8 The Netherlands: Probing into the Submerged Prehistoric Archaeology, Landscapes and Palaeontology of the Dutch Continental Shelf

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Abstract

The Dutch sector of the North Sea is an important source for archaeological and palaeolandscape data from prehistoric times. A vast body of artefacts and palaeontological remains, dating from the Palaeolithic and Mesolithic, has been dredged and trawled from the seafloor. Contacts with industry, and fishermen in particular, permitted private collectors and professionals to assemble valuable collections for research. Although the overwhelming majority of finds derive from unknown contexts, these are of scientific importance. Firstly, they demonstrate the potential for the presence of well-preserved submerged archaeological sites and palaeolandscape contexts. Secondly, there is a lot of 'intrinsic' information that can be extracted from individual specimens, notably for radiocarbon dating, diet reconstruction (stable isotopes) and aDNA. Work in recent years has been increasingly concerned with the contextualisation of these data. Geoarchaeological investigations off the Dutch coast have permitted insight into the stratigraphical origin of Middle Palaeolithic flint artefacts, and the fragment of a Neanderthal skull. Targeted geoarchaeological research in the extension of the Rotterdam harbour has provided an opportunity to partially investigate a Mesolithic site at 20 m below sea level. This has led to increasing awareness among stakeholders that this submerged heritage is valuable and needs to be taken care of. Several initiatives have been taken to anticipate the potential presence of important archaeological and palaeolandscape remains in zones of economic interest.

Keywords

Submerged prehistoric · Submerged landscape · Palaeontological · Rotterdam harbour · Mesolithic · North Sea · Palaeolithic

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8.1 Introduction

The publication of a paper by Louwe Kooijmans (1970/1971) describing a number of prehistoric implements caught in fishing nets from the North Sea floor first led to a general awareness that prehistoric landscapes extended into the present-day North Sea. In addition, the exten-

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sion of the Rotterdam harbour (Maasvlakte) in the late 1970s led to the discovery of hundreds of Mesolithic bone and antler implements (mostly points) from mudspoil used for land reclamation (Verhart 1988). Unfortunately, the exact stratigraphic, sedimentary, and broader archaeological context of these finds was largely unknown. In addition, the layers of archaeological interest were covered with about 20 m of sediment and water and were out of reach for detailed investigation. Consequently, initiatives to collect further information about the submerged prehistoric environment had to rely on an increasing number of finds without any clear context (Verhart 1995).

Cooperation between palaeontologists and fishermen since the 1980s has permitted systematic collection of palaeontological materials and artefacts, in addition to the registration of find zones (Glimmerveen et al. 2004, 2006; Mol et al. 2006; see also Maarleveld, Chap. 27, this volume). Also, targeted expeditions were organised on a yearly basis to 'fish for bones' (Glimmerveen et al. 2004). For the first time it was possible to identify the geographical location of finds to some degree of precision. The vast number of palaeontological and archaeological materials retrieved from fishing nets triggered initiatives to develop heritage management approaches (Maarleveld and Peeters 2004; Peeters et al. 2009; Peeters 2011). Over the past few years, academic and development-driven research has turned towards efforts to provide context for hitherto context-less finds.

Below, we provide an overview of finds and sites (Fig. 8.1). We underline that this overview will be of a somewhat impressionistic nature, as 'hard' data are few, while a systematic inventory is not yet available at this stage. In addition to the discussion of quantitative and qualitative aspects of finds and sites, we will discuss the research potential, and current scientific and management approaches in connection with the 'North Sea Prehistory Research and Management Framework (NSPRMF)' (Peeters et al. 2009), which sets a baseline for developments in the Netherlands.

8.2 Geological Context

The complex geology of the Dutch part of the continental shelf is affected by river dynamics, glacial processes, sea-level fluctuation and tectonics. Due to its importance for the Holocene occupation history of the Netherlands, relative sea-level rise has received particular attention in the work of geologists and archaeologists (e.g., Louwe Kooijmans 1974; Jelgersma 1979; Hijma 2009). However, factors such as palaeogeography, and sedimentation and erosion are equally important to take into consideration to gain insight into the human use of landscapes during the Pleistocene and Holocene, and the representativeness of the archaeological record (Peeters et al. 2009).

This record, however, is not a single 'container' of finds, as materials were left behind by very different people, at different times, and under variable conditions. In order to explain some of the emergent patterns, emphasis is placed on research that provides a geological context for finds (Hijma et al. 2012; Cohen et al. 2014; Peeters and Cohen 2014; Peeters and Momber 2014; Roebroeks 2014). At this stage there is still a lack of sufficiently detailed studies on the occurrence of Pleistocene and Holocene sediments to identify potential zones of archaeological interest within the Dutch part of the southern North Sea. Nonetheless, research conducted in the Middeldiep area (Middle Palaeolithic) and in the Port of Rotterdam (Mesolithic) demonstrates that there is potentially a lot to gain by an integrative approach. Also, future collaboration between geologists and archaeologists is planned with the aim of detailing and further dating the submergence of the North Sea basin at potentially informative core-drilling locations.

More recently, geological data on palaeogeographical developments in the North Sea basin have been reconsidered from a perspective that seeks to integrate prehistoric occupation dynamics and the formation of the archaeological record (Cohen et al. 2017). Similar work has been done for the Channel/La Manche and Celtic Sea (Farr et al. 2017). These are important steps to reach a

Fig. 8.1 Map showing the geographical location of the find zones mentioned in the text. A: Brown Bank and De Stekels; B: Eurogeul; C: Middeldiep; D: Westkapelle; E: Colijnsplaat, Roompot and Onrust; F: Maasvlakte-Europoort, Maasvlakte II-Yangtze harbour and Hoek van Holland; G: Scheveningen, Monster and Kijkduin. Site information from the SPLASHCOS Viewer http://splashcos-viewer.eu. Drawing by Moritz Mennenga

better understanding of taphonomy at a wider geographical scale, and without which it is impossible to assess the significance of archaeological and landscape phenomena as encountered at a more local scale. The importance of this work also reaches beyond the submerged world itself: the present-day terrestrial archaeological and palaeolandscape records also need to be understood in relation to areas now flooded, but which were once part of a past world.

8.3 A Survey of Sites, Finds and Collections

A considerable number of archaeological and palaeontological finds are known from the Dutch part of the southern North Sea. As most of these finds have been brought to the surface by fishing or dredging activities it is difficult to refer to 'sites' in terms of precise locations that delivered clear concentrations of materials. In some cases, however, it is possible to identify zones which produced finds over a number of years, making targeted 'fishing' expeditions possible (Glimmerveen et al. 2004).

8.3.1 Brown Bank and De Stekels

A small number of Mesolithic artefacts derive from the Brown Bank area, an elongated ridge of 35 km in length at *c.* 80 km off IJmuiden. Its top is only 19 m below water level. The Brown Bank is generally interpreted as an erosional remnant consisting of Late Pleistocene deposits (Busschers et al. 2007; Hijma et al. 2012). Gyttja-like deposits of Early Holocene age have been found in the surroundings of the Brown Bank (Louwe Kooijmans 1970/1971). Most of the Brown Bank finds are larger pieces of worked bone and antler, among which are large shaft-hole picks, socketed and pointed axes, adzes as well as (perforated) antler tines (Fig. 8.2). Waste products with saw and cut marks (Louwe Kooijmans 1970/1971) provide evidence for local production of tools. Some pieces show marks that may result from gnawing by dogs (Verhart 1995). Apart from bone and antler artefacts, the Brown Bank area has also yielded lithic finds such as a cobble mace head with conical perforation. While it is clear that the Brown Bank area harbours an interesting potential for uncovering Mesolithic (and older) remains of camps and activities, the current picture is severely biased. Another interesting aspect of this location is the fact that Neolithic finds, among which are at least two polished axes, have been found here, one of which at a location known as '*kolenboot*' (Louwe Kooijmans 1985, p. 14; Mol et al. 2008, 173).

An area south-west of the Brown Bank has also over some years yielded a considerable number of finds, including several human bones (mainly skull fragments and long bones). Currently, more than ten AMS radiocarbon dates indicate an Early Holocene (mainly Boreal) age; most dates fall between about 8700 and 6900 cal BC (see Glimmerveen et al. 2006; Mol et al. 2008). Among the bone and antler tools are socketed adzes and perforated mattocks; one mattock has the wood of the handle preserved. A socketed adze is decorated with zigzag incisions. In addition to objects of bone and antler, there are several stone tools including cobble mace heads. Together with the human bones, these finds (most are kept in the private collection of Mr. Jan Glimmerveen) indicate the presence of one or more sites within a restricted area according to the information provided by fishermen. As the bone material is in very good condition, it is likely that the finds derive from gradually eroding cultural layers. The character of the finds could point to the presence of a cemetery.

Apart from the Mesolithic finds, the presence of several Middle Neolithic axe blades is intriguing (Maarleveld 1984; Glimmerveen 2007) (Fig. 8.3). Both axe blades are of considerable size (one measures 19 cm in length, the other 32 cm), and skilfully manufactured out of flint that probably originates from southern Limburg (Netherlands). During the Neolithic, the North Sea coastline was roughly situated at its modern-day position, and sea levels were only a few metres lower than today. As far as we can tell, major highs such as the Dogger Bank and Brown Bank were by

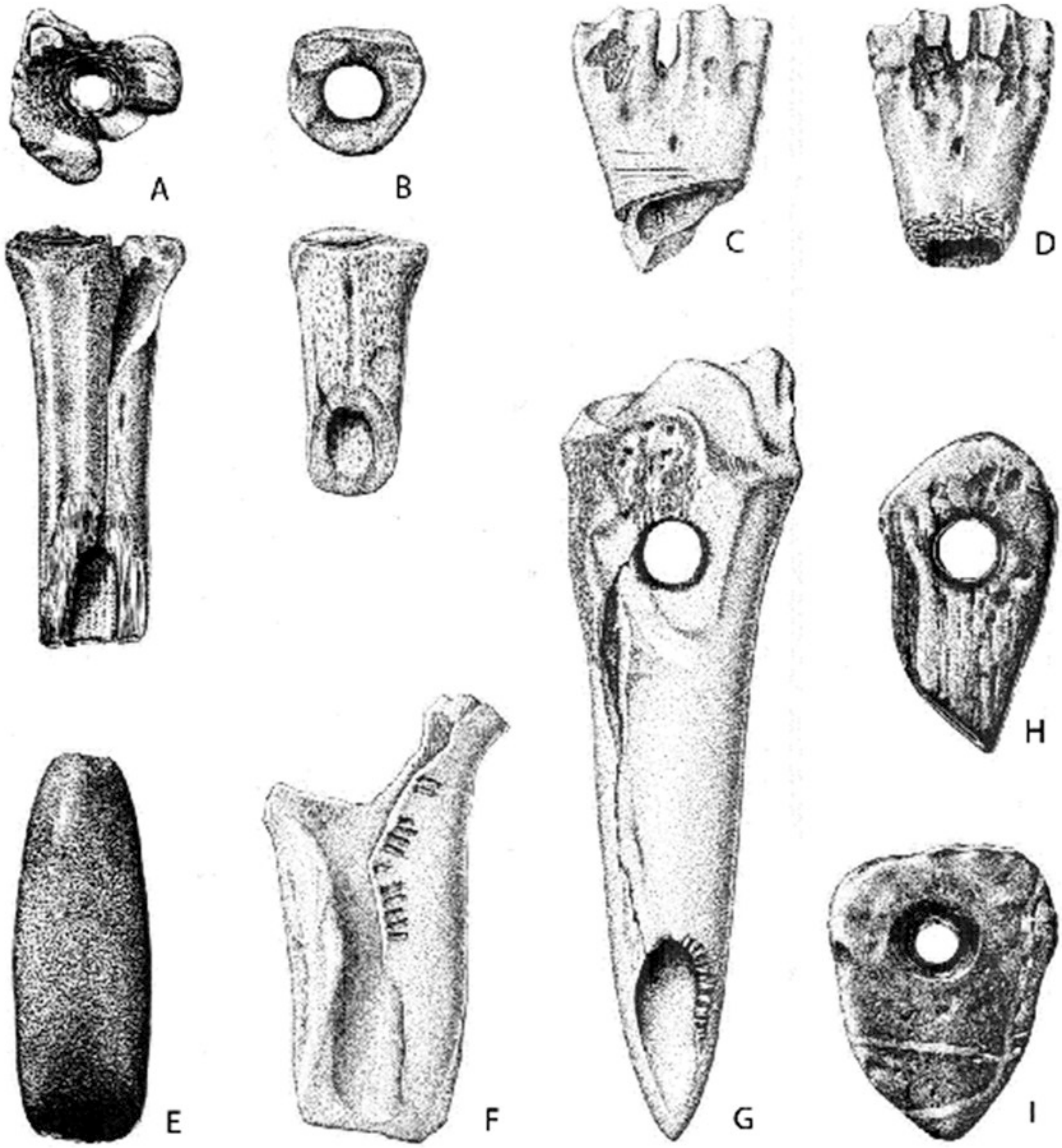

Fig. 8.2 Mesolithic implements from Brown Bank (**a**–**b**, **f**): socketed adzes; (**c**–**d**): distal parts of bones with saw and cutmarks; (**e**): ground stone axe (Neolithic?); (**g**): shaft-hole pick; (**h**): perforated antler mattock; (**i**): perforated stone 'wedge'. Drawing by JNJ Caspers, from Louwe Kooijmans (1985)

then permanently flooded. An obvious question is what these objects are doing in such a truly marine environment. Although lost cargo may be an explanation, it is also probable that the axes were ritually deposited, a practice that is well documented for the Neolithic in wetland areas on land (Wentink 2006). The extension of this practice into the marine environment suggests that the sea was as much part of the 'landscape' as were drylands. As such, the location is probably not accidental. Recent work by Gaffney et al. (2009, 145–146) has indicated that during the early Neolithic, the highest parts of the Brown Bank may have been exposed as shallow islands or banks at low tide (Van de Noort 2011, 143–144). Depending on the degree to which islands existed, occupation or ritual deposition at these submerging stepping stones should be taken into account.

8.3.2 Eurogeul

Another major find zone is the Eurogeul. Dug in the 1970s, 57 km in length and 23 m deep, it gives access to the Rotterdam harbour. The corridor is maintained on a regular basis by means of so-called trailing suction hopper dredgers; it yields 5–7 million tons of sediment per year. The Eurogeul area is mainly known to produce large quantities of fossil bones, and to a lesser extent wood and stones, brought up by fishermen (Fig. 8.4). Targeted 'fishing' expeditions in this area focus on the collection of bones from the seafloor (Mol and Post 2010; Mol 2012). The majority of finds consist of Pleistocene fauna. Several bones show cutmarks, indicating human interference. Mammal bones have been dated and pre-date the Last Glacial Maximum (Glimmerveen et al. 2004, 2006; Mol et al. 2006). However, there is evidence that most of the finds were reworked during the Late Glacial (Hijma et al. 2012). Most of the Holocene sediments were reworked as well during the Holocene transgression. Early Holocene finds may lie concentrated in lag deposits at the base of the Holocene sediments. Closer to the shore, however, the geology has remained intact and mammal remains as well as Late Palaeolithic and Mesolithic artefacts may be found in situ (ibid.).

Fig. 8.3 Two Neolithic polished flint axes from the Brown Bank area. The length of the axe blades measures 32 cm (top) and 19 cm (bottom). Photo courtesy National Museum of Antiquities, Leiden, the Netherlands

In order to collect further information about the stratigraphic context of finds from the Eurogeul area, research has been conducted in the

Fig. 8.4 Together with large quantities of fish, fishermen bring up Pleistocene bones in their nets on a daily basis. Photo by Rob Buiter

sand extraction zone for land reclamation in the Rotterdam harbour, the so-called Maasvlakte 2 (Kuitems et al. 2015). This extraction zone is situated next to the Eurogeul. The project involved intensive geological research by means of core drilling and geophysical techniques (seismics, side-scan sonar), as well as targeted 'fishing' trips in the sand extraction zone to collect bones, molluscs, and archaeological objects using a beam trawler. In addition, systematic surveys were conducted on the artificial beach of Maasvlakte 2 by means of manual and mechanical (Mega Beach Cleaner system) collection of objects. The geological investigations and offshore collection of finds made it possible to obtain better insight into the stratigraphical context of finds, but also delivered new insight into Late Pleistocene sea-level fluctuations. Swathes of sand extraction—following lithological layers—were followed by trawl collection of objects, which permitted the development of a coarse biostratigraphy. Based on this sequence and OSL dates of sediment sampled from the high-resolution cores, it could be established that the area saw a marine transgression phase in the early Weichselian (MIS 5d–a), instead of a lowstand as was generally believed. To some extent, this might explain the Weichselian dates obtained on bone remains of beluga and other marine mammal species (Mol et al. 2006).

8.3.3 The Zeeland Ridges: Middeldiep, Westkapelle, Roompot and Onrust

Further south, an area off the Zeeland coast has become known as a Palaeolithic 'treasure trove'. Finds derive from waste heaps at wharves where shells are brought ashore. Since private fossil collectors regularly check the origin of shells, and the dredging areas are relatively restricted in space (often 1 or 2 km in length and several tens of metres wide), a number of 'sites' have been identified in this part of the Southern Bight over the years. All sites are part of the so-called Zeeland Ridges area, a complex of SW–NE oriented sandy ridges, situated parallel to the Dutch coast. These consist of (often re-worked) sediment with material dating to the Early Pleistocene, Eemian, Weichselian and Holocene (Hublin et al. 2009; Amkreutz et al. 2010). The first find zone includes the neighbouring sites of 'Roompot' and 'Onrust', situated in an elongated gully with a depth of 20 m (Louwe Kooijmans 1970/1971; Verhart 2001). These locations yielded several Mesolithic stone tools and waste products, as well as worked pieces of bone and antler, including a bone awl (Verhart 2001). Comparable finds are known closer to shore in a relatively shallow (−7 m) flat area near Westkapelle. Another find zone is the Middeldiep area, part of which is known as the 'Steenbanken' (Stone Banks), adjacent to a deep gully, known as Middeldiep (−27 m). The area has yielded a number of Middle Palaeolithic flint implements, including two hand-axes (Verhart 2001) (Fig. 8.5) and several Levallois flakes (Verhart 2004).

Of particular importance is the find of a Neanderthal frontal bone (Hublin et al. 2009) from the Middeldiep. The skull fragment (Fig. 8.6) was discovered among the remnant cat-

Fig. 8.5 Small Middle Palaeolithic handaxe from the Zeeland Ridges. Photo by Jan Glimmerveen

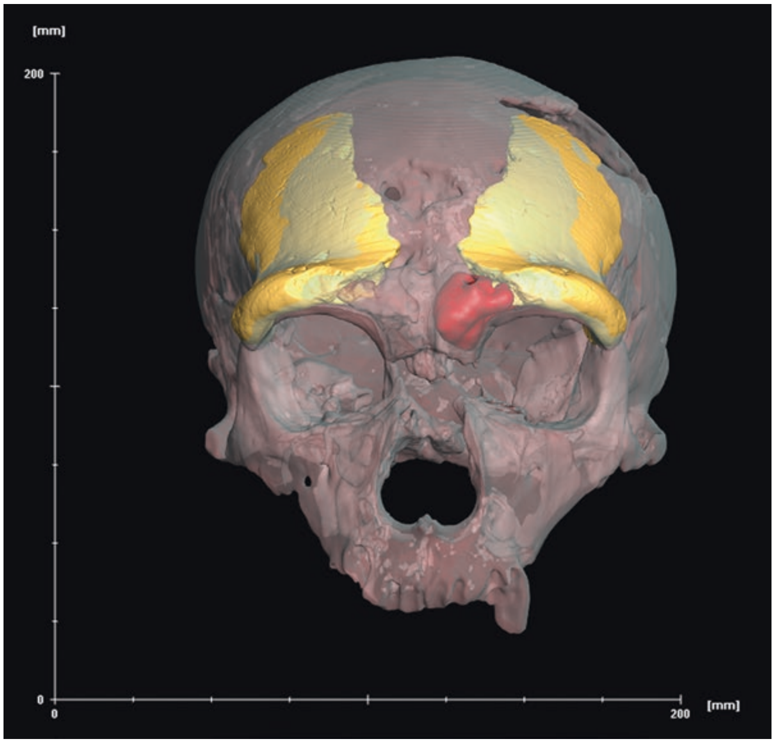

Fig. 8.6 3D scan of the Neanderthal frontal bone (right on the picture) projected on the La Chapelle-aux-Saints (France) Neanderthal skull. The red zone indicates the location of the cavity that was identified as a lesion resulting from an epidermoid cyst. The frontal bone fragment has been mirrored to the other side of the skull. Courtesy J-J Hublin, Max Planck Institute for Evolutionary Anthropology, Leipzig

egory of finds of the collector and identified years after it had been picked up as a potential Neanderthal brow-ridge. Physical and chemical analyses were conducted at the Max Planck Institute in Leipzig. There was insufficient collagen left to produce a radiocarbon date. However, an elaborate analysis of the skull fragment's morphology indicated that it is 3000 times more likely that the fragment belongs to a Neanderthal than to an anatomically modern human. Additional analysis indicated that it probably belonged to a young adult male individual. Furthermore, carbon and nitrogen isotope analysis indicated that the individual probably had a predominantly carnivorous diet, typical for Neanderthals. Finally, the bone showed a cavity behind the brow ridge which was identified as a lesion resulting from an epidermoid cyst. This palaeopathology had never been documented before in Neanderthals.

Finding the first Dutch Neanderthal is of interest (Amkreutz et al. 2010). Unlike the surrounding countries of Germany, Belgium and Britain, the Netherlands has no caves, which are known to provide good contexts for the preservation of Neanderthal remains. The piece therefore forms a welcome addition to the information in the Netherlands from this period, which is otherwise largely based on lithics. The find is, however, even more important since it derives from the North Sea. It is indicative of the enormous potential of the Pleistocene and Holocene archaeological archive offshore from our coast. As such it is also a symbol of the current large increase of this archive through unmonitored industrial activities such as mining for aggregates, fishing, construction of cable infrastructure and other offshore industries.

A recent geological study made it possible to correlate offshore stratigraphic units in the Middeldiep area with onshore deposits dated between 50,000 and 30,000 BP (Busschers et al. 2007; Hijma et al. 2012). This would place the flint tools and Neanderthal fossil at the end of the Middle Palaeolithic, which is in line with the morphological features of the Neanderthal frontal bone (Hublin et al. 2009). The Zeeland Ridges area may currently be designated as one of the most interesting zones where prospects for finding well preserved sites are good.

8.3.4 Maasvlakte-Europoort

When the Port of Rotterdam was extended in the early 1970s, land reclamation was based on the extraction of mudspoil from various locations in the Rotterdam harbour area (Verhart 1988). At the pristine surface and along the new shores of this reclaimed land, Maasvlakte-Europoort, private collectors found fossil bones, as well as bone artefacts, mostly barbed points (Louwe Kooijmans 1970/1971). Over the years, over 500 points (Fig. 8.7) have been reported, which are of Preboreal to Boreal age (Verhart 1988). From the conditions of discovery, it is clear that the Maasvlakte-Europoort collection cannot be considered as an assemblage with high integrity. However, in consideration of information on the origin of the sand used for land reclamation, all material has to come from a rather restricted area. Verhart (1988) has suggested that the concentration of points in the area is related to the specialised exploitation of a near-coastal lagoon, e.g. spearing of aquatic mammals and fish. However, the stratigraphic origin of these finds always remained obscure. New construction works in the Port of Rotterdam subsequently provided opportunities to collect information about the possible context of these materials (see below).

8.3.5 Coastal Areas and Beaches with Coastal Reinforcement

Along the Dutch coast, several locations are known where prehistoric artefacts are regularly found. In general, these are locations where sand

Fig. 8.7 Mesolithic bone points from Maasvlakte-Europoort. The largest point, third from left, is 95 mm in length. Photo courtesy National Museum of Antiquities, Leiden, the Netherlands

is deposited for coastal reinforcement; the sand is dredged up from various, nearby offshore locations (usually at distances up to 10 km) and transported by pipelines or sprayed on the beach (Verhart 1995, 2004; Amkreutz et al. 2017). Clearly, these find spots are of limited archaeological value regarding their geological context, yet they also provide further clues to the potential of the North Sea. A well-known site is the beach at 'Hoek van Holland'. This location has yielded several barbed points as well as a shaft-hole antler axe. At Scheveningen, a shaft-hole antler axe was found amidst sand coming from 30 km offshore. At Monster, flint nodules, some worked flint, barbed points and bones were found amidst sand dredged from a depth of around 26 m at 5–7 km off the coast (Verhart 1995). In both cases an Early Mesolithic date for the finds is most likely. Additional finds have been reported recently from these locations, as well as from a number of other locations along the Dutch coast, e.g. near Kijkduin. Other finds derive from Colijnsplaat and include several pieces of worked antler of Mesolithic and Neolithic age (Louwe Kooijmans 1970/1971). Occasionally, Palaeolithic artefacts are found as well, as at Petten in North Holland. One of the most important sites is the 'Zandmotor' ('Sand engine'). This is a large artificial beach situated in front of Kijkduin and Ter Heijde and intended as a natural method of beach replenishment. In total 21.5 million cubic meters of sand extracted off the coast were deposited here over an area of 128 hectares. This area, apart from many finds of fossil fauna, has now yielded many hundreds of lithic artefacts, including tools of Palaeolithic and Mesolithic date, tools and waste products of bone and antler, pieces of jewellery and human bone dated to the Mesolithic.

8.4 Rotterdam-Yangtze Harbour: Investigating an Underwater Site

Cooperation between the Port of Rotterdam, local and national authorities, and scientists has permitted for the first time an integration with the construction workflow of systematic geoarchaeological surveying and an 'excavation' (Weerts et al. 2012). As Early Holocene land surfaces were expected to be present at depths between 17 and 22 m below sea level, it was impossible to follow the usual land-based surveying strategies. Geological information indicated the presence of one or more Late-Glacial river dunes in the Yangtze harbour basin. A model of the submerged and sediment-covered land surface was constructed on the basis of additional sediment cores and seismic data (Vos et al. 2010). Based on the knowledge of the use of river dunes by prehistoric people in the Central Netherlands river area, two areas of high archaeological potential were selected for further investigation. This led to the discovery of a Mesolithic site at a depth of 20 m below sea level (Moree and Sier 2015).

In the autumn of 2011 a small-scale 'excavation' was conducted by means of a special grab-sampler that permitted exact horizontal and vertical positioning from a pontoon (Fig. 8.8). Each grab sample filled two big bags with sediment that was subsequently wet-sieved through a 10 mm and 2 mm mesh. The archaeological material found consists of thousands of fragments of bone, flint artefacts and charred plant remains (Fig. 8.9). Although the spatial resolution of the excavation is not ideal, the results are of immense value for our understanding of human adaptations in a dynamic landscape. The combined information from the excavation and a series of high-quality piston cores, which were sampled for high-resolution palaeoenvironmental analysis, has permitted a very good insight into the hunter-gatherer occupation history of the dune, in the context of landscape change. Starting in the second half of the Preboreal, activities were conducted on an inland floodplain landscape. The dune continued to be used until the first half of the Early Atlantic period, when sea-level rise led to its flooding (Fig. 8.10). The results from this research currently provide the earliest evidence for Mesolithic coastal activity in this sector of the North Sea (Peeters et al. 2015).

Fig. 8.8 Use of specially designed grab sampler for excavation at the Maasvlakte excavation showing a large bag being filled with sediment sampled from a sand layer at 18 m below sea level. Photo by Dimitri Schiltmans, BOOR

Fig. 8.9 Residue from one of the large bags being checked for the presence of archaeological material, such as knapped flint, burnt bone and charred plant remains. Photo by Dimitri Schiltmans, BOOR

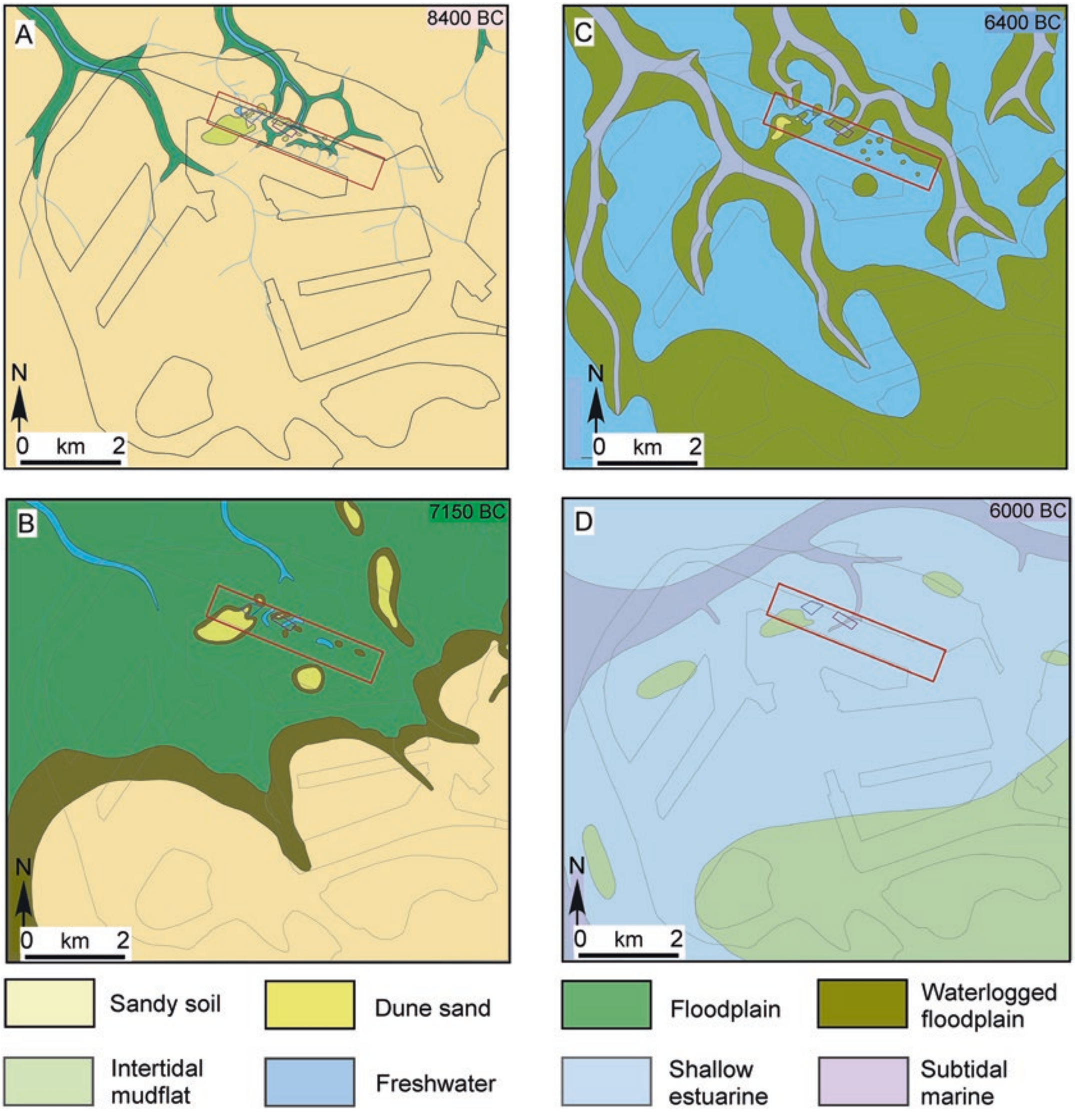

Fig. 8.10 Schematic representation of palaeogeographic development and flooding of the Yangtze Harbour area. (**a**), 8400 cal BC: the investigated site (within the red rectangle) is located at the fringes of the floodplain in the dry hinterland; (**b**), 7150 cal BC: the investigated site is located on the floodplain, which became part of an extended wetland zone; (**c**), 6400 cal BC: the investigated site is located on the floodplain, which became part of a tidal area; (**d**), 6000 cal BC: the investigated site transformed into a mudflat in a subtidal zone in an estuarine area. From Moree and Sier (2015)

8.5 Diets and Cultural Traditions from Submerged Finds

An important criticism of the Dutch situation is that most of the finds are in secondary contexts, either hauled up in fishing nets or more often deposited ashore by the gravel industry, sand replenishment for beach reinforcements or other infrastructural projects. The available contextual information is often limited to a certain area offshore where the sediments were extracted. While this criticism is correct, it fails to address two points. The first is that the quantity and quality of many of the finds indicate that there is much potential for the presence of intact sites. The excavations in the Yangtze harbour also substantiate this potential. While subsurface excavation is costly, more intensive prospection may provide a better context for the coarse find-locations (e.g., Hijma et al. 2012). Secondly, the criticism does not acknowledge the fact that the finds themselves also represent a hitherto little explored potential. The many finds of bone and antler points from various areas on the coast are gradually revealing patterns in style and execution that may be chronological or cultural (Amkreutz and Spithoven 2019). This potential is even more distinctly demonstrated in an analysis of 33 human Mesolithic bones that were fished from the North Sea or deposited ashore by the aggregates industry. The research by Van der Plicht et al. (2016) focused on the isotopic content of these bones and measured the composition of the stable isotope ratios of carbon and nitrogen, $\delta^{13}C$ and $\delta^{15}N$. These are informative on the trophic chain and the dominant type of food consumed, as they differ according to the trophic level of the consumer and the degree to which food intake includes aquatic resources. The raised levels of the Mesolithic bones clearly point to a dominant contribution of freshwater resources (Fig. 8.11). Unfortunately, the reservoir effect hampers the exact calibration of the radiocarbon dates of the bones, but their Mesolithic age and relative chronological position with regard to carbon and nitrogen levels demonstrates a clear trend. It appears that over time Mesolithic diet became increasingly aquatic. Apart from fish, this may also have included waterfowl and species such as otter and beaver. This ‘Doggerland-menu’ of course relates to the fact that the low-lying basin of the North Sea gradually drowned after the Last Ice Age (between 9500 and 6000 cal BC). Previously, it was often assumed that this submergence forced people out of the North Sea Basin or that they adapted to a diet characterised by marine resources. The current research, however, changes this idea. The importance of freshwater sources indicates that the inhabitants made the most of the changing environment and of the developing wetlands that expanded around them in the delta areas of the Meuse, Rhine and Thames before the area finally flooded. This is not strange as these freshwater wetland areas are among the richest in (food) resources worldwide (Nicholas 2007). Later Mesolithic sites in the Rhine-Meuse delta of the Netherlands confirm this focus on aquatic resources (Louwe Kooijmans 2003; Smits et al. 2010), but the research particularly underlines the fact that flooding should not always be regarded as a catastrophe (see Leary 2009) and that the Mesolithic inhabitants demonstrated a strong flex-

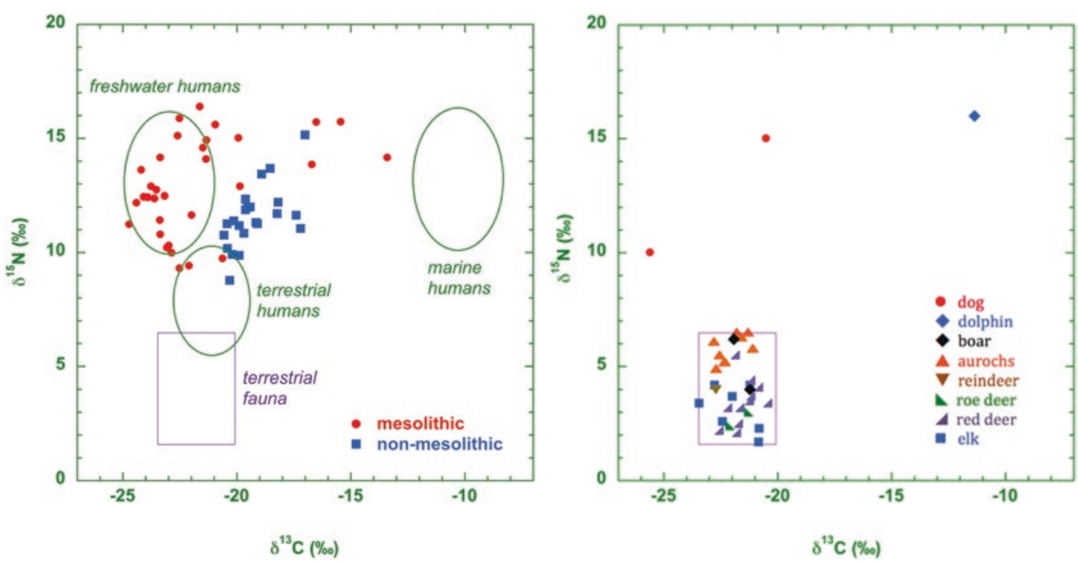

Fig. 8.11 Comparison between stable isotope data of human remains (left) and terrestrial mammals (right) from the North Sea. From Van der Plicht et al. (2016)

ibility in changing their lifeways, traditions and diet (Amkreutz 2013). This is of relevance for further studies into the Mesolithic, but perhaps also has some repercussions for current debates regarding rising water levels and climate change. Finally, it underlines the fact that isolated finds with little contextual information may nevertheless form an important contribution to our knowledge, especially when they come from a largely unexplored and vast prehistoric landscape in front of our coast. Recent information that Mesolithic bone material from the North Sea is particularly suitable for aDNA analysis further underlines this perspective (see Bailey et al., Chap. 10, this volume).

8.6 Collections and Developments in Heritage Management

The responsibility for the offshore archaeological heritage lies with the Cultural Heritage Agency (Rijksdienst voor het Cultureel Erfgoed, RCE). However, legislation concerned with archaeological heritage is restricted to the waters falling under national jurisdiction, and (in strict terms) applies only to items made by humans. Although there is an obligation to report finds from these waters to the authorities, this is often not done. However, stray finds are more often reported to the National Museum of Antiquities (Rijksmuseum van Oudheden Leiden). Palaeontological finds (or other non-human items) without any sign of human interference are not covered by the Monuments Act. National museums, such as the Natural History Museum Rotterdam and Naturalis (Leiden), play an important role in the registration and storage of this category of finds. Apart from these official institutions, private collectors play a pivotal role. Both archaeological and palaeontological finds are mostly kept by individuals, who may, or may not, be organised in workgroups, such as the ‘Werkgroep Pleistocene Zoogdieren’ (Workgroup Pleistocene Mammals) or the ‘Archeologische Werkgemeenschap voor Nederland’ (Archaeological Work Community for the Netherlands).

This situation poses some problems, as it is difficult to get an up-to-date overview of prehistoric finds and sites from the Dutch part of the North Sea (also see Verhart 1995). Even more important is the problem of getting access to the wharves where thousands of fossils and artefacts are brought ashore on a yearly basis. Both finds from waters within, and beyond national jurisdiction, are at risk of disappearing from view without ever having been spotted. In addition, as legislation only applies to artefacts, other materials, such as mammal bones, fossil tree trunks or even lumps of peat, which provide a lot of information relevant for the reconstruction of the (environmental) past, are artificially separated from human-made items (see also Van Kolfschoten 2006). This is in marked contrast to the situation of terrestrial archaeology. Fortunately, recent developments demonstrate a change of attitude in this respect, for instance in the context of the Port of Rotterdam. Additionally, in 2016, a group of professional and amateur researchers started to collaborate in the informal ‘Doggerland Research Group’ (Werkgroep Steentijd Noordzee). They have compiled a list of c. 100 amateurs with archaeological artefacts from the North Sea in their collections. Their aim is to investigate new finds, document sites and collaborate with different government bodies and commercial parties in protecting and researching prehistoric archaeology from the North Sea. As the archaeological record as we know it today is clearly biased, joint efforts to produce an inventory of finds and clarify their context is crucial.

Alongside the efforts to build an inventory of finds originating from the North Sea, indicative models of archaeological significance are being developed on the initiative of the Ministry of Infrastructure and the Environment (Rijkswaterstaat) and the RCE. Large-scale economic developments (e.g. wind farms, aggregate extraction) in the near future need a proactive approach with regard to the archaeological heritage. The focus is no longer restricted to historic wrecks; the prehistoric heritage in its palaeoenvironmental context is now explicitly considered. One model (Fig. 8.12) covers the Dutch sector of the continental shelf and indicates the possible

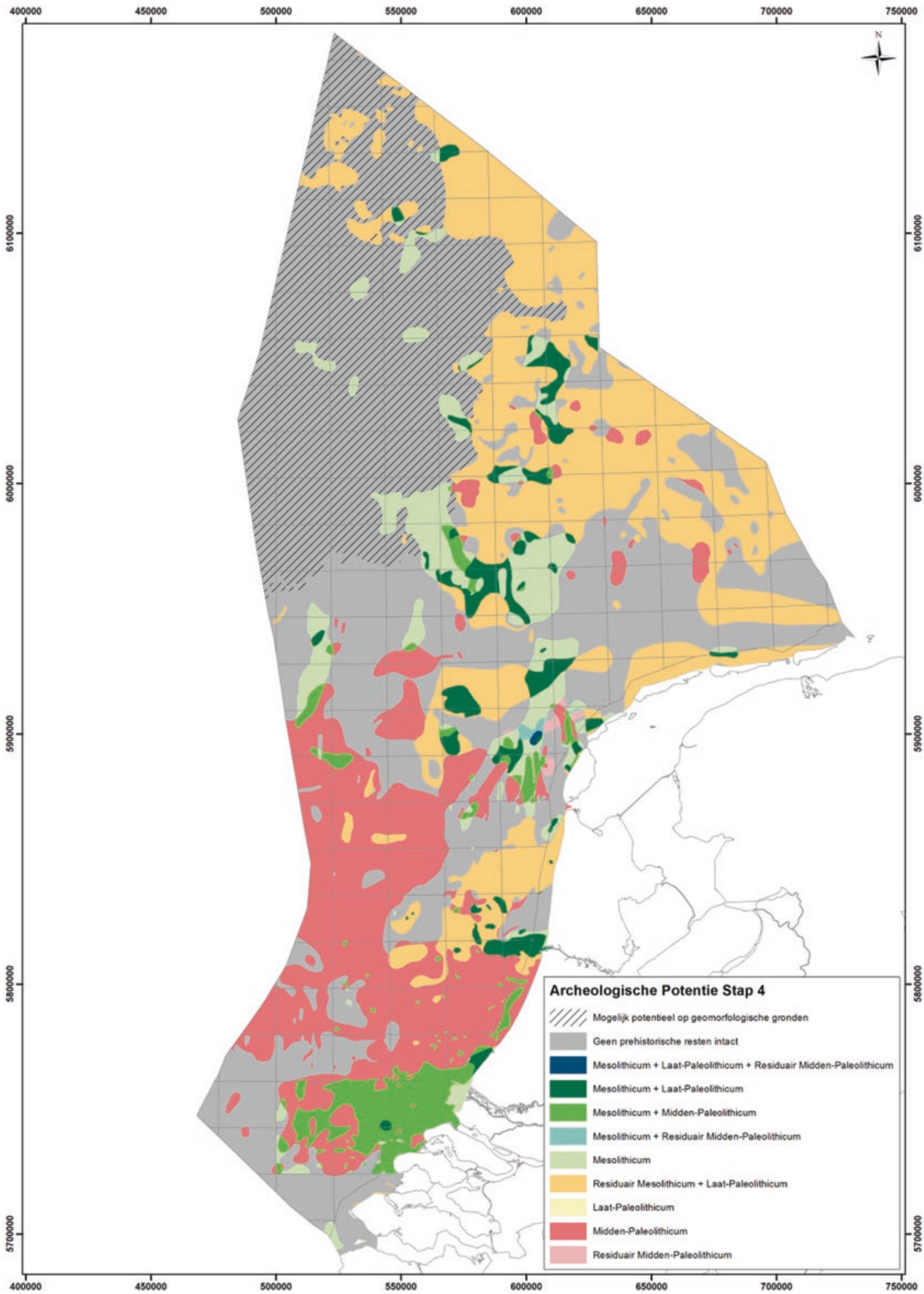

Fig. 8.12 Indicative map of archaeological potential of the Dutch sector of the North Sea. Different areas have potential for archaeology of different periods ranging from Middle Palaeolithic to Mesolithic. Colour codes refer to different archaeological periods or combinations of periods. From Vonhögen-Peeters et al. (2016)

presence of prehistoric remains based on a geoarchaeological assessment of mapped lithostratigraphy (Vonhögen-Peeters et al. 2016). A second model, which is still under construction, focuses on the 12-mile zone which is specifically targeted for sand extraction. In this model, particular attention is focused on the spatial extent and intactness of early Holocene basal peat and the effects of tidal erosion in relation to the terrestrial archaeological record on the Dutch coast.

A further step has recently been taken in a joint project by the TNO-Geological Survey of the Netherlands/Deltares and the Netherlands Institute for Sea Research (NIOZ). The project involves an offshore survey of basal peat by means of seismics and high-resolution vibrocore sampling, focused on the study of Early Holocene sea-level rise and its effects on environmental conditions. The first results are very promising, due to the collection of well-preserved sections of peat, as well as (unexpected) gyttja deposits which can be connected to the initial effects of sea-level rise (personal communication Mr. Freek Busschers). Such new data are crucial for the assessment of previously collected data and core descriptions which mostly focused on other issues than palaeoenvironmental developments and archaeology.

8.7 Conclusions and a Look to the Future

The preceding pages show that the current state of knowledge about submerged archaeology and landscapes in the Dutch sector of the continental shelf is still restricted. However, the situation has changed considerably since the NSPRMF (2009), and new initiatives are being taken. Many finds originating from this drowned world are known, but numbers are rapidly growing now that the richness of archaeological and palaeontological materials found on beaches and originating from sand extracted from the North Sea floor is attracting considerable attention from the media and private collectors, as well as from scientists.

The first steps towards contextualisation of these finds through the radiocarbon dating and isotope analysis of palaeodiets make it clear that there is great potential and scientific value in such material. Efforts to investigate submerged sites at considerable depth under conditions where diving is impossible (Rotterdam Yangtze Harbour) has shown that significant data and information can be obtained despite many restrictions. It is a matter of choosing between doing nothing and remaining uninformed about contexts of finds and human-landscape relationships in a submerging world, or trying to make the best out of it, while accepting that one cannot obtain the resolution/control that we are used to onshore. The experience in terms of engineering and logistics is highly valuable and serves as an example for projects elsewhere.

An important spin-off from the Yangtze project is the compilation of an inventory of collections and finds; the opportunities created for private collectors to collect bones and artefacts on the artificial beach of Maasvlakte 2 and have these identified by palaeontologists and archaeologists triggered a lot of enthusiasm. In the wake of all this, the significance of submerged prehistory and landscapes has caught the attention of policy and decision-makers who have to operate within a dynamic context of economic interest and valuation. Finally, we are witnessing targeted offshore research which has direct archaeological significance, and which goes beyond the submerged parts of the Dutch continental shelf.

We should, however, consider these developments as first steps towards more structured investigations of this submerged heritage. It is evident that the economic stakes are high in the offshore environment, and that legally embedded safeguarding of the prehistoric heritage, be it through excavation or in situ preservation is unrealistic as long as expectations cannot sufficiently be underpinned with empirical data. The challenge is big, but we are confident that progress can be made by means of both established and innovative approaches, but above all through a willingness to experiment and deviate from established conventions.

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