



Sweden: Submerged Landscapes of the Early Mesolithic

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Abstract

In the Swedish waters of the south-western Baltic Sea, large areas (3500 km²) of inundated land are present. Due to the complex patterns of past sea-level oscillations, combined with cold and brackish water, conditions for preserved Early Mesolithic sites (11,500–8000 cal BP) are good. So far, only 44 archaeological sites, or clusters of sites, have been found. Recent geoarchaeological and diving surveys have resulted in new information about now-submerged terrestrial remains of forests, river valleys, lakes and bogs and suggest that Swedish waters hide many unrevealed sites with a high scientific potential. From both an environmental and a cultural heritage perspective, these remains are important, but they have limited protection, since many are not defined as archaeological sites. Novel interdisciplinary research efforts combining ecological, environmental and archaeological perspectives are now being devoted to

changing the way submerged landscapes are treated and protected.

Keywords

Submerged landscapes · Baltic Sea · Mesolithic · Yoldia Sea · Ancylus Lake · Littorina Sea · Hanö Bay · Haväng

4.1 Introduction

Marine archaeology is a thriving field of research in Sweden, and Swedish waters, especially in the Baltic Sea, are well known for their abundance of shipwrecks, not least because of the good preservation of organic materials. Within the Swedish territory, 16,000 heritage underwater sites are registered by the National Board of Antiquity including shipwrecks and material of all periods. From the Stone Age, however, only 44 archaeological sites—or clusters of sites—are known (Fig. 4.1; Table 4.1; <http://splashcos-viewer.eu/>). This relatively small number most likely results from lack of research. During a span of 3500 years (11,500–8000 cal BP) at least 3500 km² of the Baltic Sea was dry land. Despite its high scientific potential and the presence of some archaeologically unique sites (Nilsson et al. 2018), only a small part of this now-inundated landscape has been thoroughly surveyed (Holmlund et al. 2017).

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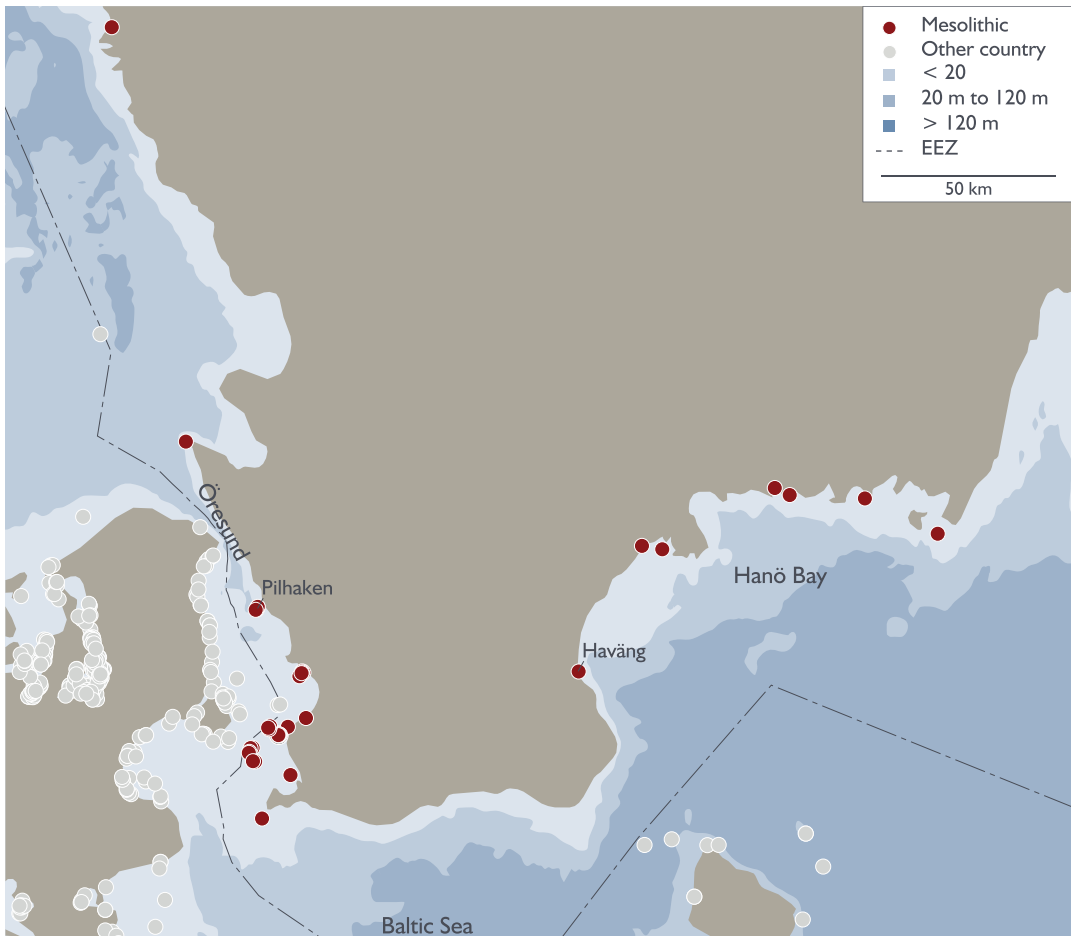


Fig. 4.1 Map of Sweden showing submerged archaeological sites and other places mentioned in the text. Site information from the SPLASHCOS Viewer <http://splashcos-viewer.eu>. Drawing by Moritz Mennenga

It is a long-established scientific fact that large areas of the Swedish sea bed in the southern Baltic Sea—the areas of the Öresund (Øresund in Danish), Ystad and Hanö Bay—were dry land for long periods of time (e.g. Wilcke 1850; Bruzelius 1870; Isberg 1927). The scientific investigation of these inundated landscapes by Quaternary geologists and archaeologists has become more important in recent decades. This is due, amongst other reasons, to the expansion of industrial activity on the continental shelf, including aggregate mining, building of offshore constructions such as wind farms and the growing need for communication and energy transfer in marine areas. Consequently, researchers, policy-makers and other stakeholders have become aware of the need for improved

understanding of the ecology and environment of the sea bed in order to better manage both its natural and its cultural resources.

In the southern Baltic, due to the complex history of relative sea-level change and the lack of the common shipworm, there are unique possibilities for the preservation of archaeological and environmental data, with potentially valuable information on climatic and culture-historical change, especially from the early Holocene (11,600–8200 cal BP) and the Maglemose period (see Bailey et al., Chap. 3, Table 3.1, this volume, for chronological chart). Studies of Quaternary geology and environmental history have been devoted for some decades to the study of Holocene shore-level displacement and the wider

Table 4.1 Distribution of underwater finds by type and period. Data from the SPLASHCOS Viewer at <http://splashcos-viewer.eu>

Types of sites	Late Palaeolithic	Mesolithic	Mesolithic–Neolithic	Neolithic	Bronze age	Indeterminate Prehistoric	Total	
							N	%
In situ cultural features- Settlement data	–	11	–	–	–	–	11	25
Unstratified material- Multiple finds ^a	–	22	7	–	–	1	30	69
Graves (human bone)	–	1	–	–	–	–	1	2
Single unstratified find	–	1	–	–	–	–	1	2
Votive deposits	–	–	–	–	–	–	–	2
Miscellaneous other	–	1	–	–	–	–	1	
Total N	0	36	7	0	0	1	44	100
%		82	16			2		
Presence of organics (wood and/or bone)	–	11	–	–	–	–	11	25

^aThis category contains areas with more than one archaeological site

history of the Baltic (for a review, see Berglund and Björck 1994; Björck 2008; Berglund and Sandgren 2010). Some of these studies specifically targeted remains of the submerged landscape in Hanö Bay during the 1980s (Hansen 1985, 1986, 1995; Björck and Dennegård 1988; Gaillard and Lemdahl 1994).

Nevertheless, archaeological investigations of Swedish submerged landscapes and their incorporation within governmental policies for management of the cultural heritage have been quite limited in comparison with other West European countries, such as Denmark, Germany, the UK and the Netherlands. This is despite the favourable circumstances for the preservation of underwater material and the strong tradition of heritage management in Sweden. There are of course exceptions. Some Stone Age sites, mostly sites of Late Mesolithic age in the Öresund region, were excavated during the late twentieth century from the late 1970s onwards (Larsson 1983; Fischer 1993, 1996).

Since 2010, there has been renewed scholarly interest thanks to new archaeological findings and the initiation of the SPLASHCOS Action, with a cluster of new research projects at Lund University (Nilsson 2012a, b; Nilsson and Sjöström 2013; Hansson 2018). This research programme includes a wide range of researchers from the disciplines of geology, bioarchaeology, marine archaeology, digital heritage and marine

survey technology (e.g. Holmlund et al. 2017; Nilsson et al. 2018).

The aim of this chapter is to give an overview of some of the studies already made, highlight important findings and discuss future opportunities and strategies.

4.2 Geological and Archaeological Context

4.2.1 Shoreline Displacement

After southernmost Sweden became ice free at about 16,000–15,000 cal BP (Bailey et al., Chap. 3, this volume), the shoreline of the Baltic Ice Lake was situated at about 50–70 m asl (above sea level). At 11,700 cal BP, this lake drained into the Atlantic with a catastrophic drop in water level of 25 m in just a few years, exposing large areas of coastal land in the southern Baltic Basin during the subsequent Yoldia Sea and Ancylus Lake Stages (Björck 1995). In the Hanö Bay, the coast was situated several km offshore from the present-day coastline, as is evident from abundant remains of submerged forests found on the sea floor (Hansson et al. 2017).

At Haväng, a key locality situated on the Scanian coast of Hanö Bay and described further below, remains of rooted tree stumps and lagoon sediments have been used to reconstruct the level

of the Yoldia Sea lowstand and the timing of the subsequent Ancylus Lake transgression (Hansson 2018; Hansson et al. 2018a), revealing 3500 years of submerged landscape history (Fig. 4.2).

The deepest-rooted pine stump at Haväng was found at 20.7 m bpsl (below present sea level), indicating that the Yoldia Sea lowstand was situated at 24–25 m bpsl. This corresponds to a lowstand of approximately 20 m depth in the northernmost part of the Hanö Bay (the Blekinge Archipelago) and 28 m depth in southernmost Sweden (the Ystad area, Scania).

Based on the radiocarbon dates of rooted pine stumps obtained at 5–20 m bpsl in the Haväng area, the timing of the onset of the Ancylus Lake transgression can be dated to 10,800 cal BP (Hansson et al. 2018a). The transgression continued for 500 years with a constant rate of rise in the water level of the Ancylus Lake of c. 4 cm per year until a maximum of c. 5 m bpsl was reached at 10,300 cal BP. The Hanö Bay and the southwestern part of the Baltic Basin then experienced a regression when the Ancylus Lake found a southern outlet after 10,300 cal BP, which low-

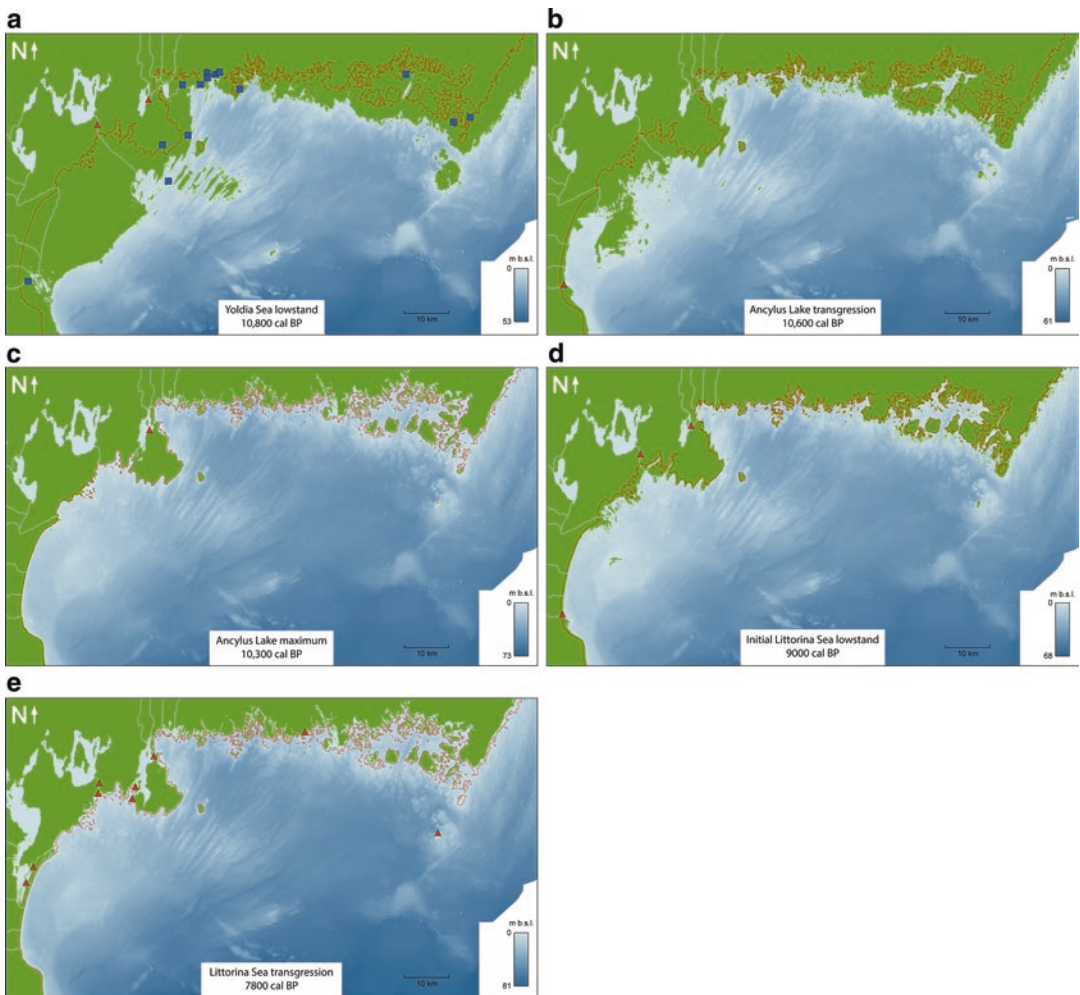


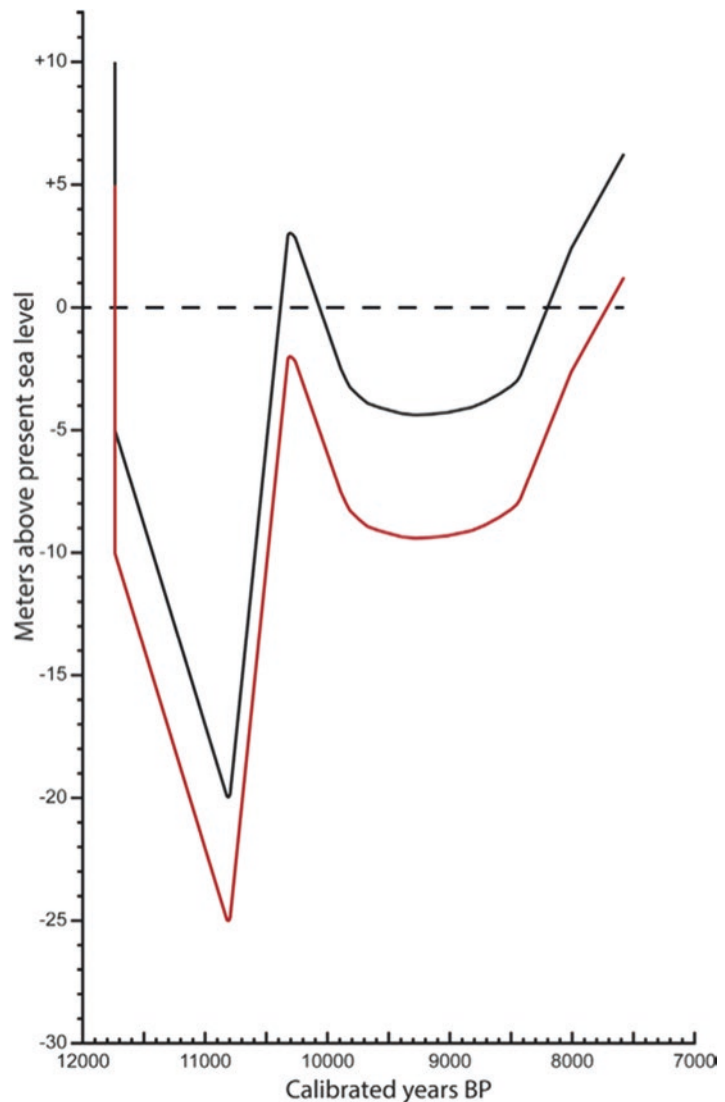
Fig. 4.2 Shoreline positions in the Hanö Bay during (a) the Yoldia Sea lowstand, (b) the Ancylus Lake transgression phase, (c) the Ancylus Lake maximum, (d) the Initial Littorina Sea lowstand and (e) the Littorina Sea transgression phase. Blue boxes: areas with submerged wood remains. Red triangles: excavated or radiometrically dated near shore or submerged findings. Topography data © Lantmäteriet. After Hansson 2018

ered the level of the Baltic Basin to ocean levels (Björck et al. 2008; Andrén et al. 2011). During the succeeding phase, the Initial Littorina Sea Stage (9800–8500 cal BP), the innermost parts of the submerged landscape at Haväng were characterised by thick compacted gyttja sediments formed in a highly productive freshwater lagoonal environment (Hansson et al. 2018b). This gyttja is found down to a depth of 12 m bpsl. Given that gyttja formation needs a water depth of a few metres, this suggests that the water level was approximately 10 m bpsl during the Initial Littorina Sea lowstand (9800 cal BP). Several

stationary fish traps used in the lagoon are found from this period. At about 8500 cal BP, ongoing global sea level rise, combined with a decrease in the rate of isostatic uplift, reactivated the Öresund Strait, resulting in increasing levels of salinity. In southernmost Sweden, the Littorina transgression reached 5–10 m above present sea level in the period 8000–6000 cal BP (e.g., Berglund et al. 2005). From this period on, all subsequent shorelines are situated above the present shoreline (Fig. 4.3).

The waters of south-western Sweden, such as the Öresund Strait between Denmark and Sweden,

Fig. 4.3 Late Glacial and Early–Mid Holocene shoreline displacement diagram from Hanö Bay. Red: Haväng (Hansson et al. 2018b); Black: western Blekinge (Hansson et al. 2018c). The trends are similar in both areas, but the levels are different due to differences in land uplift



and the southernmost Kattegat Sea, are not part of the Baltic Sea proper, and have a different shore-line displacement history, as these areas have been connected to the Atlantic Ocean since the deglaciation. In Swedish waters, the exact level of the postglacial lowstand is based on models of glacio-isostatic adjustment rather than empirical field data, and these indicate that the lowest shore-lines in the southern part of Kattegat and the northern part of Öresund were formed around 11,000 cal BP and are found at 22–18 m bpsl. After this time, the relative sea level rise reached present levels at approximately 8000 cal BP.

4.3 Submerged Stone Age Landscapes and Archaeological Sites

In Sweden, 44 underwater archaeological sites are known (<http://splashcos-viewer.eu/>). Of these, 25% have been test excavated with modern documentation methods (Larsson 2017; Nilsson et al. 2018). Some of the known sites have to be regarded as clusters of sites (Tredenberg, Vendelsöfjorden and Måkläppen), and taking this into account, at least 62 archaeological find spots have been discovered in Swedish territories. Most of the recorded sites are found in shallow water. Some are not certainly *in situ* and could have been redeposited as a result of post-depositional erosion.

The majority of the sites represent multiple finds of chronologically significant lithic remains, mostly flint scatters and tools (Table 4.1). Sites that are excavated very often reveal organic remains and well-preserved settlement refuse layers. Until now no hearths or remains of dwelling structures have been found.

Around the Måkläppen area in the south-western part of southern Sweden, human remains have been washed ashore, possibly from inundated Mesolithic burials, discussed in more detail below.

In addition to the archaeological sites, several ‘natural’ sites (tree stumps, inundated peatbogs, etc.) have been detected, not least in the northern part of the Hanö Bay, at the Blekinge coast. These

are not protected by culture heritage legislation but are an equally important record for cultural and natural history studies.

Due to variations in topography, geology, hydrology and shore-line displacement, submerged Early Holocene landscapes can be divided into three main geographical areas: the Kattegat and Öresund area of south-western Sweden, the riverine and lacustrine palaeo-landscapes of south-eastern Sweden and the Hanö Bay and the archipelago of Blekinge. Below is a brief presentation of these areas and the archaeological remains.

4.3.1 The Öresund and Kattegat Area

The Öresund is the strait that divides modern Sweden and Denmark and is about 10 km long and 4–30 km wide. During low sea-level periods, this area constituted the land bridge between the Scandinavian Peninsula and the European continent and became a marine seaway during the Littorina transgression 8500 years ago. Since then the Strait has played an important role in the hydrology and ecology of the Baltic Sea, not least due to the important influx of saline and oxygen-rich water into the brackish Baltic Sea basin. In the Öresund, several submerged Stone Age finds have been made on both the Danish and Swedish sides (Fischer 1993, 1996; see Larsson 2017 for a full review; see also Bailey et al., Chap. 3, this volume). Most of these consist of flint scatters eroded from nearby sites. Some, however, are found in peat deposits with preserved organic debris such as bone fragments, nut shells and charcoal.

4.3.1.1 Pilhaken

A notable example is Pilhaken, a shallow bank north-west of Landskrona (Larsson 2017), an area long known for its remains of submerged landscapes, mainly tree stumps and peat deposits (Wilcke 1850). During the late 1930s, zoologists found worked flint in sub-bottom samples, which 40 years later captured archaeological interest (Rausing and Larsson 1977). After systematic

archaeological sampling and subsequent diver investigation, some areas were test excavated with Danish colleagues during the 1990s (Larsson 2017, Fig. 11.3). The result showed that Pilhaken comprised a set of several sites. Radiocarbon analysis of hazelnut shells and oak dates the oldest site now located at 7–8 m depth to c. 9000 cal BP. At that time the settlement was situated on the estuary of the former Saxå River, a ‘typical’ location for larger late Maglemose coastal sites (Nilsson et al. 2018). The palaeochannel is clearly visible today, and several smaller sites are located along this channel or in nearby shallow areas, but these are heavily eroded.

South of Pilhaken, and along the coast down to Malmö, several sites are found, but none of these have been excavated or more thoroughly surveyed. In Malmö City, due to harbour expansion and railway construction, interesting findings have been made. Here, a transgression sequence from 8100 to 7500 cal BP is recorded. The evidence of a rapidly drowned oak and alder forest, submerged by the opening of the Öresund during the Littorina transgression around 8500 cal BP, gives a good picture of the ecological impact of the inundation and how landscapes were subject to sudden transformations. In the subsequent period, the forest was transformed into a fishing ground.

Extremely well-preserved wicker cages and weirs, wooden leister shafts and other wooden artefacts were found in the transgression sediments. During a couple of hundred years, some few generations only, the forested landscape was transformed into a shallow marine bay, suitable for fishing and hunting (Hammarstrand Dehman 2009; Nilsson 2011).

During this time, there was a socio-economic shift and increased dependence on marine resources (Fischer 2005; Larsson 2017). The cultural adaptation was swift and far-reaching. Here, and on both sides of the Strait, we have rich evidence from the Middle and Late Mesolithic (see Bailey et al., Chap. 3, Table 3.1, this volume for chronology) of burial areas, fishing grounds, large settlements and middens. However, to fully understand this environmental and cultural transition, more focus must be put on older sites that are now

submerged. Not only will these tell a different story than the one we are used to, due to their relatively older age, but there is also a high probability of finding well-preserved organic material. From this point of view, the coastal archaeology of the Öresund area is of international importance, providing one of the few areas where accessible deposits of the right age and with good conditions of preservation provide a window into the nature of the earliest coastlines of the Littorina Sea and their associated archaeology.

Recent excavations in Swedish waters north of Öresund, at Vendelsöfjorden in the Kattegat outside of Varberg, Halland, bear evidence of several submerged sites. The extent and date of these remains are not thoroughly understood; the indisputable archaeological evidence contradicts existing geological shoreline displacement models (Von Arbin 2008), and this is an issue that needs to be more thoroughly examined in the future.

4.3.2 The Southern and Eastern Coasts of Scania

The shallow waters on this coastline have long been known for the presence of submerged bogs and tree stumps (Bruzelius 1870; Isberg 1927; Nilsson 1961). Trawler fishing and near-shore eel fishing have revealed several areas where Early Holocene terrestrial remains are abundant, especially offshore of today’s river estuaries.

4.3.2.1 Haväng

One of the most famous sites, which has been examined on several occasions during the last 50 years, is Haväng near the Verkeån River north of the city of Simrishamn (Fig. 4.4; Nilsson 1961; Hansen 1985, 1995; Björck and Dennegård 1988; Gaillard and Lemdahl 1994; Nilsson et al. 2018; Hansson 2018).

The earliest scientific investigations at Haväng concentrated on the submerged pine forest. In the 1970s and early 1980s, some 40 logs and stumps, many of which were rooted, were dragged ashore from water depths between 13 and 80 m bpsl (Fig. 4.5). Stratigraphic investigations were also

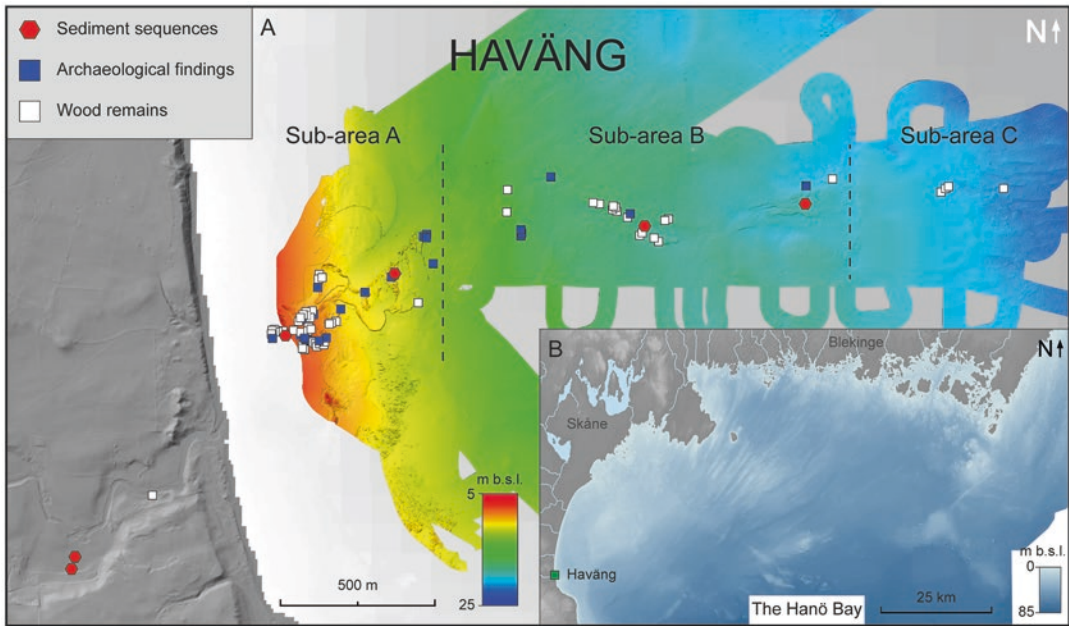


Fig. 4.4 Overview of the Haväng study area and the Hanö Bay (after Hansson 2018). (a) Topographic and bathymetric composite map of Haväng, showing the subdivision of the study area and the locations of the sediment sequences (red hexagons), archaeological findings (blue boxes) and tree stumps and trunks (white boxes). Not shown are the locations of the discrete organic sediment samples obtained immediately adjacent to each sampled stump or trunk. (b) Topographic and bathymetric composite map of the Hanö Bay region, showing the location of Haväng and the main rivers and lakes. Bathymetry data: Marmor, Sjöfartsverket, MMT, Landscapes Lost/Blue Archaeology project, Lund University. Topography data © Lantmäteriet



Fig. 4.5 Fallen trees and diver Beesham Soogrim at the Haväng site. Photo by Arne Sjöström

carried out on organic deposits found in shallower deposits associated with remains of pine trees (Hansen 1985, 1986; Björck and Dennegård 1988; Gaillard and Lemdahl 1994). The sediments were analysed for pollen and macroscopic plant and insect remains, and tree-ring records were measured, establishing some fragmentary, floating dendrochronologies. Twelve of the trees were dated by radiocarbon to c. 11,000–10,600 cal BP, i.e. the end of the Yoldia Sea stage and the onset of the Ancylus Lake stage. Since then, it has been assumed that the pine forest was flooded by the Ancylus Lake transgression. The Hanöbukten project, led by Hansen, was most active during the mid-1980s and the mid-1990s. Due to lack of funding, this high-profile project was discontinued. From 2010, a research program directed from Lund University (Landscapes Lost Project, 2010–2016; the Blue Archaeology Project, 2017) has continued and expanded the research. Geoarchaeological sampling and coring (Hansson 2018) have been complemented by acoustic surveys and diver investigation (Nilsson et al. 2018). This has resulted in important new results and indicated considerable potential for further archaeological discoveries over a wider area.

We now know that the submerged archaeological sites at Haväng span a long period—from 11,000–8500 cal BP—and extend over a large area. The sites are clustered along the now-submerged estuary and its lagoon formations, traceable today from the remains of ridges of sediment up to 4-m thick along the old river course. Several subareas (A, B, C) within the 3000 x 500 m inundated river bed and lagoon have yielded artefacts of bone, antler and wood. Fish traps, fences, wattle structures and weirs have been found, all dating to 9000–8500 cal BP (Fig. 4.6). They are some of the oldest known wooden stationary fishing traps in the world. None of these have been excavated so far. (For excavated examples of later date in Denmark, see Bailey et al., Chap. 3, this volume.) The bone material consists solely of mammals and covers a period from at least 10,700 to 8400 cal BP. All bones show marks of human use. There are also many examples of worked wood, but due to con-



Fig. 4.6 Hazelwood strips from a panel of a fish weir at Haväng. The hazelwood is dated at 8800–9000 cal BP and the diver is Beesham Soogrim. Photo by Arne Sjöström

servation costs, none of these have been sampled so far.

The archaeological findings can be divided into two chronological phases—the Early Littorina (Hansson et al. 2018a, Nilsson et al. 2018) and an older phase belonging to the period of the late Yoldia Sea and Ancylus Lake phase (Hansson et al. 2018b,c). The latter is primarily found in sub-area B, even though older findings have been recovered in the lower part of the sediments in sub-area A. No excavation has yet been conducted, however, only geological sampling, during which archaeological material has occasionally been found. The archaeological material is well preserved and largely comprises redeposited refuse material and debris displaced from a nearby settlement that has now been completely eroded away (Fig. 4.7).

One prominent finding, with evident human traces, consists of an aurochs (*Bos primigenius*)

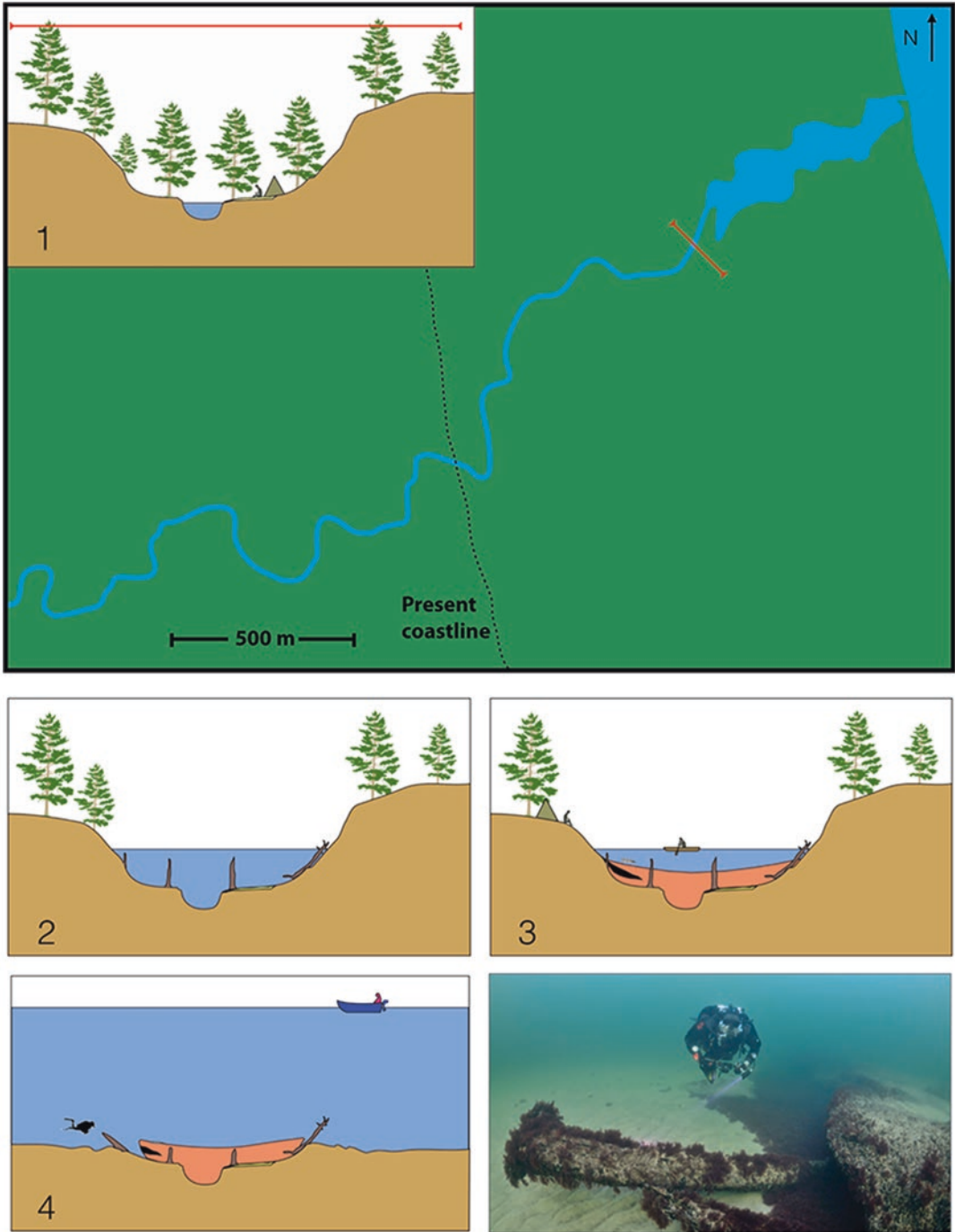


Fig. 4.7 Possible sedimentological and archaeological model of how the Haväng remains have originated. Schematic N–S section of the gyttya remains at sub-area A. Upper image shows a schematic valley and cross section. (1) at c. 10,500 cal BP, showing a river valley with pine forests, situated some kilometres from the coast, with evidence of an Early Maglemose settlement. Lower image shows successive transformations with sea level rise. (2) At 10,300 cal BP, the area is now submerged due to the Ancylus transgression. (3) At 9000 cal BP, during the Littorina lowstand, the section is situated within the estuary and with a Late Maglemosean settlement in the vicinity. Layers of gyttya (in red) fill the near-shore lagoon. Stationary fishing traps (in black) in the lagoon are important features of the settlement. (4) Present day. The sandy deposits along the river have been completely eroded away by the Littorina transgression (see photo at bottom right). What remains is the lagoon sediments with remains of fish traps and refuse layers from the Early Mesolithic settlement



Fig. 4.8 A metatarsal from an adult aurochs situated on top of the organic sediments at Haväng at 15.4 m bpsl. The bone has a distinct groove made by a burin. Possibly this is a rejected piece of raw material. Around the bone there are several pieces of worked wood. The bone is dated to c. 10,600 cal BP and the sediments are a hundred years older. Photo by Arne Sjöström

metapodial with a cut mark made by a burin (Fig. 4.8). It was found exposed in a gyttja which yielded ages of 11,800–10,600 cal BP. The bone itself is dated to 10,650–10,400 cal BP and is most likely to have been discarded from a bone-working area at a nearby settlement. Wooden debris is also found in the vicinity; some of it evidently worked. In the western part of sub-area B, an aurochs metapodial and several bones (tibia, fibula and ribs) from the European beaver (*Castor fiber*) were found a few metres apart at a depth of 15 m bpsl. The beaver is one of the oldest found in Scandinavia and dates to 10,700–10,500 cal BP. A worked antler of red deer (*Cervus elaphus*) found in the grey silty gyttja in sub-area A dates to c. 10,200–9900 cal BP. Not far from this find, but higher up in the sediments, a large pick axe made from a polished and decorated elk antler was found exposed due to heavy erosion presumably caused by a winter storm (Fig. 4.9). A hollow pine trunk located at 19 m bpsl and dated to

11,100–10,900 cal BP appears to have been used as a log fire (Fig. 4.10).

The site of Haväng is not only important thanks to its rich and unusual inventory of material. The site also spans the entire Early Mesolithic and gives a unique insight into the marine and lacustrine economy of this period. So far, very few fish and marine mammal remains have been recovered, which stands in contrast to contemporaneous on-land sites on the Swedish west coast (see Boethius 2018 for a recent review). Proper excavations at the site might of course change this. At the same time, the site is vulnerable to loss of information from destructive agencies, especially damage caused by marine traffic (Fig. 4.11).

The recent research at Haväng has created a methodological protocol on how best to use acoustic techniques and how to find new sites along the coast. So far this has been successful. In the past 2 years, at least two more lagoon



Fig. 4.9 A pick axe made from elk antler found in an organic sediment ridge at Haväng at 5.6 m bpsl. The imprint of the broken tip can be seen in the sediment. The pick axe measures 20 cm. and is dated to 8800 cal BP. Diver Anton Hansson. Photo by Arne Sjöström

sediment-ridge complexes have been found. These are situated east of Ystad on the southern coast (offshore of the Nybroån and Kabusaån estuaries). No clear evidence of archaeological remains has been found so far; however, at one of the sites (Nybroån), there are indications of fish traps. The remains look similar to Haväng, with both sediment banks and visible pine stumps. The sites are not radiocarbon-dated, but due to uneven isostatic land uplift, the lowstand is c. 3–4 m deeper than at Haväng. Consequently, the submerged landscape is potentially more extensive, and the near-shore sediments could also be slightly younger than the Haväng sediments. From an archaeological perspective, it would be very interesting if we could find sites in the Baltic Sea proper that are contemporaneous with the Pilhaken site. Not only would this offer a possi-

bility to study the transition in slightly brackish to saline waters (9000–8000 cal BP) but also the potential effects of the 8.2 kyr climate event (for a discussion see Groß et al. 2018).

Two more finds along the Scanian Baltic coast should be mentioned. First is the interesting but enigmatic occurrence of human remains from the Måkläppen area (Fig. 4.1). The bones have given a range of radiocarbon dates in the period from c. 8000 to 7000 cal BP (Larsson 2017). The younger-dated bones must result from erosion of nearby sites on land (or represent drowned individuals). The older bones could originate from now-submerged burials, being thus some of the oldest burial grounds in Southern Sweden.

Secondly, there are recent finds from the mouth of the Skräbeå River, 50 km north of Haväng (Fig. 4.2 d, western red triangle). Here, dredging has yielded large quantities of Early and Middle Mesolithic artefacts and bones; a red deer bone (*Cervus elaphus*) is dated to 8800 cal BP. Surveys at periods of extreme low water show that lithic scatters and very large flint nodules—a type not locally present—can be found down to at least 1.5 m depth. These deposits are in situ. The bones are dredged from the river bed at depths down to c. 4 m. Judging from the findings so far, this site shows similarities with the Pilhaken site complex. The depth and the occurrence of chronologically diagnostic lithic material and good organic preservation make this a highly promising prospect for excavation.

4.3.3 The Northern Part of Hanö Bay and the Blekinge Archipelago

The province of Blekinge is well suited for shoreline displacement investigations, as the coastline runs parallel with the uplift isobases of the region, which enables data from the many basins and bays in the undulating landscape to be combined into detailed shoreline displacement records. Consequently, Blekinge has a long tradition of Baltic Basin sea-level research, starting already in the 1800s. Since then, the focus has mainly been on the Late Weichselian shoreline displace-



Fig. 4.10 A hollow and burnt pine trunk located at 19 m bpsl at Haväng and dated to 11,100–10,900 cal BP. The trunk was possibly used as a log fire. Up to now this type of fire has been recorded only in northern Sweden. Photo by Arne Sjöström



Fig. 4.11 Modern destruction of sediment banks due to fishing or anchoring at Haväng. The fish trap pictured in Fig. 4.6 is located only some metres from here. Photo by Arne Sjöström

ment, i.e. before 11,700 cal BP, and the Littorina transgressions, after 8000 cal BP, providing good evidence of fluctuations at levels above present sea level (cf. Hansson et al. 2018c).

Pine stumps dating to the Yoldia and Ancyclus stages have been found sporadically in the Blekinge Archipelago. Diving and acoustic surveys throughout the last 5 years have revealed several remains of a submerged landscape in the study area (Holmlund et al. 2017), and amateur divers have located several new areas with preserved tree stumps and terrestrial palaeosurfaces in adjacent areas (Hansson et al. 2018c). Furthermore, a recently revised shoreline displacement record for Blekinge (Hansson et al. 2018c) suggests that there exists a significantly long period (c. 9500–8500 cal BP) with a relatively stable sea level during the Initial Littorina Stage at 4 m depth, well below today's shoreline (Fig. 4.3, black line).

Submerged sites from Blekinge are quite few. Recent surveys and excavations have yielded several interesting coastal sites (Fig. 4.1, Fig. 4.2). They are mainly situated some 0–2 m below the modern shoreline. To date, most of the findings are flint scatters from submerged settlements. Some of the artefacts have been polished by wave action, but there are also 'fresh' specimens indicating the presence of eroding near-shore sites located further out in the sea. The sites are difficult to date typologically, but in the few cases where this has been possible, the dates range from late Early to early Middle Mesolithic (c. 9500–8000 cal BP), i.e. during the rather long lasting Littorina low-stand period (Hansson et al. 2018c).

The Blekinge Archipelago is strikingly different to the two other areas discussed above. The potential to find well-preserved settlement sites from the Early Mesolithic is high. In marked contrast to Haväng, where refuse layers are preserved, but the settlement itself has been washed away during later transgressions, the protected environment in Blekinge could yield more complete settlement remains. The abundance of exposed palaeosurfaces from the Ancyclus stage, and indication of flints washed ashore, gives a hint of what one can expect. However, this remains to be tested by underwater excavations.

4.4 Swedish Submerged Prehistories: Future Strategies

The field of underwater cultural heritage in Sweden has long focused on objects, especially shipwrecks. However, the increased interest in the prehistoric archaeology of the shallow sea floors of the Baltic Sea has promoted new thinking and emphasised the need for a broader approach that integrates the joint investigation of cultural and natural resources and their protection. Other factors promoting change are advances in marine spatial planning (MSP), the European Landscape Convention (ELS), notions of 'seascape' and the need for better scientific methods and new knowledge about submerged landscapes to underpin Environmental Impact Assessments in marine planning. In Sweden, policy discussions are currently under way at regional and national level and are still at an early stage.

In recent years, research efforts have more than doubled the number of known archaeological and geological submerged sites, including the discovery of finds that are unique in character. The Blue Archaeology project has focussed not only on discovering new underwater sites and their further implications for understanding prehistoric cultural developments but on enhancing the role and practice of underwater cultural heritage management and emphasising the need for integration of cultural and natural processes of change.

One important outcome of the Blue Archaeology project has been to highlight the value of Mesolithic seascape as a concept with which to critically examine the Mesolithic record. The new results have highlighted the likely significance of the coastline and marine resources in the Early Mesolithic period. Until recently, knowledge of this period in southern Sweden was based mainly on the study of inland settlements and areas that are on or near the modern coastline. Socio-economic and demographic interpretations have therefore been founded on settlements with land-based economies. However, it is clear that the new information from

submerged coastlines is highlighting the early existence of maritime economies and that this will require a revision of views about the Early Mesolithic. Permanent fishing installations found at the Haväng site suggest large catches, which in turn calls for a new analysis of how these societies were organised (Nilsson et al. 2018). Similar trends are apparent in Denmark (Bailey et al., Chap. 3, this volume) and Germany (Jöns et al., Chap. 5, this volume) with the difference that in Sweden the submerged landscapes and archaeology of the Early Mesolithic period (equivalent to the Maglemosian in Denmark and northern Germany) are more extensive and more easily accessible and therefore fill a gap in the archaeological record that cannot easily be addressed from the underwater record elsewhere.

This concept of a Mesolithic seascape is not only ‘good to think with’ when addressing the interpretation of the archaeological record but also when bringing an archaeological perspective to bear on the modern situation with its settled and land-based society (Nilsson 2011). The discovery and exploration of new submerged sites of the Stone Age in Scandinavian waters are not only changing the way we conceive of the Stone Age but is also highlighting the value of the Baltic Sea as a cultural and natural resource in the modern world as well as its vulnerability.

4.5 Management of the Underwater Cultural Heritage

As in many European countries, archaeological competence and legislative power in marine matters are spread across several institutions and government agencies. National, regional, local and academic actors work side by side, and together they constitute the key organisations. Institutions with high marine archaeological competence such as academic institutes at universities, or even single scholars, have a small advisory function.

Offshore exploitation of the seabed is governed by the Act concerning the Continental Shelf under the executive direction of the

Geological Survey of Sweden (Sveriges Geologiska Undersökning, SGU). If it is suspected that industrial activity could interfere with cultural heritage sites or culturally protected areas, the SGU involves the Swedish National Heritage Board (Riksantikvarieämbetet) and the Swedish National Maritime Museums (Sjöhistoriska Museet), both operating under the Swedish Ministry of Culture. The Swedish National Maritime Museums is the main institution with competence in maritime archaeology and has a professional archaeology unit that undertakes mitigation work associated with offshore developments.

Marine cultural heritage management in areas which are near-shore, or already governed by any regional or local marine planning, is treated in the same way as heritage on land, i.e. as a regional matter. This means that the County Administrative Boards (Länsstyrelse) handle the case according to the Heritage Conservation Act. The County Administrative Board assigns the proper agency if archaeological surveys or excavations are needed. This may be either the Maritime Museum (part of the Swedish National Maritime Museums), a regional museum, or private archaeological consultants. When it comes to management of submerged landscapes—a fairly new discipline—scholars from academic institutions are often appointed as advisors, either for the County Administrative Board, or the contracted archaeology institution. In 2018, only two regional museums have marine archaeology as a contracting speciality, both in southern Sweden.

Today there is a lack of professional archaeological divers, and often private companies have to be assigned as consultants to fulfil the diving regulations. Currently, no academic institute in Sweden offers training in scientific diving or an academic programme in marine archaeology.

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