons and decades, and there is no evidence of rotting or fungal attack (although restricted beetle damage is evident). The scalp and some of the (front) teeth became detached when the body was cleaned by the finder in 1879, and are now missing. Adipocere is evident along the whole length of the thigh and extending up the buttocks. Perhaps because she was only recently re-identified, no detailed evaluation of the body has earlier been attempted. Liversage (1985) suggested that blood loss and shock could have resulted in death after her right arm was cut off. It seems worth

reviewing in more detail the evidence for abnormality and lesions as revealed by surface and radiographic examination. It is also necessary to consider *post-mortem* changes of a pseudo-pathological kind.

External examination

The surface features may be listed as follows:

- 1) On the left side of the chest, close to the left axilla, was a small area of skin damage, which is ragged and most likely to be of *post-mortem* origin.
- 2) A similar lesion, also likely to be of *post-mortem* origin, is present on the anterior surface of the left upper arm.
- 3) The left forearm is angled across the lower chest and displays an “S”-curved deformity along its whole length. There is clearly flattening of this forearm as well, and it seems likely that these features are the result of a tight strap which held the arm in position and which could have caused *post-mortem* deformity when the left ulna and radius became decalcified (figs. 2a,b).
- 4) The chest and well-defined breasts are flattened and have deformed towards the right side laterally. There are a few further areas of superficial *post-mortem* skin damage.
- 5) The right arm shows three contrasting forms of injury, only one of which is *post-mortem*. Approximately half-way along the upper arm, the humerus shaft protrudes from the dried and shrunken soft tissue. The shape of the end of the shaft may be modified by drying, and appears to be relatively “cleanly” broken across. While the end of the bone as now preserved does not show any clear evidence of cut marks, there is an associated shallow cut through the skin, which is straight and must originally have been caused by a sharp implement (figs. 3a,b). It is cut roughly at right angles to the long axis of the humerus and the broken end of the bone. This evidence would support the view that the arm was cut off, and agrees with the original observation at the time of discovery that the arm was separate.
- 6) There is the distinct possibility that the forearm was also hacked in two or the amputation of the arm was performed twice, first below and then above the elbow. In fact the whole elbow area is missing. The forearm is represented by the distal half, and again

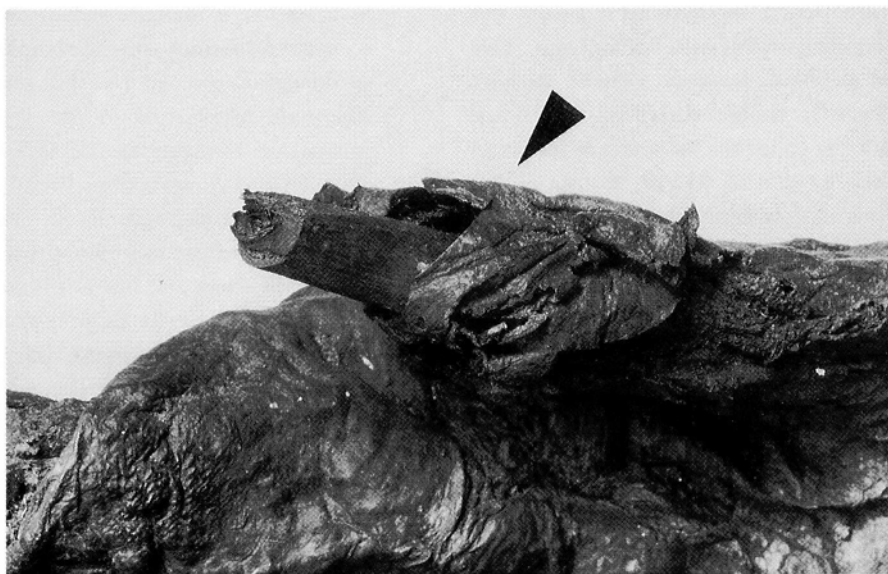


Fig. 3. a) Surface detail of the upper right arm, in the region of the damaged humerus and cut flesh (now dried). Photo, Lennart Larsen. – b) X-ray of the hacked off humerus. Note also the rib cage with the unusual highlighting of the costal cartilages.

the bone shafts (ulna and radius) stand out from the soft tissue as a result of differential shrinkage. The ends of the bones are broken across without obvious splintering, and near the broken end of the radius are three fine cut marks at 45° to the long axis of the shaft and approximately 10 mm in length (fig. 4a). The fine nature of these cuts would again suggest that a sharp instrument was used, and that this was drawn across the arm to the bone three separate times. An alternative explanation might be that they resulted from a glancing blow, which jarred across the bone.

- 7) At about 90° to the orientation of the forearm cuts are three separate lines of damage, two rough “incisions” into the skin just above the wrist and a long cut which has severed the fingers (but not the thumb). The implement which took off the fingers has caused somewhat ragged damage across the metacarpals and irregular tearing to the non-palmar skin of the hand (fig. 4b). It was reported that the hand was accidentally taken off by the peat cutter at the time of discovery, and this is compatible with the nature of the damage to the region of the fingers. It should be noted that the damage to the wrist and hand does not have the same orientation as the fine cuts on the mid-forearm. Peat cutting was presumably always parallel or at right angles to the peat face, and is extremely unlikely to have given rise to cuts with differing directions. Also, the fine superficial nature of this surface damage is not the sort of thing which is likely to have occurred from a peat tool rubbing on soft decalcified bone.
- 8) On the left thigh, near the buttocks and knee, are two areas of damaged skin (exposing white adipocere which extends from the thighs onto the lower back). These are probably *post-mortem* in origin (fig. 5a).
- 9) In the femoral shaft region of the left thigh the skin surface has been pressed down and distorted (figs. 5 a,b). Can this have been the result of pressure from the post or stake found with the body? Pressure from such an object on the corpse could certainly have had this result. We will return to this question in the section on radiography.
- 10) Below the left knee, with an orientation of about 45° to the long axis of the tibia, is a fine straight cut through the skin. This incision is of about 30 mm in length and must have been made with a sharp instrument.
- 11) Above the outer aspect of the left heel, near the fibula

articulation, is another lesion, some 31 mm in length, showing a broader zone of compressed damage which could indicate contact with a peat spade.

- 12) Below the inner aspect of the right knee, in an area of *post-mortem* damage to the soft tissues, the tibia is exposed and shows a deep broad cut into the bone 26 mm in length (fig. 6a). To the side of this, and parallel in orientation, is a short, fine cut about 7.5 mm long. This short and fine cut is similar to those on the forearm. Both of the injuries could have been made with the same instrument, but in one case the cut went deep into the bone (fig. 6b).
- 13) In the region of the right medial malleolus is another incision of about 21 mm in length, roughly at right angles to the injuries on the tibia (fig. 7).
- 14) In a different plane altogether to the other injuries on the right leg is a straight deep cut of about 30 mm in length on the upper surface of the foot, above the arch. The incision has opened out owing to drying and shrinkage, and clearly penetrates deep into the upper tarsal area (figs. 8a,b).
- 15) Two low-angle cuts into the skin on the medial side of the right foot have produced soft-tissue flaps about 20 mm and 15 mm long. A fine sharp cutting tool would have been needed to produce such injuries.

This, then, is the main evidence for external damage, possibly *ante-* and *post-mortem*, to the Huldremose woman. It will be seen that the injuries are mainly to the arms and legs. The back appears to be free of injury. The injuries appear only partly to be explained by damage from a peat-cutting tool.

The radiographic examination

The X-rays of the Huldremose woman are remarkably good in view of the decalcification which occurred while she was buried in the peat. In this respect they are comparable with the quality of the Grauballe radiographs, but are noticeably different to those of the Lindow body, where sufficient contrast could only be obtained by xero-radiography. As in the case of the surface detail, comment seems best listed point by point.

- 16) Frontal and lateral views of the head provide much information on inner detail. Even allowing for drying and shrinkage, the cranial vault appears to be generally thin, and in frontal view there is the appearance

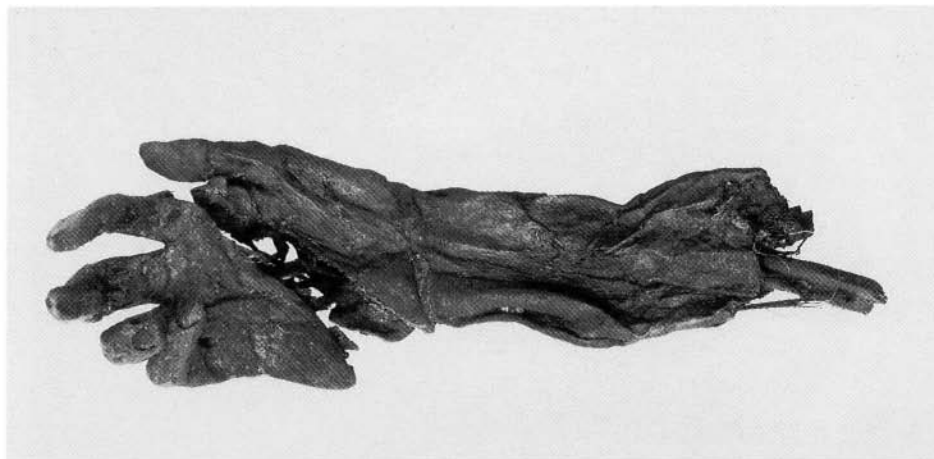


Fig. 4. a) Right distal forearm and hand (cut with a peat tool). Photo, Lennart Larsen. – b) X-ray of the hand and wrist, showing metacarpals damaged by the peat cutting tool. Note also that the impact of the tool has dragged the carpals away from the distal radius at the wrist.

of slight sagittal keeling associated with what is interpreted as pseudo-parietal thinning of *post-mortem* origin (fig. 9). The coronal suture is not well marked and could be partly obliterated, but the sagittal and

lambdoid sutures are clearly present. The cranial base is well defined, with a normal shaped atlas and axis in articulation. There is little evidence of frontal sinus extension into the frontal region, a female char-

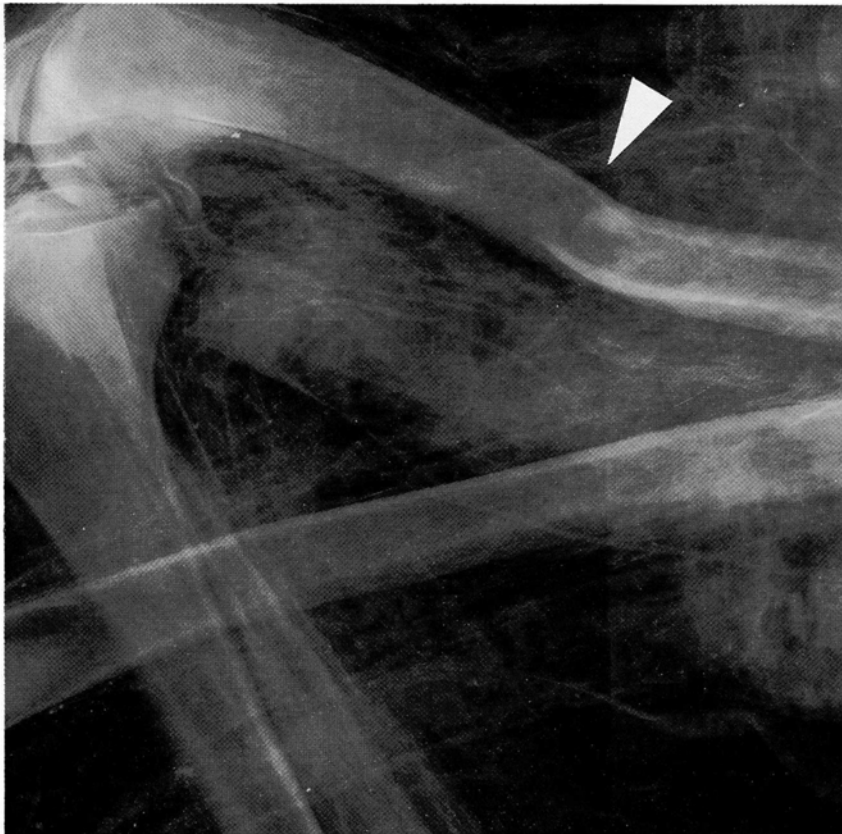


Fig. 5. a) Surface detail of the left thigh, showing post-mortem deformity. Photo, Lennart Larsen. – b) X-ray of the thigh deformity, showing the bowed femoral cortex (and lack of fracture callus).



Fig. 6. a) Right tibia (exposed by post-mortem damage), showing a deep and sharply defined cut. Photo, Lennart Larsen. – b) X-ray detail of the injury to the tibia.

acteristic. The teeth are poorly defined and some are recorded as lost soon after the recovery of the body. The gonial region of the mandibular ramus is noticeably everted, a somewhat male characteristic. The brain mass is well defined, but much reduced and mainly restricted in extent to the occipital area (fig. 10). No evidence of structure can be seen, and like the Grauballe brain it may be somewhat altered and decomposed.

- 17) The vertebrae can be seen clearly, and could be scanned for evidence of arthropathies, especially the commonly occurring osteophytes. However no marked changes could be seen, and the state of the joints would give support to the view that the individual was probably under 40 years. However the sixth and seventh thoracics, and possibly some lumbar, display marginal "sharpening" of the joint margins, with perhaps slight lateral extension. There are no Schmorl's nodes.
- 18) The ribs, scapulae and sternum are relatively faint. Surprisingly, the costal cartilages show up far more clearly, and could have undergone considerable, but incomplete, calcification in life (showing up as a bubble effect). This is an uncommon feature which would suggest a person of more than young adult years. There is no evidence of rib fractures or other *antemortem* pathology. Extending up as far as the last rib, in the central area, is a granular mass, which is tentatively interpreted as material contained within part of the alimentary tract. The shape of this mass, which extends to the right side of the somewhat flattened abdomen, does not permit closer identification of which parts of the stomach and intestinal tract may be involved.
- 19) Both clavicles are clearly seen and may show slight deformation as a result of *post-mortem* changes. It should be noted that the right clavicle displays a more robust shaft, which could indicate an old well-healed fracture.
- 20) The left arm is complete, but the right one is clearly damaged. The left humerus is intact but a little distorted. The right humerus is only represented by the proximal half. The bone shaft terminates in a relatively flat end-face at right angles to the long axis of the bone, but owing to shrinkage and distortion it does not appear as a "clean" flat cut. The left forearm is noticeably distorted into a flat "S" shape, possibly because this arm was bound to her

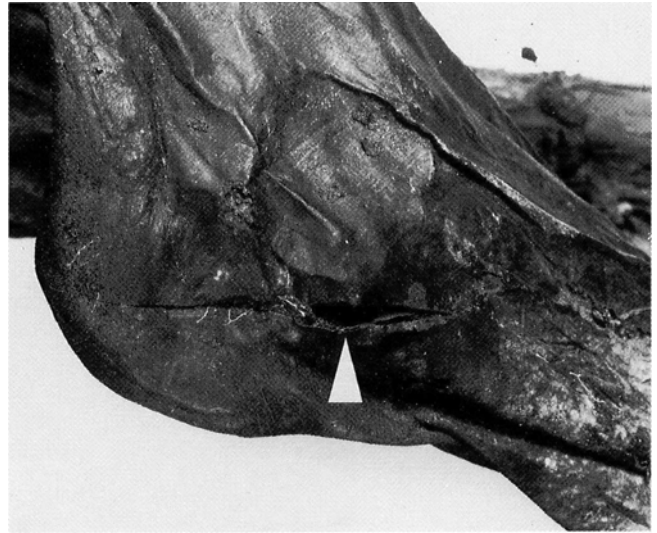


Fig. 7. Surface detail of the injury near the right ankle. Photo, Lennart Larsen.

body by a leather strap, as observed during the unclothing of the corpse in 1879. On one X-ray there appeared to be evidence of an unhealed fracture, but the subsequent X-rays revealed that this was pseudopathology caused by the superimposition of a hardened skin fold over the bone. There is no evidence of joint pathology, either at the left elbow, wrist or hand. The cortical bone of the ulna and radius are of normal thickness. At the right distal forearm and hand which were found detached from the body, there are no abnormalities in the X-rays which cannot be seen in the surface detail (and are described above).

- 21) The pelvic and abdominal area presents a very different picture to that of the thorax (fig. 11). In fact detail of the bones is partly obscured by what appears to be dried muscle tissue, adipocere, and food residue within the alimentary canal. X-raying this area of the body presented considerable problems owing to the positioning of the trunk in relation to the legs.
- 22) The legs are generally in a good state of preservation. The hips and knee joints appear to be normal. Cortical thickness at the femoral shafts is not great, but when shrinkage is allowed for is nevertheless well within normal range. The right femoral mid-shaft area displays an abnormal curvature which has previously been interpreted as indicative of an old healed trauma (Liversage 1985). However, further radiography shows fairly certainly that this may well be a



Fig. 8. a) The straight injury on the upper surface of the arch of the right foot. Photo, Lennart Larsen. – b) X-ray detail of the right foot, showing minor damage below the skin surface.

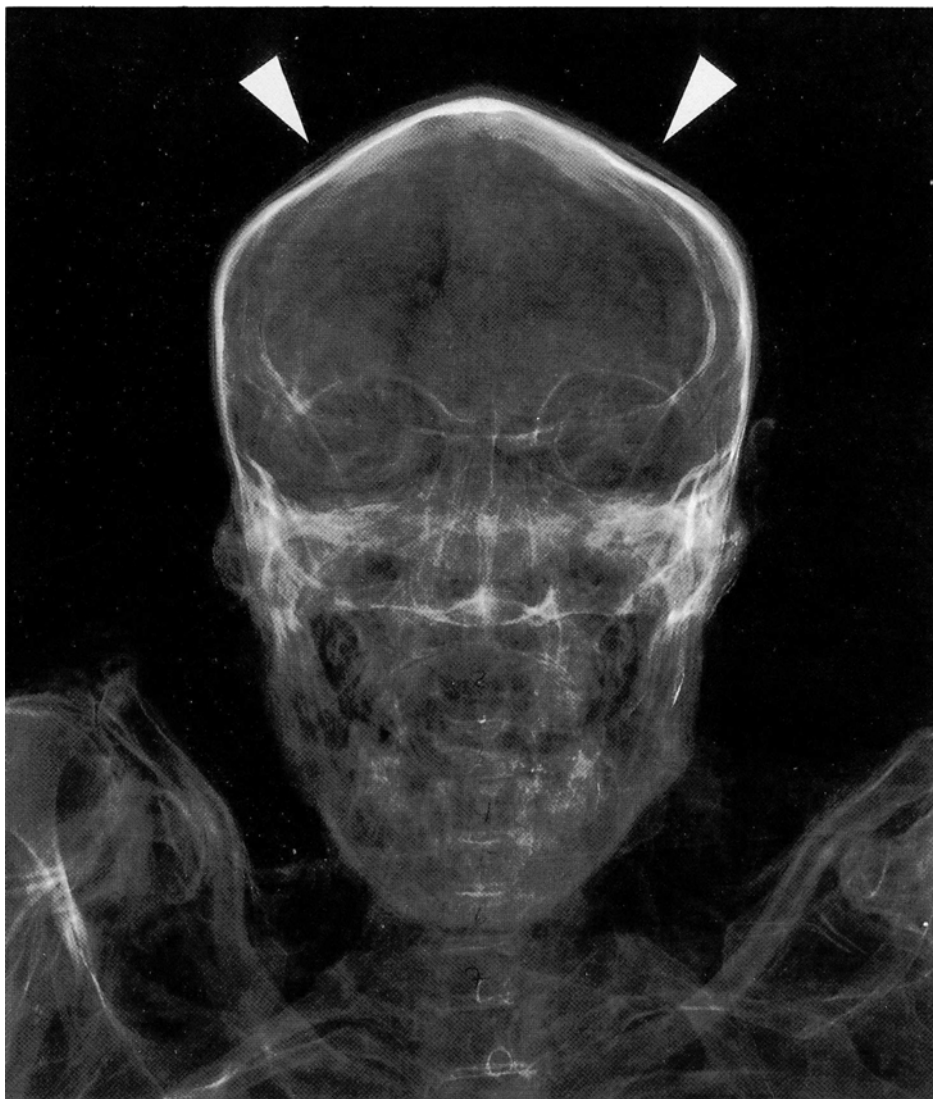


Fig. 9. X-ray of the antero-posterior view of the head, showing the thin (dried and shrunken) skull bones, with pseudo-parietal thinning.

post-mortem pressure deformity. Both tibiae are normal in size and general shape. The right tibia shaft displays evidence of trauma in the form of an approximately two centimetre deep cut at about a 45° angle to the long axis of the shaft. Owing to shrinkage the two sides of the cut are now well separated. There are no certain Harris lines on these or any other long bones. The fibulae show no pathology. The tarsal and foot joints all appear to be free of arthropathies. However in the case of the injury (deep cut) into the upper part of the right foot, there is clear evidence of

penetrating bone damage, with some localised crushing of the cancellous tissue.

COMPARATIVE FINDS

Here we will try as others have done before to summarize the essential facts about the find group. Full references will not be given as bibliographies are already available in several places, e.g. Glob (1965), Lund (1976), Fischer (1980), Ebbesen (1986), etc.



Fig. 10. X-ray of the lateral view of the skull vault, showing the posterior positioning of the reduced brain mass.

Date

Though hominid remains from virtually all Holocene periods can be found in peat bogs, those actually preserved as corpses, apart from a few that are later, for instance medieval, are shown by radiocarbon dating to be centred on the Pre-Roman Iron Age with some overlap over the periods before and after. Though finds of skeletons have a wider range than those of corpses do (see Bennike and Ebbesen 1987), it is clear that killing and submerging in bogs must have been a fairly widespread occurrence in the last centuries B.C.

It is thought that the bodies could only be preserved and survive as corpses if they were deposited in the winter (Gregersen 1980; Andersen and Geertinger 1984). The corpses should then only be a relatively small proportion of the original depositions, and the original bog burials may therefore have been more numerous than the finds suggest. Many discoveries of unaccompanied clothing may indicate bodies that were too badly preserved to be recognized as such by the peat cutters (see Hald 1950).

The radiometric dating bracket is firmly confirmed by Lise Bender Jørgensen's study of prehistoric textiles. She showed that the bog bodies are associated with a textile technology dated to the Pre-Roman Iron Age, and continuing in finer quality into the Early Roman Iron Age.

She referred to this as the Huldremose group of textiles (Bender Jørgensen 1984; 1986). The radiocarbon datings of some bodies place the earliest of these textiles at the end of the Bronze Age, from which there are no other dated textile finds. There is a problem with the radiocarbon datings, as Tauber (1980) has shown that some of the first made of these were too young owing to contamination with humic products and possibly laboratory preservatives (Tauber 1980). Among these doubtful datings is K-1396, made of part of the inner cloak of the Huldremose woman and placing it in the Early Roman Iron Age (1920 ± 100 bp uncalibrated). A recent accelerator dating of a small piece of gut from the body agrees well with this dating (OxA-2826, 1910 ± 110 bp), but suffers from the same problem of possible insufficient pre-treatment. These are the only dating indications we have apart from the textile technology, which, as said, points more to Pre-Roman times.

Conditions of deposition

These are often a little obscure because of the difficult field conditions. The questions are whether the bodies were placed in natural hollows or dug holes such as old peat cuttings, and more particularly whether or not they were then buried by having peat thrown on top of them.

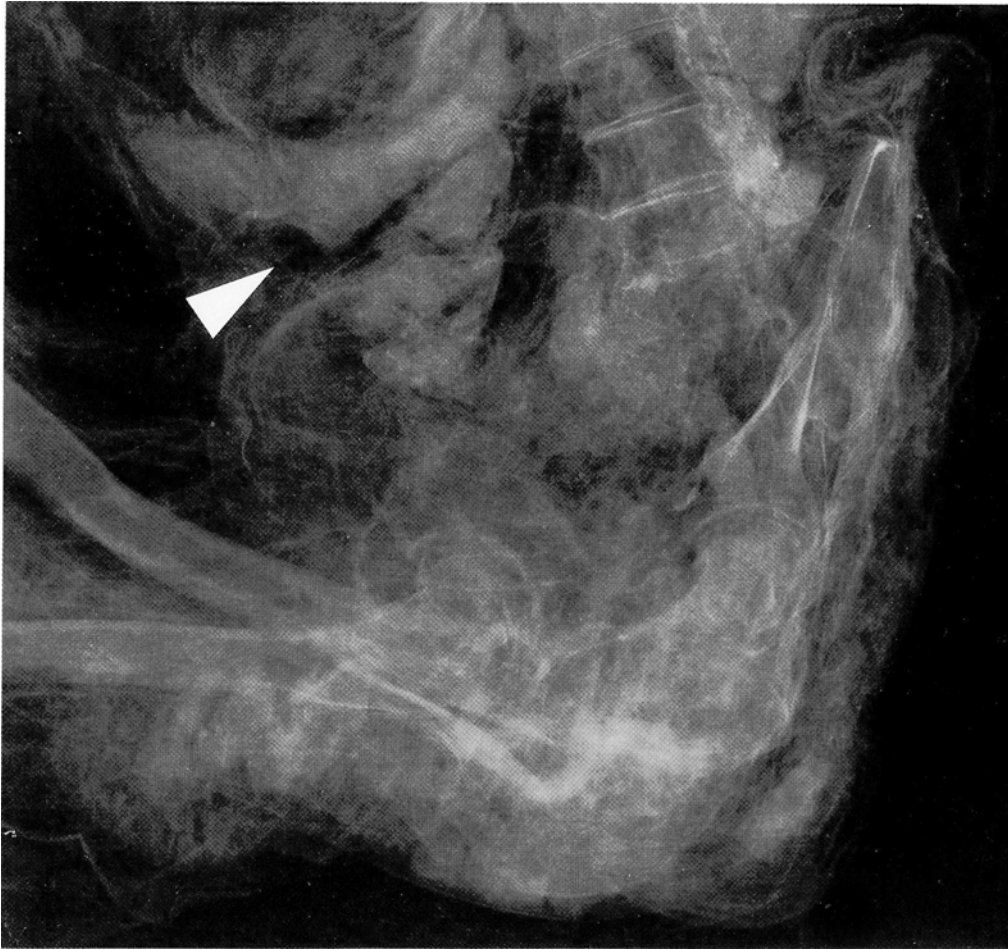


Fig. 11. X-ray of the region of the pelvic basin and upper thighs, showing skeletal detail and the apparent granular mass of material in the interior of the abdomen.

Liversage (1985) argued that the bodies must have been buried by throwing peat over them, for otherwise they would have been disturbed by animals and birds and in one way or another ended up in a more or less scattered condition. However in the report on the Lindow corpse in England it is pointed out that the fingernails had drifted away from the fingers, and the same was reported of the Borremose 1948 body, which implies lying loose. It could perhaps be argued that the fill in a carelessly refilled pool would be loose, and move enough with fluctuations in the water level for finger and toe nails to drift away; however the basic question is whether an unburied corpse can survive in articulation in an open bog pool, and this would be best answered through modern forensic science.

As regards the lesser question whether the bodies were

placed in natural or artificial hollows, the answer is of course both are possible and do not exclude each other. There is much evidence of peat cutting in Iron Age times, so suitable old peat cuttings must have been available. On-site examination suggested that the bodies from Dätgen, Grauballe, and probably Kayhausen had been placed in natural hollows, while those from Store Arden, Windeby I, the Borremose bodies of 1946 and 1947, and probably Tollund came from ancient peat cuttings. A more detailed palynological examination at Store Arden established a hiatus in the pollen sequence, showing that the peat had been cut (Brorson-Christensen 1948), and at Grauballe the nearby undisturbed section was festooned with old peat cuttings (Jørgensen 1956). Conditions are naturally very difficult for carrying out systematic study

in a peat cutting where a body has been found, and the important overlying deposits are likely already to have been removed.

Some specific field observations have been emphasized by earlier writers, but not always very carefully. For instance Christian Fischer (1980, 35, 38) writes that the Borremose body of 1948 lay on a layer of birch bark placed there deliberately. Unfortunately the bark was from a different find, the 1947 body, not the 1948 one, and E. Thorvildsen's original note reads, "The overlying peat was taken away. It contained much wood as did the corresponding layer in the bog ... and also contained peat lumps that were harder than the surrounding peat, i.e. were already dried out pieces that had fallen into the peat cutting. Also the peat around the body was rich in heather stems." The palynologist, A. Andersen, added wood determinations and wrote that there was birch bark underneath the body. The report appears to suggest a refilled hole, and in the absence of specific mention, especially from A. Andersen, the wood and bark may be taken to be part of the wood peat of which the bog consisted at this level.

C. Fischer also writes of the Borremose body of 1948, that "... the survivors had gathered bog cotton and buried the body surrounded by it on a bed of birch bark, which does not suggest that violence was used as torture as part of punishment, but was necessary for the execution". He cites that in a lecture B. Brorson-Christensen had said that this material could not have grown in place and must therefore have been deposited. Whether the lecture is correctly remembered or not, the birch bark and the bog cotton were from different bodies, and Brorson-Christensen's original report on the separating in the laboratory of the 1948 body from the peat block it had been transported in gives a somewhat different impression. It says that the body was surrounded by a tough layer 2–6 cm thick of felted roots mixed with *Eriophorum vaginatum* peat. A little original peat still survived above the body and was described as nearly pure *Eriophorum vaginatum* peat. There is probably here also a case for some kind of refilling, but Fischer's idea of tender burial under a layer of bog cotton goes rather far considering the state of the evidence, and the piece of scalp thrown in the pit below the body and the smashed face with splinters of wood in the eye (Andersen & Geertinger 1984) do not suggest any great tenderness!

The Windeby I body is described as lying in an old peat cutting measuring 1.5 × 2 m, containing fen peat of lighter colour. This description suggests that the old peat

cutting for a long time afterwards had been a pool in which reeds grew. Gebühr (1981) however quotes an unpublished letter according to which the body had first bog cotton over it, and above that a refill which included blocks of cut peat. It is hard to know which account to follow, but the letter sounds convincing.

On the other hand there was no evidence to show the Dätgen body had been deliberately buried at all, and apparently it was thought to have been placed in a steep muddy hole that more or less closed over it.

Also the Kayhausen body was said to have been laid in a hollow that grew over naturally.

Despite their deficiencies it seems arguable from these accounts that some bodies were deliberately buried and others left lying in hollows in the bog. Generally the best documented accounts are those supporting burial in natural hollows or old peat cuttings.

Gebühr (1981) has a novel argument that the bog bodies may have been normal burials that happened to be placed in bogs. The paper includes interesting supplementary information on specific finds, but is not convincing even for the Windeby I discovery, at which it is principally aimed, and certainly fits the evidence for bog bodies as a whole very badly.

Manner of death

The more the evidence is considered, the clearer it becomes that a significant proportion of the bog bodies had suffered very violent deaths.

Hanging or strangling. The bodies from Borremose 1946, Tollund, and Lykkegårdens bog had a noose around their necks. The Tollund man had been hanged, and the cord was long with the slip-knot drawn up at the back. Borremose 1946 had the slip-knot in front with two short ends with added knots for purchase, as though for strangling by two people pulling in different directions. The Elling body had a hanging groove behind her neck and the noose was also present among the objects disturbed by the finders. The Windeby II body had a very nasty device still on the neck, in the form of a square frame of four hazel rods, each over one and under one of the others, surrounding the neck on all four sides. It is illustrated on the remains of the body by Gebühr (1981), fig. 7,3, and must presumably have been tied together with cords that have not survived, for otherwise it could hardly have remained in position when the body was deposited in the pit or hollow. It could perhaps have been manipulated to

give prolonged strangulation, and recalls the Borromose 1946 noose for two men to work.

Severe blows to the head. As well as having a noose around the neck, the Borromose 1946 body had the back of the head smashed. Also Grauballe had suffered a fatal blow to the head. The blow to the Borromose 1948 woman had been from in front to the face and there were splinters of wood in the eye. A severe blow had also been inflicted to the Osterby head.

Other beating is reported at Dätgen, where there were several bone-breaking blows to the back and lower body. It may be pointed out that a very common field observation has been that substantial staves had been laid on top of the corpses (Havdals mose, Huldremose, Skærum mose, Vester Torsted, Windeby I, Dätgen). It is possible, and in fact the simplest explanation, that these stout sticks were merely instruments of coercion that were discarded at the site, presumably after serving their purpose. It is without doubt difficult to distinguish bones broken by beating from post-mortem damage.

Broken legs also can be difficult to distinguish from post-mortem damage, but are reported at Borromose 1946 and 1947, and at Grauballe, and also at Dätgen, where they were thought most likely to be post-mortem as the limbs were stretched out in a normal way. Breaking of a leg can have been used to make escape impossible in the pre-execution phase, and calls to mind an Assyrian relief of prisoners' legs being broken by soldiers.

Cuts and amputations are particularly clear at Huldremose, where the right arm was cut off, perhaps twice, and there were cuts on the right foot and leg that went deep into the bone and other cuts on the legs, foot, and right arm that reached the bone without penetrating it deeply. There were also gaping cuts on the back and chest of the Dätgen body, one of which was considered to be a fatal stab to the heart. Another possible case of amputation was a badly investigated occurrence in Lykkegårdens bog, where, after all the bones had been carefully gathered up after discovery the whole left lower arm was found to be missing. Wounds to the head or back of the neck were reported at Rendwühren and Bornhoved. The throat had been cut at Grauballe and there were other cuts on the body. Kayhausen had been stabbed in the throat and arms. In addition to the injuries mentioned above, the Dätgen body lacked genital organs though this part of the body was generally in a good condition when found. The skin in this area was too badly preserved to establish whether it had been cut, so the question is unsettled.

Scalping is reported at Driessen and must, despite the scepticism with which it has been regarded by some, have taken place in the case of the Borromose woman (1948), as a piece of scalp the size of a hand lay underneath the body near the throat (see original report in National Museum). There is therefore no possibility that it was a peat-cutting injury as suggested by Andersen and Geertinger (1984), who fail to describe the lesion properly, and generally treated this unique document in a cavalier manner.

Beheading is shown by heads found without bodies at Osterby, Stidsholt, and Roum Fen, and near the body from which it had been removed at Dätgen. The discovery of heads alone is particularly interesting, because it shows that the individual, represented by his head, could be subjected to disposal in a bog even when death had taken place elsewhere (perhaps even in fair fight). This must show that particular ideas were attached to this form of disposal of the body, perhaps that it was shameful or degrading, for otherwise there could be no reason to carry the head so far. Presumably the head was taken and buried in the bog alone because of the inconvenience of transporting the whole body.

Drowning does not leave definite traces, but comes readily to mind when fatal lesions have not been observed, as with the Haraldsted body, and seems not at all unlikely in the cases where the body was found held down by rails, or hooks, or oblique stakes (Haraldsted, Windeby I, Bunsøh, Hokkerup). The stones found in some cases on the body could hardly have been effective alone to produce drowning.

Multiple injuries. There are several cases with several severe injuries or more than one injury that alone would have been fatal. The Grauballe man had the skull broken, and the throat cut, as well as a leg broken in two places. The Borromose 1946 man was both strangled and given a fatal blow to the head. The Borromose 1948 woman had the face crushed in and had been scalped. The Huldremose woman had an arm hacked through (perhaps twice) and had been cut through the flesh and deep into the bone in other places. The Dätgen man had been cut, beaten resulting in broken bones, stabbed to the heart, beheaded, and possibly had the genital organs cut off. The most alarming account is Driessen, two bodies found in 1890 and said to have had lips and ears cut off, been incised down the back from head to foot, and to have had their scalps wound off around a stick (Dieck 1969). Despite the uncertainty of some of the accounts there seems to be

evidence of what could literally be described as “overkill”.

Mutilation of the corpse. Therefore some of the injuries must have been inflicted after death and really been mutilations of the corpse. Andersen and Geertinger (1984) lay emphasis on the absence of indications of haemorrhage in connection with the scalping and the smashed face of the Borremose 1948 body, and appear to regard both injuries as post-mortem. They also see the absence of warding-off injuries as indicating that the blows were administered after death. Here the question of the validity of negative evidence deserves more attention than it is given. There are scenarios where the woman could have been unable to ward off, and it is a fact that the body was so much less well preserved than normal forensic material that one also wonders if the lack of evidence of haemorrhage is definitive. On the whole it seems doubtful whether a great deal should be concluded from the multiple fatal injuries. It is not particularly likely that the executioners were closely observant of the exact moment of clinical death. After all a little extra beating is only being thorough, and there may have been standers by who wanted a turn!

It is worth pointing out however, that formalized mutilation of the corpse, as recorded for instance in some of the criminal justice of historical times, seems not to have taken place.

Other aspects

There are some further features that to our way of thinking may seem more harmless, but nevertheless belong to the complex of phenomena accompanying the bog bodies and should be noted as such.

Shaving the head. Some of the individuals had their heads shaved. This may have been done twice with an interval between to the Windeby I girl, as the hair was freshly shaved on one side and 2–2.5 cm long on the other (Gebühr 1981). It now seems the whole head of the Huldremose woman had been freshly shaved (see below). The Tollund man had short hair, but this may have been his normal haircut. Presumably shaving the head was regarded as a degrading and humiliating procedure, and parallels are even known from Europe immediately after the Second World War.

Nakedness. Many of the victims were buried, and presumably also killed in a naked condition. The Grauballe, Tollund, Borremose 1948, Dätgen, Kayhausen, Bunsöh, and Damendorf Seemoor bodies were definitely unclothed. The Tollund body still wore his hat and belt, but

not his blanket, as though the latter had been ripped brusquely off leaving only the belt. It seems that nobody wanted to inherit the clothes of the bog people, for in many cases these were found close to the body, lying at its feet, or under it, or spread over it. It is quite likely that some, or perhaps all of the textiles found alone during peat cutting are all that is preserved of a bog burial.

Some individuals, however, were found dressed, or at least partly so, for when only a cape or capes were worn, the question presents itself whether this really was all the victim's had to wear or not. One would suppose that the woollen blanket wound around the loins was the basic garment, which survived in its original form to modern times in the Celtic kilt – not to mention the sarong and lungi of Asia. The Windeby I girl wore only a leather cape. It seems that the Elling girl was wearing one of her capes, but the other was under her feet. It is not quite clear whether the Borremose 1948 woman died still wearing her blanket in a somewhat dishevelled state, or whether it was thrown over her corpse. The Huldremose woman was an exception in being almost elegantly dressed in plaid skirt (blanket), two capes, and scarf. Unfortunately with many chance finds it is unclear whether the body was found clothed or merely accompanied by clothing.

Despite these deficiencies, there is enough evidence to show that stripping was a common, but not universal accompaniment to the executions of this type.

Other possibly superstitious aspects. There were other aspects of a more superstitious nature, which may perhaps be seen as deterrents directed at society more than as retributory measures. The most obvious of these of course was the whole idea of burial in the bogs, remote places which through the ages had been connected with ritual offerings and no doubt aroused superstitious reverence or fear. Burying the victims in bogs was obviously important, for even decapitated heads were buried in bogs after death had occurred elsewhere.

In several cases the bodies were held down by rails or sloping stakes, or by stones. Windeby II and Hokkerup were held down by oblique stakes whose points were stuck into the peat. The Haraldskær and probably also Bunsöh bodies were secured by transverse rails held down by wooden hooks. There were stones over the bodies from Skærum, Tvedemose, and Windeby I. As said these may have been connected with death by drowning, but it can also be conjectured that they prevented the body from floating to the surface (assuming it was not buried under

peat clods), or were superstitious arrangements to prevent the already dead individual from “walking” as a ghost.

Sacrifice or retribution? P.V. Glob’s theory (1965) that the bog bodies were human sacrifices has been rightly criticised by Struve (1969) and Lund (1976), and is not effectively revived by Fischer’s idea that they were conciliatory offerings from those causing environmental damage in the bogs (1980). It should be accepted that the finds do not have the stereotyped character expected of purely ritual acts. Each is a unique case, in which cruelty, humiliation, and shameful burial repeat themselves as recurring themes. They are hardly cultic. On the other hand they can hardly have been ordinary meaningless acts of common violence, casual robberies, etc. It is seen too clearly that killing took place as a collective act with a number of participants and that certain conventions or traditions were respected. The mode of disposal must at the very least have symbolized expulsion from society, which may have increased its deterrent effect. It is beyond the possibilities of archaeology and a waste of time to ask what offences were being punished, but offence of some kind there must have been.

A more interesting question is what socio-political frame such acts could take place in. From what little we know from early historical sources, which anyway are from somewhat later, we would expect that society was divided into kinship groups which lay in a nearly continual state of feud. One could ask whether the events took place inside kinship groups or between them, i.e. did the victim and the killers belong to the same or to different social groups? Were the killings part of feuds or were they the internal justice of the kin? Either way we should not expect society to be less violent, even if it was less organized, than medieval society, of whose violence we know a lot. Against the background of early criminal justice in the Mediterranean and Germanic legal sources, Struve placed these acts within the “private justice” of the kinship group rather than in the sphere of “public justice”, if such a thing existed at that time, it may be added.

The scalp hair; a final problem

It is part of the beneficial outcome of collaborative research effort that problems are identified by different individuals, although perhaps investigated by someone else. In the case of this Huldremose woman, during conversation on the separateness of the hair it was remarked (BG) that in fact there was a fine bristle of hair over much

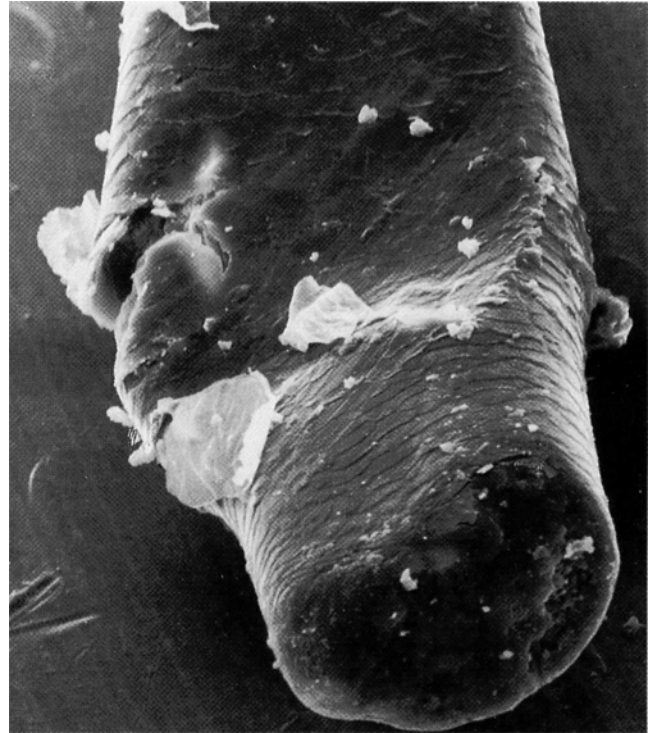


Fig. 12. End-on view of Huldremose scalp hair, showing intact cuticular scales and evidence of cleanly cut end. SEM. Approx $\times 1000$.

of the scalp (together with a few longer hairs). The more this was discussed, the more difficult it seemed to explain. If the hair had been accidentally pulled off during the initial washing of the body, surely one would have expected either some ragged hairs of unequal lengths to have remained, or possibly there could have been no hairs at all if it was pulled out of the partly decayed hair follicles. But how could one explain a fine and generally similar length of bristle? Did the hair separate at the scalp surface at the post-exhumation washing of the body, and then with the drying and shrinkage of the scalp become extruded?

The problem seemed worth further investigation, and for this reason some short scalp hairs were plucked out for investigation by scanning electron microscopy. We had expected to find decomposed and longitudinally frayed hair ends, as a result of the separation of the main mass of hair from the scalp (as recorded in Steenberg’s letters from 1879). But in fact the evidence did not confirm this. The SEM close-up view (as exemplified in fig. 12) of these hairs shows that the hair shaft is in good condition, with

the cuticular scales undamaged and in good order. The limited squashing of the hair shaft is due to the tweezers we used to grip the hair. Most significantly, the hair end is not frayed or damaged, but shows what can only be interpreted as a clean cut from a sharp implement. It seems to us impossible that such a hair end could result from the breaking off of the degraded hair from the scalp. The internal micro-structure of the hair would have resulted in longitudinal splitting and fragmentation, not "clean" transverse breakage. An alternative explanation thus seems to be needed. This could explain why the hair seems to have come off so easily on washing. In contrast the hair of the Lindow II body was loose, but tended to come away in fine strands or clumps during cleaning and conservation when peat was being removed from the head region. It would certainly not have been possible to remove the head of hair of Lindow II in one self-contained "mop". What at first seemed unproblematic has thus turned into another enigma. It seems that it might be worth following this up by examining in the same way a few hairs from other bodies and the plaits found alone and attributed to the Bronze Age.

CONCLUSIONS

There is a perennial need in archaeology to review and reconsider aspects of the subject, including bioarchaeological materials. Uncommon and unusual finds, such as bog bodies, can be expected to reveal additional information by re-examination, and this seems to be borne out by the present investigation. Even though this body was discovered a little over a century ago, it is clear that no significant deterioration has occurred since its initial drying out. It may originally have been the best preserved prehistoric body ever recorded from a north European bog. The body was earlier best known for the complete clothing worn by it, showing what a fairly well-to-do woman in Jutland wore at probably about the time of Christ. Careful external and internal (radiographic) studies have raised some interesting questions. Evidence of injuries to arms and legs provides a case for serious trauma and blood loss as the cause of death. The interpretation of injury has demanded the careful differentiation of pseudo-pathology, due to the decalcification and pressure distortion of some bones, from recent peat cutters' damage, and the cuts likely to have been sustained at about the time of death. There seems little doubt

that some cuts to the right upper arm, forearm, and both lower legs were made by a sharp metal instrument, not a relatively blunt peat cutting tool. Fine cuts on bone and the position of the cuts on the body would also argue against these simply being peat cutting damage. Though conforming to the general pattern of violence, the Huldremose woman is unique in the details of the injuries sustained. It can be expected that further studies could tell us still more about her and the times in which she lived.

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NOTE

Since this article went to press a note has appeared (Brothwell *et al.* 1990) which specifically discusses the microsurgery undertaken to sample the food residue in the intestinal tract of the Huldremose woman. A further detailed note is in preparation on the results of the C.T.Scan.

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