

DISCUSSIONS ON THE POSSIBLE ORIGIN OF EUROPE'S FIRST BOATS - 11,500 BP

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(communicated by Giacomo Tripodi)

ABSTRACT. Three decades ago Detlev Ellmers suggested that hide (skin) boats were being used to hunt swimming reindeer in glacial lakes of northern Germany's Upper Palaeolithic. This paper presents new material in support of Ellmers' contention. A paleo-osteological study from Stellmoor suggests that arrows were directed at the neck and upper shoulders from above and behind, at close range which can be considered evidence of them being shot by hunters in boats as the animals were swimming. Lyngby axes are linked to this hunting technique which provides possible distribution and dating for this proposed early boat technology.

Introduction

Over the past 30 years various claims have been made regarding the existence of north German Upper Palaeolithic hide boats (Ellmers 1980, 1984, 1996; DSM 1981a,b; Tromnau 1981, 1984, 1987). Despite this, direct evidence for hide boats is lacking and log boats remain the earliest accepted craft. The world's oldest known log boat comes from Pesse, Netherlands and is dated to 8265 \pm 275 BP (Gro-486) (van Zeist 1957). Other dates for this discovery including 8760 \pm 145 BP. However, the climate of northern Germany/Denmark/southern Sweden during the Upper Palaeolithic remained cold and harsh. Bratlund demonstrates the trees were dwarf and not of suitable girth for the construction of log boats (Bratlund 1996, pp. 4,12,17). Ellmers postulated that around the middle of the 12th millennium BP boats were being assembled from the hide of wild (tundra) mountain reindeer (*Rangifer tarandus tarandus*), stretched over light frames and used to hunt the vast herds of quadrupeds at water-crossings during the annual migrations. New evidence, including arrow-inflicted bone damage inconsistent with terrestrial shooting together with ethnographic boat-hunting parallels are used here to support his theory.

Separately it is important to be aware that the development of such northern hide boats appear to have been independent of probable other boat forms associated with the exploitation of Melian obsidian from the Franchthi cave, Peloponnese (Renfrew and Aspinall 1990; Laskaris *et al.* 2011), over 2000 km to the south. Not addressed in this paper are water craft, but not necessarily true boats, that existed in other parts of the world (e.g. first crossings to Australia) (Bednarik 1997) prior to European boat activity set out in this paper.

The Ahrensburg Valley

In 1932 Alfred Rust discovered an Upper Palaeolithic reindeer hunting camp at Meien-dorf, now within the north east suburbs of Hamburg. The site lies in the Ahrensburg Valley and is less than 60 km from the modern coast of the Baltic. He went on to identify similar sites at nearby Stellmoor and Poggenwisch (Rust 1937, 1943; Bibby 1956, pp. 161-180). Many thousands of reindeer antlers and butchered bones were unearthed, along with those of other mammals and birds. The site strata were assigned to the Federmesser (late), Ham-burgian and Ahrensburgian series of cultures and were subsequently radiocarbon dates from c. 12,500 to c. 9800 BP.

At this time, the Weichselian Glacier had only recently retreated from its southern-most limits on the North-German plain. To the north, glaciation continued to cover most of Fennoscandia. In some areas ice remained close to 3 km deep (Breiln *et al.* 2005). The Ahrensburg valley then carried vast quantities of melt-water away from a southern outflow of the adjacent glacier before flowing onto the River Elbe. Glaciologists categorize this approximately 10 km-long shallow depression as a “tunnel valley” where the water had carved its way through the deposited till. Rust established that the valley, with its chain of lakes, lay across a major reindeer migration route where a number of corridors provided ideal killing-zones (Bratlund 1996, pp. 6,18; Tromnau 1987, p. 102). Also see Vang Petersen and Johansen (1991) for adjacent eastern Danish parallels.

Reindeer herd size and habits

The reindeer herds of northern Europe during the Upper Palaeolithic were probably large. An idea of numbers can be determined from the size of today’s herds. Bevanger and Jordhøy (2004, p. 56) quote modern Norwegian herds of 200,000 while an article in the Alaska Dispatch News Anchorage dated March 25, 2011 states that the Western Arctic caribou herd was 348,000 strong in 2009. Paleontologist Thomas Kaiser, Curator of the Hamburg Zoological Museum, advised¹ that prehistoric herds were probably much larger. Kaiser emphasizes wild reindeer/caribou are very elusive and contrast greatly from their placid semi-domesticated modern kin (also see Blehr 1997). Besides their ability to cover great distances, reindeer are excellent swimmers and will cross rivers and lakes undaunted. They readily take to the water where their coat of dense hollow fur, evolved to protect them from the bitter cold, acts as a buoyancy aid. While they can swim well, they are relatively slow and can be outpaced by a boat under paddle power.

Ethnographic evidence

Ethnographic data from several sources provides widespread evidence of the hunting of swimming reindeer from boats. Figure 1 presents a typical view obtained by a boat-borne hunter of the slow swimming quadrupeds. Figure 2 shows an illustration by Captain Lyon published in 1824: the supporting text includes “The ippoo, a specialised spear used by the Inuit for killing caribou in the water . . . The Inuit drive the caribou into the water and then kill them” from small boats (Parry 1824). Joseph Tyrrell, a Canadian mining consultant,

¹Personal communication.



Figure 1. Swimming reindeer (Photo ©3152 Joel Bennet, with kind permission of Alaska Division of Tourism)



Figure 2. Eskimaux killing deer in a lake (with kind permission of John Carter Brown Museum; image record No. 02296-32)

recorded the following account of Inuit hunting caribou during an 1897 expedition north-west of Hudson Bay (Tyrrell 1897, p. 195):

At a crossing the caribou could simply take to the water or might be scared in by people waving things or making wolf sounds or by devices such as *inuksuks* stone pillars . . . The hunters waited motionless in their kayaks . . . When the caribou were halfway across the kayaks shot out . . . the caribou could be surrounded and headed upstream until they tired and became easy prey. The light lance used was about 2m long the animals were not killed outright but wounded enough so that they would make shore and collapse . . . Those expiring in the water were towed in up to several at a time on a line. The fall hunt gave rich returns . . . At this time, the big bull skins are at their best for covering kayaks.

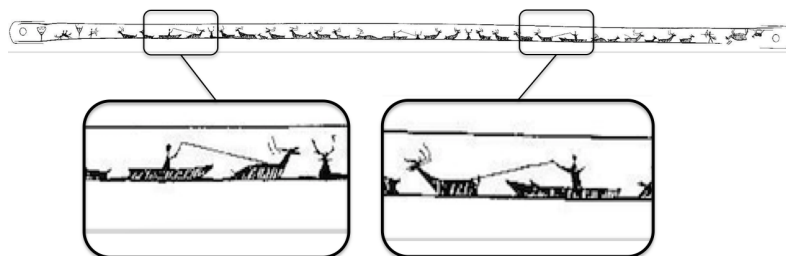


Figure 3. Inuit bow drill (courtesy of Trustees of the British Museum; Beechey/Belcher collection)

Tyrell's observation of the animals not being killed outright may be related to an ancient practice of organ/flesh wounding to get them to swim ashore; it results in less likelihood of inflicting bone lesions. Bratlund speculates that the lack of bone damage in certain clear prehistoric reindeer killings "could be consistent with a different and more precise organisation of the hunt" (Bratlund 1996, p. 27).

Figure 3 depicts caribou being hunted from boats on one of many bow drills collected from the Bering Strait that were brought to Britain by Sir Frederick Beechey and Sir Edward Belcher in 1825. Figure 4 shows an opportunist form of North American moose hunting that was captured by Frederick Whymper, a journalist, artist and mining engineer during an Alaskan expedition in the mid 19th century (Whymper 1868, facing 215).

Much has been written by Russian academics about the Nenets reindeer hunter and herders. Material includes descriptions of first millennium BC petroglyphs found in the Chukotka region of the Pegtymel River which show boats, probably of hide, being used to hunt swimming reindeer (Dikov 1974, pp. 39-41).

An early 1900s photo held by The Russian Museum of Ethnography, St Petersburg and reproduced by Tromnau (1987, p. 96) depicts a near-identical scene of a Nenets herder in a boat about to spear a closely swimming reindeer. The practice appears to have remained unchanged in near three thousand years. Interestingly, the photo shows the boat within 2 m of the beach but the spear-wielding herdsman does not stand on the shore. Herding of the once wild reindeer still takes place along this vast north Russian coastline. The referenced photo should be compared with Fig. 3.

In the 1990s further excavations were carried out at Rust's Ahrensburg tunnel valley sites (Bratlund 1990, 1991a,b, 1996). The research included re-examining parts of his extensive bone collection where both fatal and healed arrow-inflicted wounds are present. The work also involved fully reassembling a number of butchered skeletons from Stellmoor (Bratlund 1991a). Many of the lesions demonstrated the classic terrestrial hunting pattern of shooting horizontally, sometimes into the shoulder area; flint projectile point fragments were even found embedded in some of the bones (Bratlund 1996, p. 23). It was, however, discovered that most of the lesions appeared in the upper part of the reindeer (Bratlund 1991a, p. 196). These strikes had been made from extreme positions from behind the animals with some of the shots plunging at more than 30 degrees to the horizontal. These were all found in the neck and shoulders. Bratlund concluded that, as the topography around Stellmoor does



Figure 4. Moose hunting (courtesy of the Trustees of the British Museum, Fredrick Whympier collection)

not display the extreme relief which would be necessary to place the hunters on higher ground, the only possibility was that the reindeer were situated below the hunters. She also determined that the distribution of the lesions supports the interpretation that the shots were fired when the animals were swimming as the neck and shoulders were the most visible parts of reindeer (Bratlund 1991a, p. 204). The use of boats, however, was not considered. Neither were boats referenced in the study by Grønnow (1987, pp. 131-166).

A further Bratlund statement was that 105 whole or fragmented pine wood arrows shafts found in the lake sediments supported the theory that swimming reindeer at Stellmoor were hunted with bows and arrows. She further stated that as arrows have rarely been found outside this site, even in other large lakeside deposits with good conditions of preservation, these can hardly be considered normal site-waste (Bratlund 1991a, p. 206).

Weinstock gives an alternative interpretation claiming that the shots at Stellmoor were not delivered at close quarters but “from some distance” (Weinstock 2000, p. 1194), therefore negating the argument that the shooting was from boats. He did this when challenging a theory by Pohlhausen (1954) and Sturdy (1975) who had determined that Stellmoor bull reindeer were being disproportionately slaughtered. The two academics attributed this selective killing of male reindeer to hypothetical herdsman (similar to modern Sámi or Nenets) who they believed were managing semi-domesticated herds. Wienstock, correctly, points out that the slaughter was taking place in the Upper Palaeolithic when it was most improbable that heard management had developed. He appears to have introduced his

shooting “from some distance” view to invalidate the close proximity theory that would be associated with reindeer husbandry claiming that Bratlund argued for long range shooting. Weinstock, however, appears to have misunderstood Bratlund for nowhere does she suggest the use of distance arrow releasing in her publications. Interestingly, Bratlund (1996, p. 36) also suggests a greater number of male reindeer were being slaughtered at the hunting site.

The answer to Pohlhausen’s, Sturdy’s and Bratlund’s selective slaughter does not lie in impossibly early reindeer husbandry but more probably in Tyrrell’s 1897 observations, also above, where he records that the swimming bulls were targeted in the fall by close-following kayak-borne hunters. Close shooting of swimming wild reindeer (very elusive creatures on land) would have been a reliable way of selectively killing of bulls. Like Tyrrell’s 1897 Inuit, the Stellmoor hunters appear to have been targeting the autumn males with their valuable hides for a whole range of uses including covering their light boats.

Further counters to “from some distance” arrow shooting lies in experimental and ethnographic evidence suggesting that shots from beyond 20 m were rarely effective on stationary targets (Rasmussen 1976, p. 170; Jenness 1922, p. 146; Blehr 1990, p. 306). For example, Lyon (1824, p. 244) writes that the Caribou Eskimos rarely shoot until the creature is within 20 paces. The effective distance was probably limited by the bows being used.

In order to hit the neck or shoulders of a reindeer with a plunging entry of more than 30 degrees from above and “from some distance” would require the archer to make a high-elevation, parabolic shot at a moving target. Alternatively, shooting from a hypothetical elevated level a 10 m distance attempt would require around a 5 m height advantage. A hunter firing arrows over a 20 m range would need to be roughly 10 m above his prey. However Bratlund (1991a, p. 204) notes the lack of such elevated terrain or suitable trees to climb (Bratlund 1996, pp. 4, 12, 17).

Ancient archery specialist Murat Özveri advises² that if the bows were fired with two or three finger release the spine issue (the elasticity of the arrow shaft) must have been a serious consideration to get good accuracy. If the Stellmoor hunters shot with pinch draw then they probably shot lighter bows with lower kinetic energy, so they had to shoot as close as possible to the target. A copy of the Bodman bow dated to 6000-5000 BP, made by Jürgen Junkmanns - a world authority on ancient bow building (see Airune *et al.* 2007, where Junkermanns was a co-author) - had a maximum kinetic energy that was half of the minimum legally required in many states of the USA to bow-hunt whitetail deer. Özveri assumes that the far more ancient Stellmoor bow technology was less advanced and therefore less powerful. To obtain a 30 degree plunging entry would require a very long shot. Özveri estimates that even with a 50 pound primitive bow the distance would be more than 50 m with the hunter at the same elevation. Junkmanns’ shot from his primitive bow did not reach a target at a 75 m distance at the 2008 World Traditional Archery Festival in Korea.³

While shooting swimming reindeer from the lakeside cannot be ruled out, modern ethnographic evidence coupled with Özveri’s assessments of prehistoric archery suggests that the chance of hitting a swimming reindeer in the neck or upper shoulders at anything other than close at hand shooting would have been very low.

²Personal communication.

³M. Ozveri observation: personal communication.

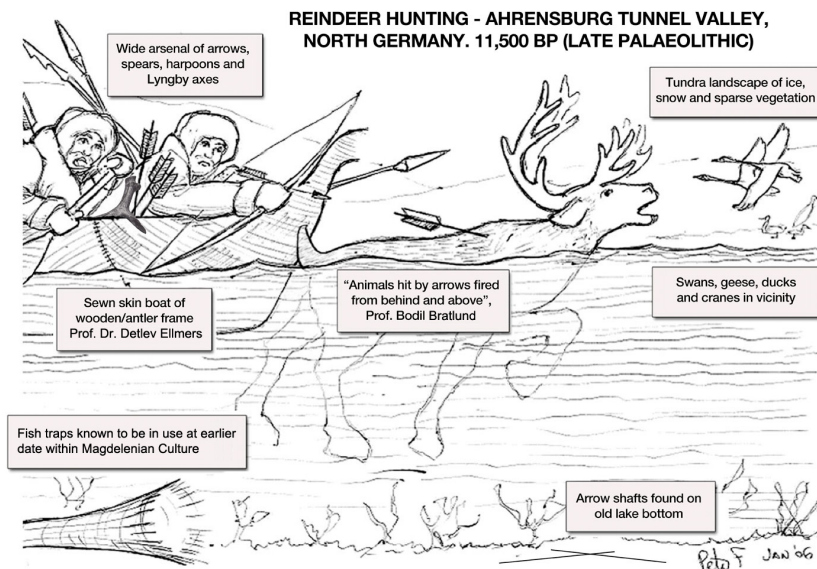


Figure 5. Reindeer hunting, Hamburgian culture, c. 11,500 BP (Fletcher 2006).

In summary, whilst Stellmoor hunters would have taken terrestrial arrow shots, those producing the pattern described by Bratlund were being shot at close quarters whilst swimming.

The approach which best fits the pattern recognized by Bratlund has hunters releasing arrows at close range into the hapless swimmers (Fig. 5) where they were most likely in boats (Fletcher 2006). When conditions allowed the hunters would probably have approached the swimming quadrupeds from behind to minimize panic and maximize the period at the target. The narrow conical pattern of arrow flight paths from behind determined by Bratlund (1991a, p. 204) in her skeletal reconstructed work supports this scenario.

Hide boats

If these north German reindeer hunters were using boats it is useful to consider how they were constructed. It is unlikely they were log boats (dugout canoes) for, as stated by Bratlund above, trees of sufficient girth for hollowing out had not populated the tundra landscape of the area by 11,500 BP (Bratlund 1996, pp. 4,12,17). Equally, such slight trees were unsuitable for providing bark-strips for sewing into hulls. Bark boats would one day be adopted but their time would not come until arboreal forests replaced the spars flora identified by Bratlund. It is, therefore, most likely that such boats were made of hide. Ellmers points out that even by the Magdalenian culture (start c. 17,000 BP) the disparate skills needed to build hide boats had been mastered as evidenced by antler needles (Tejero *et al.* 2009, p. 93) and fish traps (Andersen 1979, p. 8). Ellmers built a full sized hide craft (DSM 1981b, pp. 12-15) and Tromnau (1987, p. 102) modelled on Fosna Culture rock carvings from Evenhus in Norway's Trondheim Fjord (Ellmers 1984, p. 51). He adopted

Kayak/umiak construction techniques, reindeer antler needles and birch sapling framings. The result was a remarkably light craft able to carry a man complete with an array of hunting and fishing equipment. It should be noted that the antler item found in Husum Harbour in 1881 and claimed to be from an Upper Palaeolithic hide boat (Ellmers 1984, pp. 53-54; DSM 1981a, pp. 4-5) has been dated to 5,355 BP.⁴ McClean (2008, pp. 9-14) suggests the date for the boat rock carvings adopted by Ellmers for his reconstruction may be between 12,000 and 9000 BP and refers to the seamen who used them as “marine hunters with equipment that is similar to the late-glacial reindeer hunters on the Northern European grasslands”.



Figure 6. Kvalsund 1 rock carving (with kind permission of Tromsø Museum, Norway)

It is highly probable the same hide boat technology was carried on to the Komsa Culture in the region of Alta and the North Cape, Norway for the Kvalsund 1 rock carving (Fig. 6) depicts two men in a boat close to a reindeer (DSM 1981b, p. 3; Ellmers 1984, p. 52; Arntzen 2007, p. 11). Ellmers interprets this carving to show a hide boat perusing a swimming reindeer and even superimposes the water surface from the boat across the shoulders of the reindeer in his published images. It is interesting to compare Fig. 1 with Fig. 6 for both depict the “follow-me” tail positioning reindeer automatically adopt when swimming. Arntzen (2007, p. 32) attributes this Kvalsund carving to the Komsa culture dating it to ca. 6000-4500 BP.

⁴The 5,355 +/- 25 BP (KIA 17652) date for the worked antler found in Husum harbour in 1881 was determined by the Leibniz Institute of Marine Sciences at the University of Kiel (IFM-GEOMAR) in a commission by Schleswig-Holsteinische Landesmuseen Schloß Gottorf. Advised in three-way correspondences in 2012 between Dr. Alexander Dreves (IFM-GEOMAR), Dr. Sönke Hartz (Schloß Gottorf) and the author (reproduced by kind permission of the two scientific bodies).

Parallel examples

Bratlund (1996, p. 7) records the discovery of prehistoric bowhead whale bones at Blomvågen, Norway. The finds were radiocarbon dated to 12,110 BP +/- 100 years (T-1899/1) and 11,920 BP +/- 80 years (T-1899/2). Whilst she emphasizes there is no evidence of human involvement Bratlund states that bones from many other mammal species including reindeer were found in the same assemblage.

For the Mesolithic period, water transport is well attested by the excavation of greenstone on the island of Hespriholmen, some 7 km off the Norwegian coast (Johnstone 1980, pp. 103-104). Johnstone also suggests these seagoing boats were most likely of skin constructions. He refers to them "being in use before the forests had spread north". Little suitable timber would have been available for log boats. The hide of reindeer, seal or walrus would have been the most readily available hull material. Johnstone (1980, p. 108) also provides a wonderful illustration of what these later Mesolithic seagoing hide boat may have looked like in recounting Vilhjalmur Stefansson 18th century encounter with a craft on the hostile open waters of the northern North Atlantic:

Thirty five to forty feet long, big enough to carry two tons, and light enough for two men to carry. It is so strong and so fitted for rough handling that this was perhaps the chief reason why the Yankee whalers of north-west Alaska . . . discarded the New Bedford whaleboat for the Umiak when pursuing the blowhead.

The technique of constructing *inuksuks* (see Tyrell above) to marshal reindeer into water may have been practised for millennia. Parallels have been found at Hardangervidda, south western Norway (Tromnau 1987, p. 97), 7000 km away and dated to at least 600 years earlier. Tromnau even records evidence for such channelling dating back to Germany's Ahrensburgian Upper Palaeolithic culture (Tromnau 1987, pp. 101-104). Herds of medieval period reindeer were funnelled into the lakes at Hardangervidda by way of these rock piled corridors to be killed from following boats (Indrelid and Hufthammer 2011). The paper suggests the boat hunting practice may have dated back to the Mesolithic. Interestingly, the Hardangervidda bone record of thousands of reindeer killings from boats, significantly records little indication of bone lesions. Could this lack of bone damage at the lakes also be linked to organ/flesh wounding for the purpose of semi-incapacitating the animals rather than immediately kill them? If so it may link 19th century Hudson Bay (Tyrrell 1897, p. 195), medieval (or far latest) Hardangervidda (Indrelid and Hufthammer 2011) and parts of Upper Palaeolithic Ahrensburg tunnel valley (Bratlund 1996, p. 27) to a cruel but common practice of organ/flesh wounding which would strictly have been a boat-based hunting technique. It is also important to note (Blehr 2012) who challenges the level of reindeer hunting claimed by Indrelid and Hufthammer at Hardangervidda but does not dispute that small boats were being deployed.

Norwegian maritime archaeologist Endre Elvestad, who provided the hunting boat expertise into Indrelid and Hufthammer paper, considered that due to the presence of narrow slipways - small, slender and easily manoeuvrable craft were used for hunting the reindeer after they had been funnelled into the water. The Hardangervidda mountain reindeer became isolated from the herds that went up Norway's western seaboard in search of new lichen/moss food sources during the time of the Upper Palaeolithic/Mesolithic transition; the encroaching arboreal forests to the south had started to force the herds to leave. The



Figure 7. Lyngby axes (Schloß Gottorf Museum, Schleswig-Holsteinische; Author's photograph 2008)

Hardanger high mountain plateau and North Cape territory were also to provide the new supply of lichens/mosses essential to these tundra-loving reindeer. It is possible the boat technology (probably hide hulls) that was first used on the mountain lakes was brought there by descendants of the hunters who followed the reindeer from north Germany, Denmark and southern Sweden. McClean (2008, p. 10) presents such a scenario for the spread of hide boat technology up Norway's Atlantic seaboard.

Lyngby axes

Lyngby axes were fashioned from reindeer antler from which all the tines (spikes) have been removed but one. Tromnau (1987, pp. 102-103) suggests the axes were boat-carried hunting equipment used to dispatch reindeer at close-quarters, endorsing Ellmer's Upper Palaeolithic hide-boat hypothesis. With its single impaling tine the Lyngby axe is a devastating weapon (Fig. 7). A reindeer cranium discovered in now-drained land near Ahrensburg with a hole driven through its forehead may be testimony to a Lyngby axe-delivered coup de grace (Ellmers 1984, p. 52).

The Schleswig-Holsteinische Landesmuseen Schloß Gottorf present Lyngby axes as wood splitters as shown in the background illustration of Fig. 7. This is unlikely in view of the general lack of available substantial timber as discussed above (Those interested in viewing this museum display may be aware that Schloß Gottorf also holds the 200-450 AD Nydam boat). Besides some historians presenting Lyngby axes as "wood splitters" in a near-treeless environment others suggest they were multipurpose implements⁵ and,

⁵See British Museum web site "Lyngby Axe" for the Earls Barton axe.

therefore, part negating the existence of associated hide boats. The argument for the axe having a general use is that they appear to be the only relatively heavy artefacts produced by any of the north German Upper Palaeolithic hunters.⁶

The distribution of Lyngby axes should, therefore, been widespread. Here readers need to be aware that the axes only partly appear in the tanged-point cultural zone (the widespread coastal and inland regions of the Upper Palaeolithic Hamburgian, Ahrensburgian and Bromme reindeer hunters) and the arch-backed pointed zone of the late Federmesser (penknife) culture. For information that the tanged-points of the Hamburgian and Ahrensburgian cultures were probably used as arrowheads see Riede (2010, p. 2). Lyngby axes, unlike the characteristic tanged (shouldered) flints, are only found at low elevations near sedimentary-filled or open bodies of water as detailed shortly. Higher elevations where these distinct lithic points have been recovered do not yield such antler axes. An appreciation of the inland extent of the Ahrensburgian Culture zone can be gained by viewing *Kultura ahrensburgska.jpg* which extends 300/400 km south into central Germany. The different in distribution patterns between the far more ranging tanged point tool set and the Lyngby axes, but in use by the same or related reindeer hunters, is highly significant.

Pryor (2004, pp. 67-70) records that about forty Lyngby axes (probably far more known today) have been discovered principally as isolated finds around the edge of what is now the southern North Sea basin, in Denmark, Germany, Poland, Holland, and Britain. He states it would seem reasonable to link Lyngby axes with reindeer hunting and places the finds in the final years of the Loch Lomond sub-phase (Younger Dryas, c. 12,800 to 11,500 BP). He focuses on the Lyngby axe found at Earls Barton in the Nene valley (see British Museum reference above) and suggests its discovery site fits well into a cyclic hunting pattern around coastal north western Europe. It is interesting that Earls Barton and Stellmoor in their respective regions of the Nene valley and the Ahrensburg tunnel valley have much in common, including gently shelving banks, easy gradients where both are heavy in glacial till. They are examples of tributaries of the many river and lake systems that once carried vast quantities of melt water in the direction of now submerged Doggerland (Coles 1998).

If it is accepted that these weapons are tied to the practice of hunting reindeer from hide boats that once operated on such melt waters as then found in the Nene and Ahrensburg valleys, they could be used as an indicator of the distribution of this practice as they survive intact in the archaeological record. Their discovered at similar latitudes across Northern Europe as outlined above may indicate the widespread distribution of Europe's earliest boats.

Dating the Ahrensburg Valley Bone Record

Radiocarbon dating of reindeer bone and antler samples together with further later recovered bones provide the more precise dating from the Ahrensburg tunnel valley (earliest 12,570 +/- 115 BP (K-4332) (Hamburgian culture, Poggenwisch) through to (latest) 9,810 +/- 105 BP (K-4580) (Ahrensburgian culture, Stellmoor) (Bratlund 1996, p. 12).

There is no published bone lesion data that identifies which reindeer were killed by terrestrial shooting (ie sometimes shot horizontally in the side, occasionally in the region of the shoulder blade), as opposed to having been hit by shots to the neck/upper shoulders

⁶Martin Bell: personal communication.

from above and behind, at close range with the hunter elevated above the target (Bratlund 1991a, pp. 196, 204). On the basis that there is no such readily available data it is prudent to place the earliest case for Lyngby axes/boat hunting (when solely considering the bone record) at the close of the Bratlund-determined hunting period of c. 9800 BP. The author, however, forecasts that if such an analysis of bone dating against direction of shooting were undertaken, then earliest dates for upper shoulder and neck damaged bones would closely align with the more ancient radiocarbon dates found in Lyngby axes.

Dating Lyngby axes

Building on the base provided by Pryor, who convincingly links Lyngby axes to reindeer hunting, and on Ellmers and Tromnau who assign the axes specifically to boat-borne hunting, the author contends that wherever Lyngby axes have been discovered, those sites are likely near where hunting boats once operated and can provide quite accurate dates for Upper Palaeolithic hide craft.

The eponymous Lyngby axe was found on the foreshore at Nørre Lyngby on the northern coast of Jutland, Denmark which is about 420 km north of the cluster of Meiendorf, Stellmoor and Poggenwisch hunting camp sites. It is considered to date to the Upper Palaeolithic (Clark 1936, pp. 79-80).

The oldest scientifically dated Lyngby axe appears to be one found at Klappholz, Flensburg, Germany (south Jutland). It has a radiocarbon date of 11,560 +/- 110 BP [AAR-2785] (Terberger and Eriksen 2004). This axe was also found in low-lying ground near water only 110 km north of the cluster of Ahrensburg tunnel valley hunting camps (Clausen 2003). For further details on environment see Terberger (2006).

The Earls Barton Lyngby axe has been radiocarbon dated to 10,320 +/- 150 years BP [OxA-803] (Bonsall and Smith 1990, p. 361). This English site is typically low-lying, close to the River Nene and around 700 kilometres south west of the hypothetical centre of north German hide boat invention. A Lyngby axe dated to 10,980 +/- 110 [OxA 2791] was found at Mickelsmosse and is probably the most northerly Swedish finds at 340 kilometres north east of Stellmoor. Again the site is at a low elevation and close to a lake.

Eighteen Lyngby axes have been recovered in the actual Stellmoor horizon (Eriksen 2010). One axe is dated to 10,140 +/- 105 BP [K-4326]. The results of a programme initiated in 2009 with researchers from ZBSA and Centre National de la Recherche Scientifique, Paris, may now have generated further useful interpretation material.

The concentration of Lyngby axe finds at Süderelbe, Hamburg (see Harburg Yearbook 13, 1968/72. 31 f]), suggests the area was once a boat-based hunting site. The estuarine environment of the whole Hamburg/valley of the upper Elbe matches the criteria for reindeer hunting defined by Tromnau (1987, p. 101). These particular Süderelbe finds only came to light as a result of extensive dredging and harbour construction work in Germany's largest port. Such colossal commercial-driven activities suggest that Lyngby axes (evidence for hide boats) probably exist in other less exploited north European rivers, estuaries and expanses of water. Doggerland comes to mind.

At least seven Lyngby axes have been found in Poland including three in the low-lying Masurian Lake region in the north east of the country at Giżycko, Orzysz and Morąg. All finds are dated to the Upper Palaeolithic (Schild 1975, p. 265). These sites are some 750

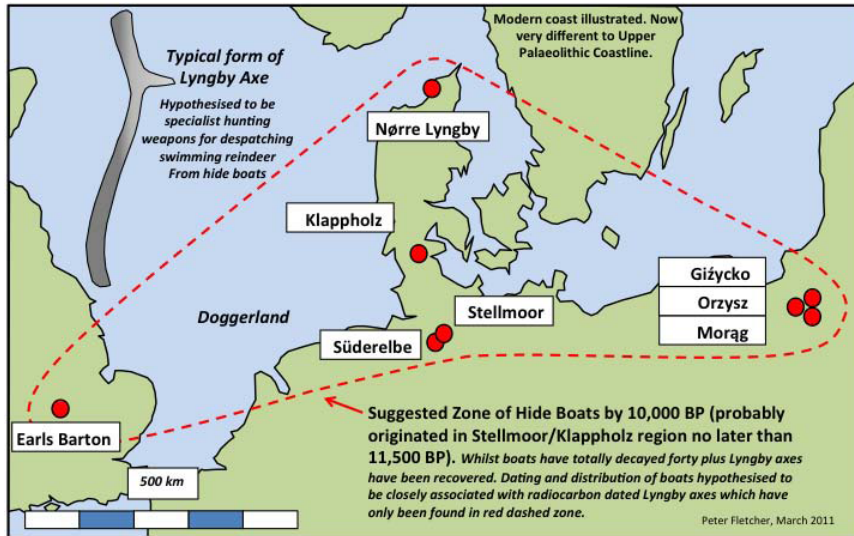


Figure 8. Suggested distribution of Europe's first boats (Author produced 2011)

kilometres east of Stellmoor. Significantly, the Polish name for the ancient Masurian lake complex is “Kraina Tysiąca Jezior” (the land of a thousand lakes) and would probably have been an ideal reindeer boat hunting region. The many Upper Palaeolithic reindeer antlers/bones found in the Masurian region appear to confirm the presence of large reindeer herds (Gross 1940). The author is, however, unaware of any radiocarbon dating of any of these axes, bones or antlers.

Based on all of the above, it is argued that hide boats carrying associated Lyngby axes (see one being carried in the hide boat illustrated in Fig. 5) were in use at least as early as 11,500 BP (Klappholz) and became widely distributed by 10,000 BP.

Distribution of hide boats by 10,000 BP

Plotting Lyngby axe locations, all within a nominal 1,500 year radiocarbon determined date range, shows they were widely distributed by 10,000 BP. As stated above the sites spanned from England to Poland and from northern Denmark to the German coastal lowlands (Fig. 8) in a near-1,500 km swathe across low-elevation northern Europe. It is suggested the red dash line indicates the extent of reindeer hunting boats 10,000 years ago. The origin of the technology may well have been situated near to the geographical centre of the zone in the region of Stellmoor/Klappholz.

The Masurian lakes (Giżycko, Orzysz and Morąg Lyngby axes) are on what could have become the north eastern exit route for the (tundra) mountain reindeer out of their traditional lichen/moss rich grazing areas south of Baltic Sea. The arboreal forests had spread northwards driving the tundra-loving reindeer to higher latitudes. This logical north eastern reindeer escape route up the coast of the Baltic States appears, however, to have been cut off to the reindeer by a combination of open stretches of sea and the rapid western

expansion of forests (continued melting of the Weichselian glaciation). As a consequence Lyngby axes, and presumably reindeer hunting boats, do not appear to have been used north east of Poland.

The research of Rankama and Kankaanpää (2008) and Ukkonen *et al.* (2006) north of this region has not detected any sign of reindeer bones/antlers in the camps identified so-far. They also highlight the influence of new cultures moving in from Eastern Europe bringing different tool sets and practices. Their prey tended to be the forest-loving Eurasian elk (*Alces alces*) and the Eurasian beaver (*Castor fiber*).

Interestingly, the far rarer forest reindeer (*R. tarandus fennicus*) with their different dietary needs to the tundra (mountain) reindeer only made it into the north of Fennoscandia arriving from north western Russia; they had not been hunted on the open tundra south of the Baltic.

The central mass of the Weichselian glacier would have initially barred the great herds of lichen/moss eating reindeers' passage north. Genetics, however, demonstrate that these creatures made their way up Norway's Atlantic seaboard. It is highly probable many of the decedents of Doggerland's reindeer population would have merged into this northward movement. As suggested by McClean (2008, p. 10), the hunters inevitably followed with their boats.

Conclusions

The inspiration for Upper Palaeolithic Europeans to build boats was probably the reindeers' ability to unwaveringly cross open water either during migration or to escape danger. Once in the water, wild reindeer are transformed from fleet-footed and difficult to hunt animals to vulnerable swimmers. The hunters' ability to provide for a family would have been totally transformed.

Perhaps most significantly the invention of the hide boat contributed to bringing about the change from the Palaeolithic to the higher culture of the Mesolithic, the timing suggests so. It is also worth pausing to reflect on the prophetic words of Paul Johnstone (1980, p. 26), whose final book *The sea-craft of prehistory* was edited after Johnstone's death and brought to publication by McGrail:

The skin boat's place in prehistory has probably been examined even less than that of the reed boat. Unlike the dug-out, early examples of which have been excavated, neither of these two types is likely to survive in archaeological contexts. But the reed boat at least has the advantage of being recorded in early historical times in the great civilisations of the Nile, the Euphrates and the Indus. The skin boat, on the other hand, tends to be used most on the edges of the populated world.

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