Tentsmuir

Ten Thousand Years of Environmental History

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To the Memory of

Dr John Berry

CBE, DL, FRSE, LLD, D.Sc, Ph.D

1907- 2002

First Director of the
Nature Conservancy in Scotland

and

creator in 1954 of the
Tentsmuir National Nature Reserve

At Tentsmuir in 1999

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Preface

The Tentsmuir Peninsula lies between the estuaries of the rivers Tay and Eden and is remarkable for being one of the largest natural areas of wind-blown sand and dunes in Scotland. This peninsula stretches for just over 7 miles from north to south and almost 3.5 miles from east to west and is outstanding for being entirely a post ice-age development. The post-glacial advance of the coastline seawards has not been a continuous process. There have been both advances and retreats of the shoreline, which continue to take place.

Despite the fragile nature of this sandy coastal terrain, Tentsmuir has been a scene of human activity for over 10,000 years. It witnessed one of the earliest known occurrences in Scotland of Mesolithic hunter-gatherers and has supported human activities throughout the Neolithic, Bronze and Iron Ages. In medieval times it was in turn, a home for the Norman nobility, a royal hunting forest with highly valued fishing rights, as well as being a summer grazing for local pastoralists with tents (hence the early name *Tentis muris* (Taylor with Márkus, 2012).

In more modern times it was valued by the early agricultural improvers of the 18th century for the manner in which the land warmed in summer. A combination of high sunshine levels due to the shelter of the mountains to the north and west, and the sandy nature of the soil made it one of earliet areas in Scotland for harvesting grain in the 19th century.

Despite the activities of agricultural improvers, the blockage of drainage by the front line of dunes causes a significant rise in the level of the winter water table. Consequently, agriculture, and forestry are limited in the extent to which they can be profitably pursued. This restriction, together with the rigours of the coastal environment was important in preserving natural refugia for a wide range of plants, as well as resident and migrating birds and other animals. Tentsmuir's mid-Scotland location also offers habitats suitable for both northern and southern species which contributes greatly to the biodiversity of this outstanding setting for wildlife conservation. The uniqueness of this coastal region, therefore led to the creation of a National Nature Reserve of 92 acres at the north-eastern end of the Tentsmuir Peninsula in 1954. Since then, an active period of coastal accretion more than trebled the size of the Reserve, which is now unfortunately eroding in places. For the future, the probability of rising sea levels and increasing exposure to storms may cause a level of destruction such that the physical existence and biological future of Tentsmuir cannot be guaranteed.

Acknowledgements

A work of this wide range could not have been undertaken without the stimulation and encouragement provided by Scottish Natural Heritage and in particular Tom Cunningham, Manager of the Tentsmuir Reserve when this book was written. His help in searching out information, contacts, and illustrative material has been invaluable, He has also read every chapter with his wife Peta, to the book's great advantage. Numerous colleagues and friends have also read and helped with various chapters. I am greatly indebted to Professors John and Bryony Coles, Dr. Torben Bjarke Ballin and the late Alan Saville for the pre-historical section. I had generous advice on place names from early times to the present day from Dr. Simon Taylor. I am also greatly indebted to Professor Christopher Smout and my wife Barbara for historical advice.

Dr. Anne-Marie Smout and Dr. Ron Summers were of great assistance in relation to the rich bird-life of Tentsmuir. Professor Stephen Buckland was extremely generous in providing many fine bird photographs. An account of the butterflies and moths would not have been possible without the benefit of the detailed knowledge that was generously shared by David Bryant and Gillian Fyfe. Many past students from St Andrews University Botany Department assisted in mapping physical changes and measuring water table levels at Tentsmuir over the past 50 years.

I am particularly indebted to Mr. Willian Berry (6th of Tayfield) for allowing me access to historical documents and family photographs. The family of Tentsmuir's outstanding naturalist and artist, the late Len Fullerton, kindly gave permission to reproduce a selection of their father's evocative illustrations of Tentsmur's wildlife. The final version of the text was greatly improved with Dr. Bill Starkey's careful attention to detail for which I am very grateful.

Chapter One

Tentsmuir in prehistory

Where the estuaries of the rivers Tay and Eden flow into the sea there lies a peninsula, entirely made of sand and water, shaped over the millennia by constant confrontation with changing ocean levels and tidal currents. This large sandy region now called Tentsmuir is an ecological palimpsest in that it has a history that has been written, erased, and rewritten by constant interaction between sand and water. World-wide, the ice age covered the polar regions of the Earth in deep deposits of ice to such an extent that the sea level was lowered globally by up to 120m.

With the passing of the last Glacial Maximum c.18,000 years ago, the ice started to melt and sea levels gradually recovered to their pre-Pleistocene level. This global increase in sea-level which brought about a world-wide coastline retreat is referred to scientifically as eustatic rise. However, this was gradually reversed as the pressure of the ice on the Earth's crust lessened and the land began to rebound. This recovery of land from marine inundation is referred to geologically as isostatic rise. The extent of the Holocene isostatic land-rise has varied from place to place as during the Pleistocene period the depth of the ice would not have been even, and therefore the depression of the land would not have been uniform due to differences in the weight of the ice.

At Tentsmuir, as elsewhere, there would have been advances and retreats. Temporal and spatial patterns of relative sea-level change in the north of Britain and Ireland have occurred during four major episodes. Each episode was marked by a rise in sea level, causing a retreat of the shore-line, followed by a period of isostatic rebound, which usually more than compensated for the previous eustatic coastal retreat (Smith et al., 2012).

In Scotland many examples of rising land levels are seen in raised beaches of varying age and height. West

Figure 1.1 Craigie Hill, N.E. Fife, where the former early Holocene shore line lay with sea cliffs now covered by Kirkton Barns Wood, before the beginning of the accretion of the Tentsmuir sand-deposits.

of Tentsmuir, an early post-Pleistocene coastline location is visible as a former sea-cliff (Craigie Hill) on the west side of the B945 road to Tayport. This former Pleistocene-Holocene boundary sea-cliff is now 3.5 miles from the sea (Figure 1.1).

Mesolithic Tentsmuir

It is not clear just when the sea retreated from this ancient cliff at Craigie Hill. It is evident however that by 10,000 years ago the coastline had advanced a considerable distance seawards. It was here that a coastal Mesolithic presence was discovered on the high ground of the 'Old Quarry' field approximately 2.5 km northeast of the cliff at Craigie. This discovery came to light when some flints were first collected from molehills and other exposures. This site of early human activity at Tentsmuir is now just under 2.5 miles inland from the sea. However, at the time of its early human occupation it was adjacent to the shore, either as a peninsula or possibly an island (Figures 1.2-3).

This early site (Morton A) was first excavated between 1963-7 by the original discoverer R.D.M. Candow with Dundee Museum and Art Gallery. The site was then further investigated in 1969-70 by J.M. Coles and included on this occasion an additional trench (Morton B). Further excavation of these two sites (Morton A and B) have revealed what is apparently a place of early human Mesolithic seasonal camping activity (Candow, 1989).

Further excavations at both sites found numerous artefacts, including various small and large end-scrapers, burins (engravers), awls and a variety of microliths (Coles, 1971). Hammerstones, together with grinding and polishing stones were found and also hearths, and stake holes, which probably served as the fastenings for wind-breaks around sleeping areas. It would appear that at the time of this early occupation, the high ground of the 'Old Quarry' field was a low island, 225 by 75 m linked to the mainland only at low tide. Whether or or not hunting groups from differing localities shared the site together at any one time is not clear.

The first of the two sites that were investigated (Morton A) was near the highest part of the former promontory at 12 m (OD) while the second (Morton B) lay on the northern slope of the promontory, 40 m NE of Morton A. It would appear from the bivouac nature of the sleeping arrangements, that these sites were probaby occupied mainly in summer for

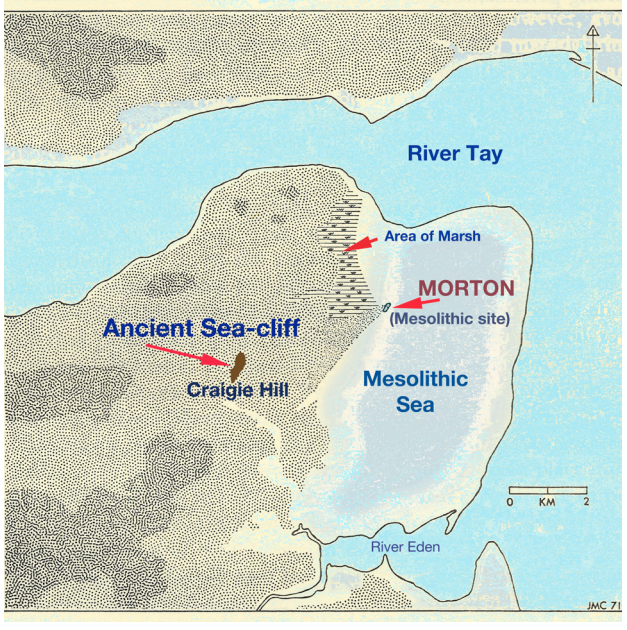

Figure 1.2 Conjectural map of the Morton area, *c.* the 5th millennium BC showing Morton as an island. Stippled areas are land over 50 feet O.D., rising inland to over 300 ft. (double stipple). To the northwest of Morton is an area of marsh. Blue shading indicates the present position of the sea. The light partially coloured area would most probably have been the sea at the time of the last Mesolithic human occupation. (Map reproduced and adapted with permission from Coles et al., 1971).

Figure 1.3 Site of the excavation of the Mesolithic site at Morton.

accessing food resources from this maritime location. The stone tools of Morton contain raw materials from St Monans, Wormit, the Sidlaws and Ochil Hills and the southern Tay shore and Fife coast as well as stone of local coastal or stream gravel origin (Coles, 1983).

The promontory covers an area of 6000 m^2, of which probably under 400 m^2 were occupied, and of this only 60 m^2 were stratigraphically excavated at site A sufficiently to detect different occupation horizons (Coles, 1983). The typology of the flint microliths is diagnostic of the Early Mesolithic and suggests that this first phase of the Mesolithic occupation of Morton is most likely to predate *circa* 8500 cal. BC as after this time there was a change to a later type of lithic tool (Saville, 2008). The early microliths were in the shape of isosceles triangles (*in which it is the two shorter sides that are of equal length*), but after 8500 cal. BC they were replaced by a more elongated form of triangle (*in which the two longer sides are the ones of equal length*).

These Mesolithic sites would have been cold and exposed in winter. It is probable however, from the species composition of the mollusc population which co-habited the site with its human population, that the climate would have been relatively dry with fallen timbers and deep shade. Similar settlements along the north shore of the River Tay might represent temporary occupations, either from Morton or other contemporary people (Coles, 1983).

The excavations at Morton (Figure 1.4) have revealed evidence also of extensive marine beach deposits which indicate that the location of the site at the time of occupation was close to the main post-glacial shoreline (Coles, 1971). Fish bones included; Cod, Haddock, Turbot, Sturgeon, Salmon (or Sea Trout). The bones of birds were mostly of species that inhabit open water which included Fulmar, Gannet, Cormorant, Shag, Puffin, Razorbill, and Guillemot. Thrush and Crow (either carrion or hooded) were also found. It was suggested that some of these species may have been caught at sea or else found after being driven ashore by storms. The animal remains included red and roe deer, wild cattle and wild boar, as well as hedgehogs and bank voles.

Some evidence was found for the use of plants, which, in addition to Hazel nuts included, Orache (*Atriplex patula*), Fat Hen (*Chenopodium album*) and Corn Spurrey (*Spergula arvensis*). The physical evidence in relation to the nature of the site suggests that it would most likely have been used for a series of seasonal occupations of the promontory over periods lasting between 200-500 years during an overall 2000 year history of periodic visitations. The small number of stone artefacts found on each occupation surface was taken to indicate the temporary nature of the camps (see Figure 1.5).

The number of people occupying the site at any one time and collaborating in building fences and having animal-drives or even constructing weirs for fish

traps, could not be accurately estimated but was thought to be in the region of 40-50 persons (Coles, 1983).

Mesolithic shell gatherers

Morton B contained a large quantity of seashells. Similar large shell midden mounds have been found around the coasts of Britain and Ireland. However, it is on the shores of Mainland Scotland and the Western Isles that have some of the largest deposits indicating the importance of shellfish in the Mesolithic diet. These have yielded further information as to the seasonal activities of the Mesolithic shell gatherers as the shells of the common cockle grow at varying rates at different times of the year, depending on air and sea temperatures and the salinity of the water. Given a constant supply of food experimentally, the greatest growth rates of cockles have been found to be in spring and early summer (Ibarrola et al., 2008).

A study of these shells at Morton has shown that a high

Figure 1.4 Excavations in progress at Morton (1969) with the Cambridge supervisor and three ladies from Dundee. (Photo courtesy of John Coles.)

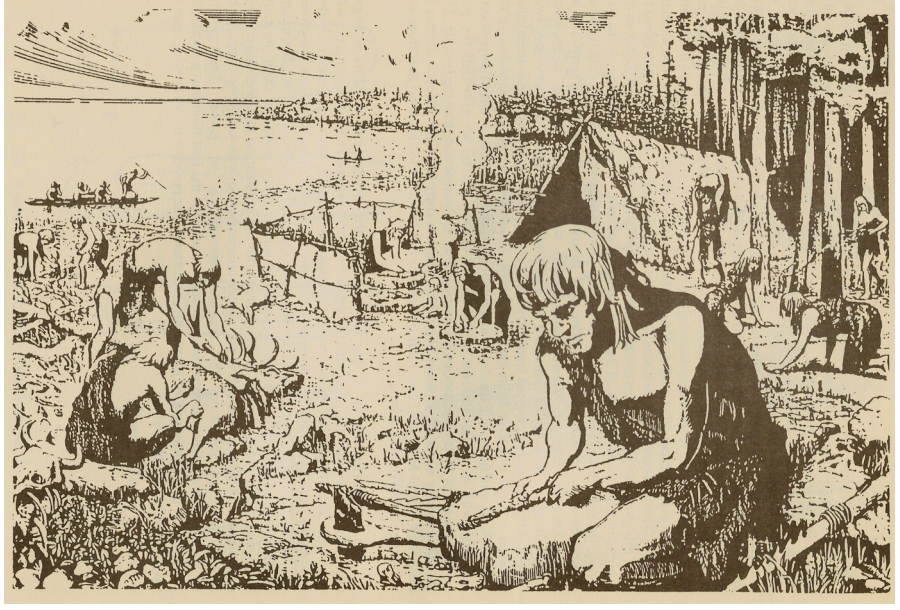

Figure 1.5 A Dundee Museum artist's impression of Mesolithic Morton (Reproduced with permission from Candow (1989).

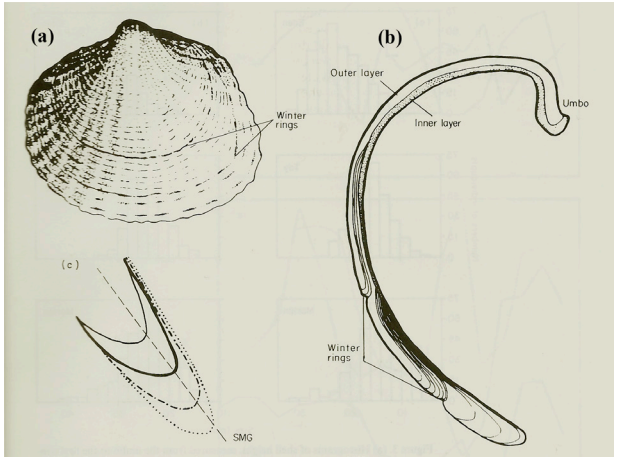

Figure 1.6 Shells of the Common Cockle (*Cerastoderma edule*). (a) Shell showing two winter rings on the outer surface of the shell. (b) A radial section shows the winter rings as indentations in the shell. (c) The growing edge in section, shows the last two increments laid down (continuous lines) and the two about to be deposited (dotted lines). (Reproduced with permission from Deith 1986).

proportion of them had been harvested high on the beach and although no particular season was found, there was evidence within the structure of the shells (Figure 1.6) that the cockles were harvested in winter as well as summer even although those harvested in winter would have been less nutritious than those harvested in summer (Deith, 1983, 1986).

An additional feature of Mesolithic shell fish harvesting is the fact that the shells were not just dumped, but were used to create large mounds. It has been suggested that these almost monumental-like middens may have had a symbolic purpose as they could have served for marking out the position of a particular band's stretch of beach (Deith, 1986). Given that Morton was not a permanent residential site, but one that was visited regularly over a long period, would indicate that already by the Mesolithic the very human attribute of having a sense of property, and the need to identify such ownership had already become part of human behaviour.

These excavations (Morton A and B) have revealed two major phases of Mesolithic occupation. The earlier phase was abandoned and covered by wind-blown sand before a later phase. Samples of bevel-ended bone tools from the Morton B site have provided radiocarbon (C-14) dates which point to the 5th millenium BC for this later occurrence and suggest that there could have been a gap in human occupation at Morton of 4000 years (Bonsall et al., 1995; Saville, 2004). The length of this gap is strange, in that it suggests that no people visited Morton for such a long time, even although the region was readily accessible (see below).

Mid-Mesolithic remains in Fife are not unique to Morton. Not far away at Fife Ness, evidence of Mesolithic activity has been found with C-14 dates from around the middle of the 8th millennium BC (Wickham-Jones and Dalland, 1998). Other Mesolithic sites have been found at Broughty Ferry, on the other side of the Tay Estuary from Tentsmuir and also at Aberdour near South Queensferry. This latter site was discovered during the excavations for the second Forth Road Bridge Queensferry Crossing. Here, remnants of a Mesolithic hut circle were found on the south bank of the Forth. The dwelling, probably for seasonal use, as at Morton, was based around an oval pit approximately 7 metres (23 ft) in length, which has been dated to around 8240 BC, making it the earliest known dwelling in Scotland (Cowing, 2012).

Norwegian Holocene Storegga Slide tsunami

Since these excavations were carried out there has been an accumulation of evidence for the deposition of massive sand and silt deposits at many sites on the east coast of Scotland. At first, some of these deposits

were thought to have been the result of an '*exceptional tide*." It is now realized that these deposits were caused by a widespread mid-Holocene coastal-flood caused by a tsunami generated by a submarine slide on the continental slope off the mid-western coast of Norway (Figures 1.7-8) referred to as the *Norwegian Holocene Storegga Slide tsunami*.

This struck the east coast of Scotland with a 70 feet (21 m) high tsunami along a stretch of coastline over 600 km long (Smith et al., 2010).

Subsequent percolation of peat deposits into the Scottish tsunami layers have caused some confusion in defining an exact date for the tsunami. However, recent studies based on the Norwegian deposits indicate a probable date of 8,100-8200 cal. BP (Vasskog et al., 2013).

Tsunamite, (the deposit left by a *tsunami*) dating from this event can be found at various Scottish coastal locations, including some Shetland Islands and is today a feature in the Montrose Basin, where there is a layer of deposited sand about 0.6 metres (2.0 ft) thick. (Figures 1.7-8).

The *Norwegian Holocene Storegga Slide tsunami* left its mark on Tentsmuir. Towards the western edge of the Tentsmuir Peninsula near Craigie, the rising ground consists of raised beaches from the last glacial period (Late Devensian). These raised beaches, are dissected by a number of gullies leading eastwards which are now filled with peat bogs. The largest of these is Silver Moss which lies within St Michaels Wood. Here a series of varied deposits of geological detritus have been found with prominent layers of grey, micaceous, fine

Figure 1.7 Deposit 2 feet thick in Montrose Basin caused by the Storegga tsunami (Photo courtesy of Wikipedia Commons).

sand. As with other similar deposits, they were at first thought to be due to storm surges, but have now been identified as being a result of the *Norwegian Holocene Storegga Slide tsunami*.

At, or about the time of the last *Storegga Slide*, there was an area of land known to archaeologists as 'Doggerland.' This name was given by B.J. Coles (Coles, 1988) for the land that once linked Great Britain, Denmark and the Netherlands across what is now the southern North Sea (Figure 1.8). The Dogger Bank is so named from the Midde Dutch name for a Cod Fishing boat. The *Doggerland* is believed to have included within its coastline areas of lagoons, marshes, mudflats, and beaches, which provided rich hunting, fowling and fishing grounds for Mesolithic peoples (Coles, 1998; Coles, 2000). Although much of Doggerland was already physically submerged by the time of the tsunami due to a gradual rise in sea level (Ballin, 2016) it has been suggested that the

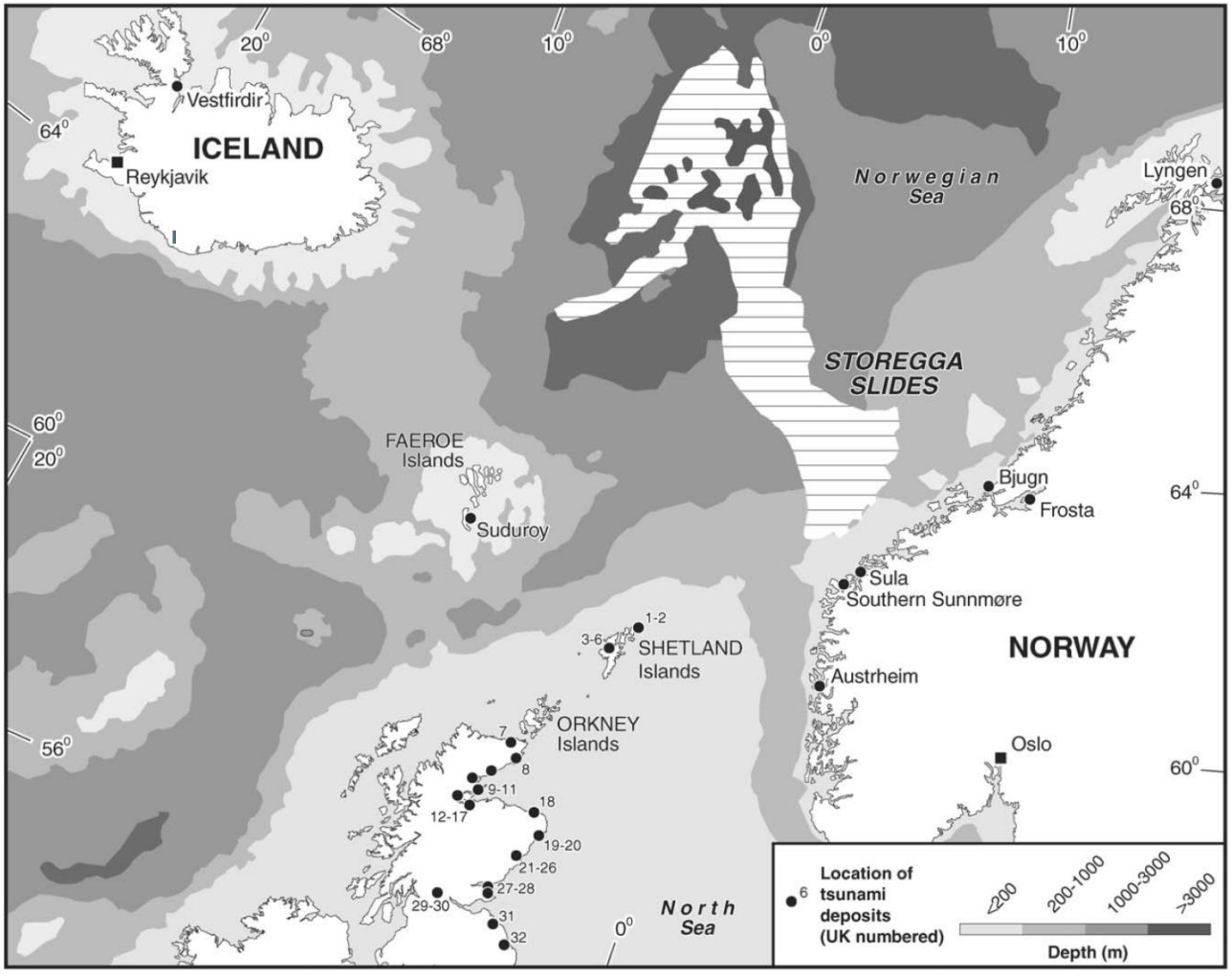

Figure 1.8 Location of the Storegga Slides and sites where evidence for the Holocene Storegga Slide tsunami has been found in the United Kingdom (reproduced with permission from Smith et al., 2012).

tsunami would have had a catastrophic impact on a significant part of the contemporary Mesolithic populations. Widespread destruction and drowning would have taken place in coastal areas of both Britain and mainland Europe (Figure 1.9). There would also have been severe restrictions on the movements of the human Mesolithic populations in what are now the Low Countries of the European continent. This landmass, the Doggerland, which is now covered by the North Sea, has been thought to have had an

important influence on the course of prehistory in northwestern Europe.

Opinions differ in relation to the gradual inundation of Doggerland by rising sea levels. Professor Bryony Coles, who invented the term Doggerland, produced a hypothetical map (Figure 1.10) of the major estuaries and the coastline that would have been attractive for Mesolithic human settlements (Coles, 1998). Various attempts at more precise outlines showing the progressive retreat of the Doggerland coastline have subsequently appeared (Ballin and Bjerck, 2016) but as yet there is no unanimity or precision in this matter. The development of a maritime-based society along the northern coast of Doggerland, would have had specialized adaptations to this zone, including an ability to move with changing sea-levels. It has been suggested that such a mobile culture might have delayed the spread of farming into coastal regions (Coles, 2000).

The question remains as to from where the Scottish Mesolithic people originated. Recent studies have compared with great precision the form of the late Palaeolithic and early Mesolithic small stone tools (microliths) usually made of flint or chert and have been able to define a difference in style from those found in northern Britain from these found in the south. The differences in these artefacts strongly suggest that northern Britain was settled or visited from the north-east, by groups belonging to the Scandinavian Palaeolithic-Early Mesolithic complex.

There are different views as to the development of Doggerland between c. 16,000-8,000 BC (see Figures 1.9-10; Ballin and Bjerck, 2016; Coles, 1998). However, following the map presented in Figure 1.9 it would have been possible for people to walk almost the entire way from Norway to Scotland in a straight line.

Archaeological excavations carried out at Morton, on the former peninsula just to landward of the mid-Holocene shoreline, disclosed two phases of Mesolithic occupation. The earlier phase, as dated from the typology of the flint microliths is now thought to predate *c.* 8500 cal. BC and would therefore have

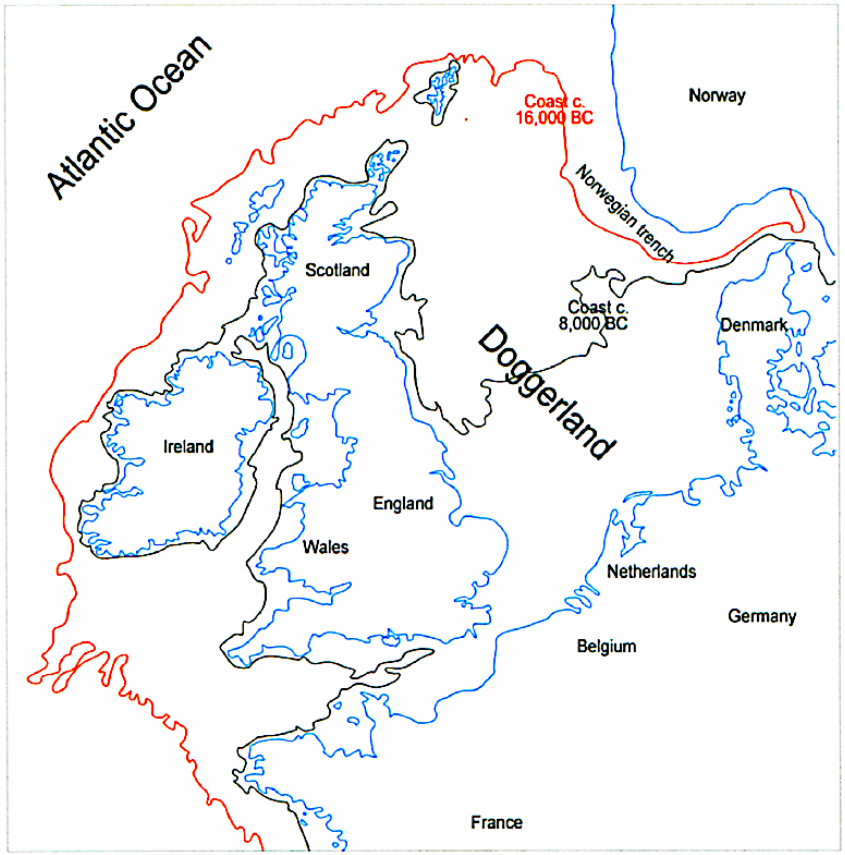

Figure 1.9 Map of Doggerland, showing the staged retreat of the Doggerland coastlines at ca. 16,000 BC and ca. 8000 BC according to Spinney et al 2012). The red lines indicate the coast around 16,000 BC, and the black lines around 8000 BC. (Reproduced with permission from Ballin and Bjerck, 2016).

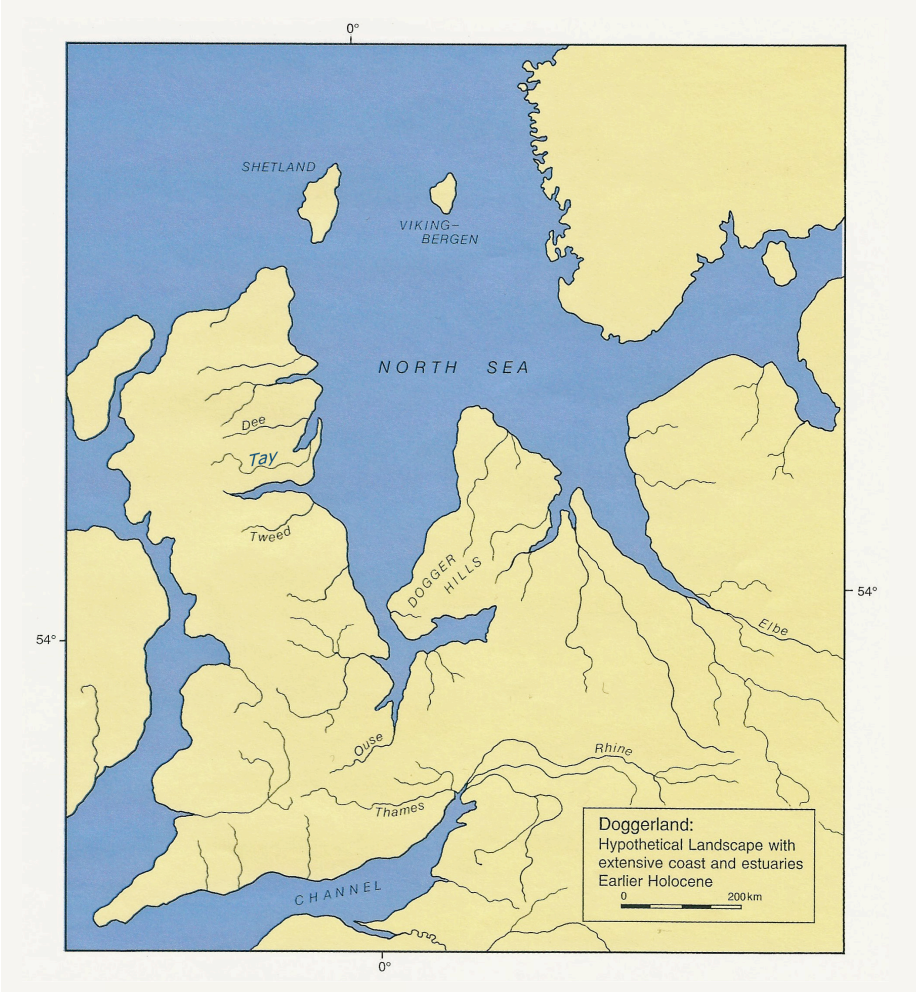

Figure 1.10 A hypothetical map of Doggerland and surrounding areas of northwest Europe in the Earlier Holocene. The major estuaries and the coastline would have been attractive for Mesolithic human settlements (Coles, 1988). Map devised by B.J. Coles & S.E. Rouillard. Copyright B.J. Coles and S.E. Rouillard.

been a pre-tsunami activity which was abandoned and covered by wind-blown sand before a later post-tsunami occupational phase.

The circumstances of abandonment of the earlier phase are unclear, although it was noted that the site had become more exposed to the sea. If the tsunami was involved, the dates from the excavations here would place it between the two occupation phases of Mesolithic Morton. The question therefore arises,, did the Main Holocene Transgression play a role and make occupation impossible for a period? If so, the catastrophe of the *Storegga Slide tsunami* would have isolated the Mesolithic inhabitants in the North Sea. Whether or not this brought about an avoidance of coastal sites by early peoples, causing the long-lasting absence of Mesolithic activity for several millennia as noted at Morton, is a matter of speculation.

The Morton Mesolithic site is now nearly 4 km from the sea, which indicates that there has been an advance seawards of the shore-line at Tentsmuir which has averaged 0.5 m per annum over a period of *c.* 8000 years. Such a rate of accretion would appear quite possible when put into context with recent coastal changes. At the end of the 20th century the shoreline at the north-eastern region of Tenstsmuir advanced seawards by several metres per annum (see Chapter 2).

Neolithic, Bronze and Iron Age Tentsmuir

Tentsmuir continued to be a site for human activity throughout prehistory. Evidence for this is found largely in the western part of the peninsula (Figure 1.11) where numerous finds and crop marks have been found (Carter, 1997).

Already in 1905 it had been noted that whenever the soil is disturbed large fragments of coarse pottery were turned up regularly over the whole location (see Longworth et al., 1966). Such finds have included a cinerary urn, and numerous beakers. In the 19th century the remains of a fine corded beaker were discovered on the Earlshall Estate (Figure 1.12).

The numerous items found include, Neolithic pottery, grooved ware, and beakers specifically for domestic use. The stone implements comprise leaf-shaped flint

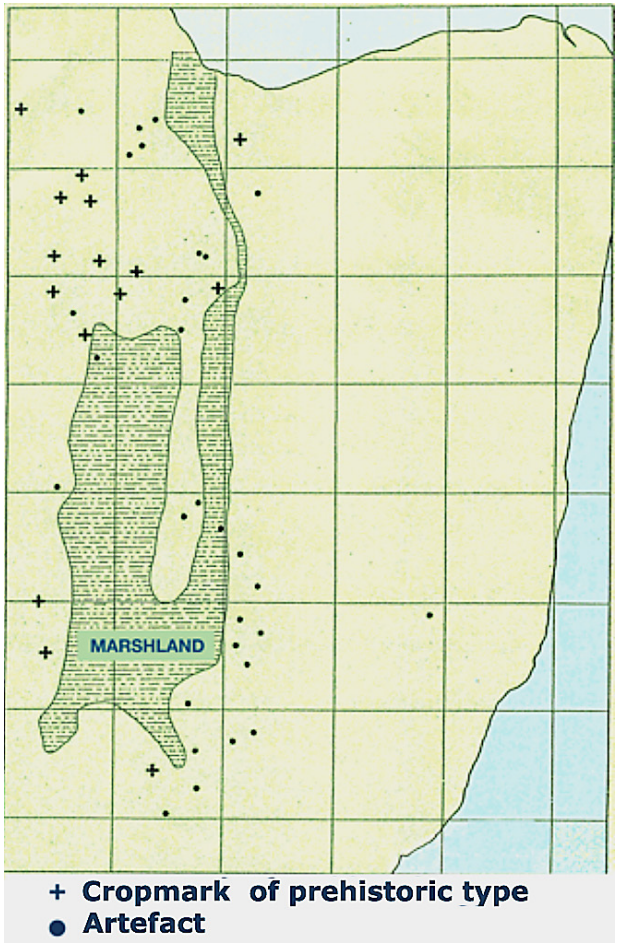

Figure 1.11 Distribution at Tentsmuir of Neolithic, Bronze Age, and Iron Age sites and artefacts (Reproduced from Headland Archaeology Ltd unpublished report (1997).

arrowheads and polished stone axes. Bronze Age sherds have been found at Shanwell and on Garpit Links (Longworth et al., 1966-7).

Neolithic finds at Tentsmuir comprise pottery, including beakers, food vessels, collared and cordoned urns, as well as large food vessels. The absence of crop marks and artefacts in the eastern parts of present-day Tentsmuir (Figure 1.11) would indicate that the prehistoric coastline had not at this time advanced to this region. There is only one record of a small prehistoric deposit found in this eastern region by Candow (Carter, 1997).

The implements found include, barbed-and-tanged flint arrowheads with numerous bronze artefacts including many pins. Other finds comprise, beads of vitreous paste, jet, amber, and glass, all found singly, and ornaments of jet, including armlets. A possible mid-Bronze Age blade was found in association with an urn (Coles, 1964). Shell mounds have frequently been noticed but it is not always certain that they are of human origin. Excavations of some minor shell middens has suggested that they were merely a product of collapsed and eroded sand-hills (Shand, 1908).

A record of early dwellings in the shape of hut circles was reported in the 18th century in the 1st

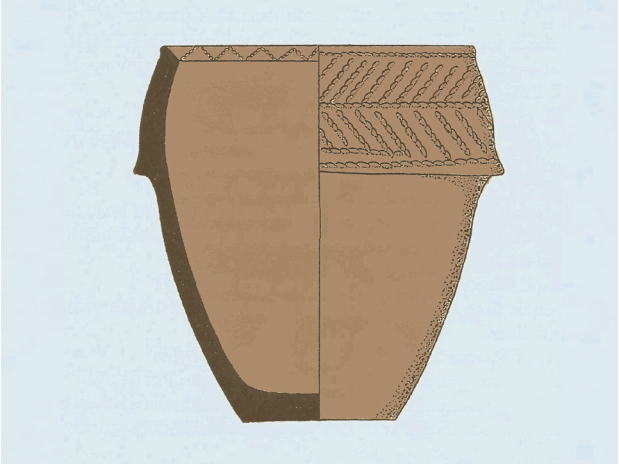

Figure 1.12 Reconstruction of a corded beaker found on Earlshall Estate made of coarse paste tampered with grit and with a smooth light brown surface. Decoration: on the collar, twisted cord lines. In the rim, twisted cord zigzag. (Reproduced with permission from Longworth et al., 1966-7).

Figure 1.13 Map of Tentsmuir including locations of Neolithic, Bronze and Iron Age artefacts mentioned in text. (Reproduced with permission from Longworth et al., 1966).

Statistical Account by the Reverend Kettle the Minister of Leuchars (Kettle, 1796). These were described as circular hollows 10-15 feet in diameter, surrounded by earthen or turf mounds and have been subsequently interpreted as prehistoric round-houses, but are no longer visible. They may have been genuine prehistoric structures that have unfortunately been destroyed by a wave of agricultural improvement at Tentsmuir in the latter half of the 18th century and forestry plantations in the 20th century. No traces of these structures have survived as confirmation of such dwellings.

The nature and quantity of these finds has led to the conclusion that Tentsmuir was settled perhaps intermittently by differing peoples from Late Neolithic times and through much of the ensuing Bronze Age. The majority of the finds come from sand bunkers north and south of Wards Farm and the Earlshall Estate, as well as from south of Morton Lochs and Garpit (see Fig. 1.13).