3.4. A GOOD PLACE

Stone Age Locations in Southern Norway: A Diachronic GIS Approach

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INTRODUCTION

The E18 Tvedestrand–Arendal project focuses on two important areas of research in which an analysis of the prehistoric landscape is essential. The first is a discussion on the function of the Stone Age sites, where the setting in the landscape certainly is a vital parameter. The second is a macro level analysis of the settlement history in the region, where the material excavated within the project can pave the way for future studies (*cf.* Mjærum & Lønaas 2014: 12; Mjærum *et al.*, chapter 1.4, this volume).

In this GIS study, all sites presented in this volume's part 2 are included (chapters 2.2.1–2.5.5), and they cover the greater part of the Stone Age, *c.* 9000–1700 cal. BC. The majority of the sites included in this study are presumed to have been shore-bound at their time of use, and the dating of them relies heavily on the local shoreline displacement curve (*cf.* Romundset, chapter 3.2, this volume). However, two sites are dated by typology, namely the site *Kvastad A2* (also dated by C14) and the site *Mørland D11*.

The connection between Stone Age sites and prehistoric shorelines was first discussed by the geologist Brøgger (W.C. Brøgger 1905). The first test pitting in search of Stone Age sites was conducted a few years later by geologist Nummedal. His approach resulted in the identification of a great number of sites along the Norwegian coast. A view of Stone Age sites as being shore-bound was established, although Brøgger also suggested that sites could be located inland close to rivers and lakes (Berg-Hansen 2009: 37–40, with references). Since then, the presence of inland sites has been confirmed by several test pitting and excavation projects (*cf.* Indrelid 1994; Berg-Hansen 2009: 42; Stene 2010), and, with the exception of Neolithic farming sites, Stone Age sites are primarily connected to coastal resources and ancient shore lines, or to bodies of water in the interior of Norway (*cf.* Bjerck 1990, 2009, 2017; Indrelid 1994; Berg 1997; Boaz 1998; Bjerck *et al.* 2008; Stene 2010; Nyland 2012c; Breivik 2014; Jaksland 2014; Breivik & Callanan 2016).

The local landscape and people's knowledge about it has always been an important factor when people decide where to live, where to hunt, gather or fish; some locations are selected over others, depending on cultural preference and subsistence strategy. Through this study we hope to hint at some of the factors influencing site location preferences along the coast of Aust-Agder.

OBJECTIVES AND METHOD

Through an analysis of the topographical setting of the investigated sites, this study aims at showing and discussing preferred site locations along the coast from Tvedestrand to Arendal in Aust-Agder county from the Early Mesolithic to the Late Neolithic. The analyzed sites are from a limited area, namely the *c.* 200 metre wide and 23.6 km long route of the new E18 motorway between Tvedestrand and Arendal. Being a limited area, the observed patterns may be regional in character, rather than chronological. The motorway crosses several valleys and hills, and mainly follows the border between mainland/fjords and archipelago as it was during Stone Age sea levels (for maps, see Reitan, chapter 2.1; see also Romundset, chapter 3.2, this volume). The prehistoric outer coast has therefore not been investigated. Our study initially included variables such as "situated on small islands" and "located close to the open sea". However, it became clear that these variables were not applicable to the sites excavated within the E18 Tvedestrand–Arendal project. It would seem that the most reliable results are for the Early Mesolithic sites, being both the most numerous and represented within different parts of the route of the new E18 motorway, while the results concerning the other periods are less robust.

The position of the sea in relation to the sites has been reconstructed according to the suggested time of use in combination with the shoreline displacement curve (*cf.* Romundset, chapter 3.2, this volume). In table 3.4.19 below, the relative sea level (*Rel.s.l.*) specifies which elevation has been used to represent the sea in relation to each site. Other than this, the topographical information/elevation data is derived from the FKB Standard data (based on *LiDAR* scanning) from

Kartverket (*Norwegian Mapping Authority*), which have not been modified. This means that there are a number of modern-day features present (roads, dug canals, artificial ponds/lakes, etc.) in the data, which is a potential source of error. In particular, the number of rivers and lakes within the catchment area might not directly reflect the past situation (*cf.* Bergsvik 1994: 245). Still, such features are included since they can give an indication of the resource potential within the catchment area.

The analysis will be done using GIS and takes as its point of departure two scale levels, a "macro level" and a "micro level":

A) The *macro level* has been defined as a circular area around the site, regardless of topography. The size of this local catchment area is 8 km in diameter, resulting in a surface area of 50.3 km^2. The foraging radius in this model (4 km) can be seen to be at the lower end of both recorded and predicted cases (*cf.* Roper 1979; Morgan 2008). It has been kept low to account for the long time span represented by the sites, where different modes of subsistence were probably present, and is also in line with earlier studies (*e.g.* Welinder 1978; Von Hackwitz & Stenbäck 2013). Within the macro area the following variables have been calculated:

- *Number of inlets to the site*. This gives a measure of accessibility to the site and also to what degree the localization can be seen as sheltered.
- *Landscape zones*. The catchment area has been separated into three parts: mainland (A), archipelago (B) and outer coast (C), expressed as percentages of the total catchment area. These are viewed as constituting quite different ecological zones containing different resources.
- *Distance to mainland and sea*. This is measured as the shortest distance from the site to the landscape zone borders as defined above and expressed in kilometres. This is an important variable, since foraging efficiency drops with increasing distance (Roper 1979).
- *Fresh water*. This variable is represented by a manual count of the number of lakes and rivers within the catchment area. The presence of bodies of fresh water is included since they represent biotopes containing resources other than those found in the sea or on land.
- *Site location*, can be on either mainland or island. It also takes into account whether the site can be described as being in the proximity of a sound, a fjord basin or in a bay.

B) The *micro level* is a close-up view of the site in its immediate surroundings, represented by a circular area with a diameter of 800 m (radius of 400 m), resulting in a surface area of 0.5 km^2. This radius is also in line with earlier studies (*cf.* Morgan 2008). This selection has been used to calculate the following variables:

- *Seascape*. The water surrounding the sites is summarized in m^2 and further separated into a beach zone (0–2 m below relative sea level), shallow water (here defined as 2–12 m below relative sea level) and deep water (> 12 m below relative sea level). These depth zones represent the potential for different marine resources within the immediate site surroundings, as well as illustrating the potential for different ways of fishing/gathering of marine resources close to the sites (*cf.* Dupont *et al.* 2009: 98–102). For instance, people wading could harvest sea shells and crabs in the beach zone. In shallow water lines, nets, leisters or harpoons could be used to catch fish, or people could dive to gather shellfish or sea shells. In deep water, lines or nets are likely tools used for fishing.
- *Orientation*. The main site orientation (N/S/E/W).
- *Facing* denotes whether the sites are facing land (L) or sea (S). If land is visible within the marked 400 m radius in the direction of the site orientation, the site is facing land. If land is not visible, the site is facing the sea.
- *Landing sites* denotes the number of potential landing sites (for boats). The landing sites are categorized using two variables, namely defined (D) *vs.* undefined (UD) and shallow (SH) vs. steep (ST), thus giving four potential classes of landing sites. A defined landing site is a bay that can function like a harbour. A site with an undefined landing site has no natural harbour, but a straighter shoreline.
- *Exposedness* describes whether or not the site is sheltered and to what degree it is sheltered. The sites can be open (O) or sheltered (S). An open site has no natural wind- or waterbreaks in its immediate proximity, whilst a sheltered site has topographical features

(hillsides and outcrops) that can act as wind- and waterbreaks. The directions the sites can be sheltered from are north, south, east and west (N/S/E/W).

THE SITES

In total, seventeen sites were analyzed. One of the sites, *Kvastad A2*, is a multi-phased site, with Early- and Middle Mesolithic as well as Neolithic use-phases (Stokke & Reitan, chapter 2.5.5; Reitan *et al.*, chapter 3.9, this volume). As the Early Mesolithic is well represented by four other sites in the Kvastad area, and Kvastad A2 has had a very similar location, Kvastad A2 will be presented both as a Middle Neolithic site and as a Late Neolithic site. Below, the various sites and the landscape surrounding them will be visually presented in figures 3.4.1–3.4.18.

Early Mesolithic (*c.* 9000–8300 cal. BC) site locations

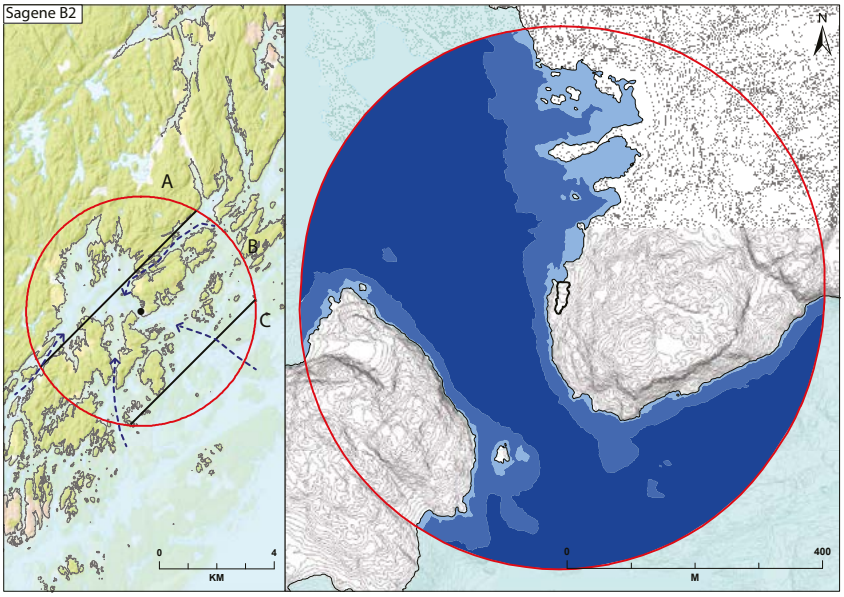

Figure 3.4.1: Sagene B2 and landscape at a sea level of 55 m above present. Local catchment area/macro level (left) and immediate surroundings/micro level (right). On the macro level, the landscape has been divided into three zones, namely A: Mainland, B: Archipelago, C: Outer coast. Arrows indicate inlets to the site. On the micro level, the sea is divided into beach zone (light blue), shallow water (darker blue) and deep water (dark blue).
Map: L.S. Johannessen / KHM.

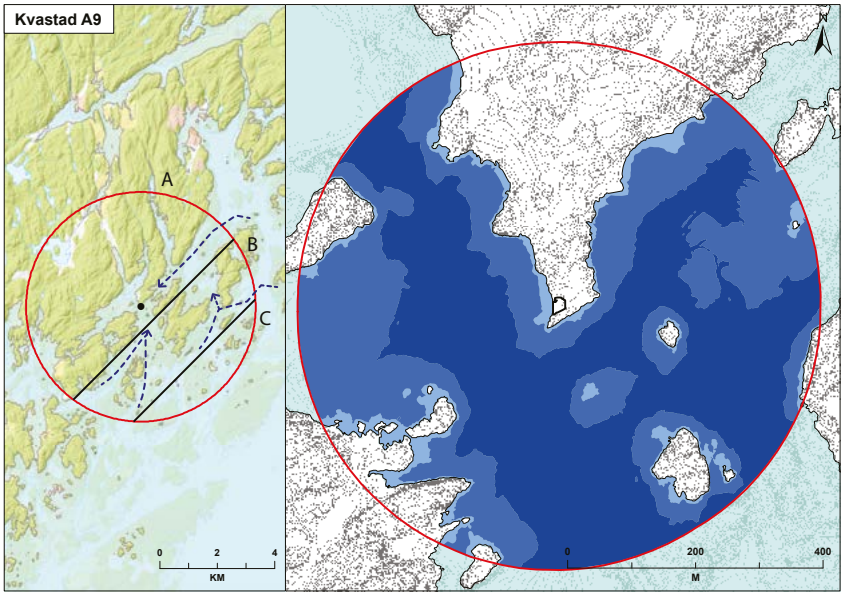

Figure 3.4.2: Kvastad A9 and landscape at a sea level of 54 m above present. Local catchment area/macro level (left) and immediate surroundings/micro level (right). On the macro level, the landscape has been divided into three zones, namely A: Mainland, B: Archipelago, C: Outer coast. Arrows indicate inlets to the site. On the micro level, the sea is divided into beach zone (light blue), shallow water (darker blue) and deep water (dark blue).
Map: L.S. Johannessen / KHM.

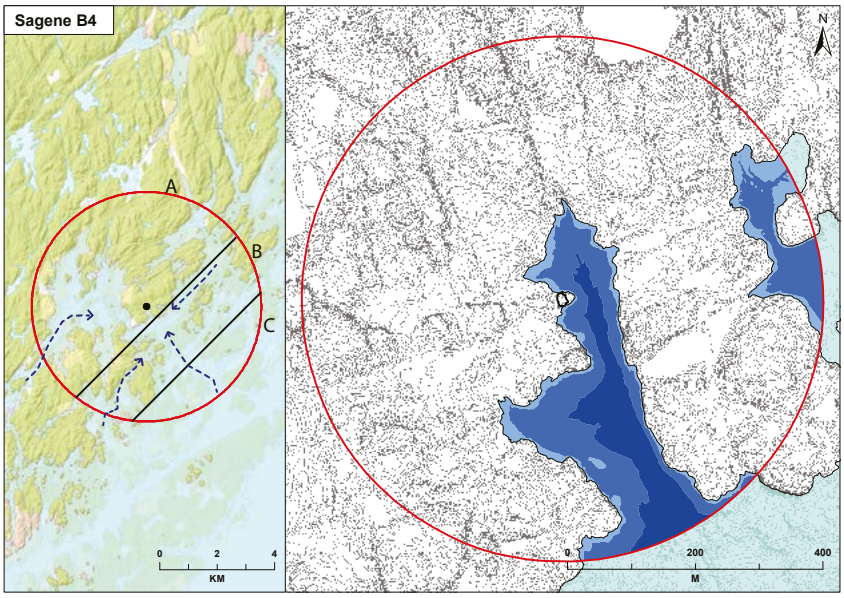

Figure 3.4.3: Sagene B4 and landscape at a sea level of 53 m above present. Local catchment area/macro level (left) and immediate surroundings/micro level (right). On the macro level, the landscape has been divided into three zones, namely A: Mainland, B: Archipelago, C: Outer coast. Arrows indicate inlets to the site. On the micro level, the sea is divided into beach zone (light blue), shallow water (darker blue) and deep water (dark blue).
Map: L.S. Johannessen / KHM.

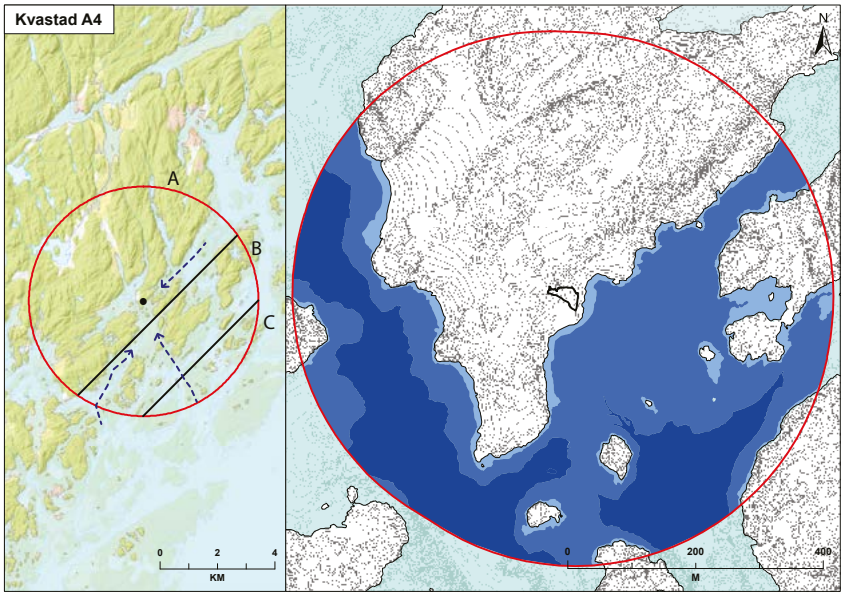

Figure 3.4.4: Kvastad A4 and landscape at a sea level of 50 m above present. Local catchment area/macro level (left) and immediate surroundings/micro level (right). On the macro level, the landscape has been divided into three zones, namely A: Mainland, B: Archipelago, C: Outer coast. Arrows indicate inlets to the site. On the micro level, the sea is divided into beach zone (light blue), shallow water (darker blue) and deep water (dark blue).
Map: L.S. Johannessen / KHM.

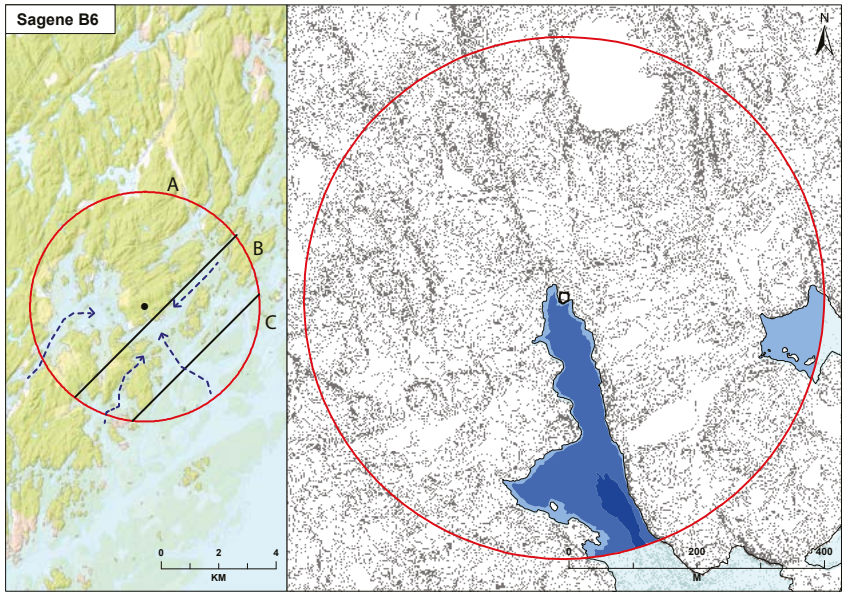

Figure 3.4.5: Sagene B6 and landscape at a sea level of 49 m above present. Local catchment area/macro level (left) and immediate surroundings/micro level (right). On the macro level, the landscape has been divided into three zones, namely A: Mainland, B: Archipelago, C: Outer coast. Arrows indicate inlets to the site. On the micro level, the sea is divided into beach zone (light blue), shallow water (darker blue) and deep water (dark blue).
Map: L.S. Johannessen / KHM.

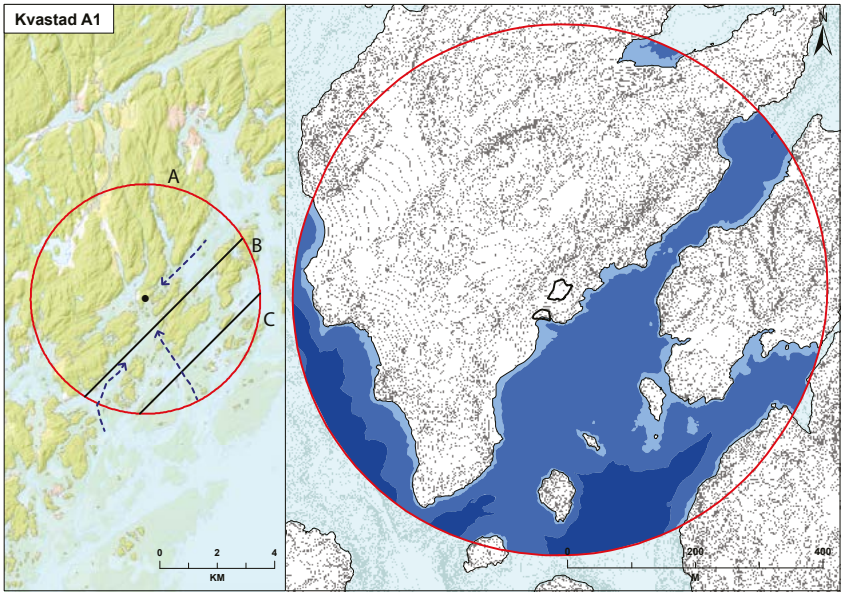

Figure 3.4.6: Kvastad A1 and landscape at a sea level of 48 m above present. Local catchment area/macro level (left) and immediate surroundings/micro level (right). On the macro level, the landscape has been divided into three zones, namely A: Mainland, B: Archipelago, C: Outer coast. Arrows indicate inlets to the site. On the micro level, the sea is divided into beach zone (light blue), shallow water (darker blue) and deep water (dark blue). Map: L.S. Johannessen / KHM.

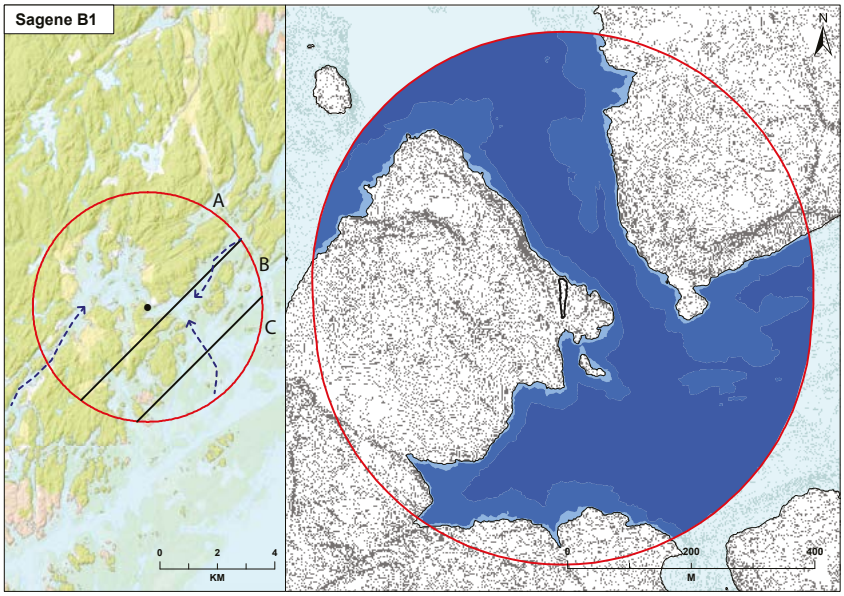

Figure 3.4.7: Sagene B1 and landscape at a sea level of 47 m above present. Local catchment area/macro level (left) and immediate surroundings/micro level (right). On the macro level, the landscape has been divided into three zones, namely A: Mainland, B: Archipelago, C: Outer coast. Arrows indicate inlets to the site. On the micro level, the sea is divided into beach zone (light blue), shallow water (darker blue) and deep water (dark blue). Map: L.S. Johannessen / KHM.

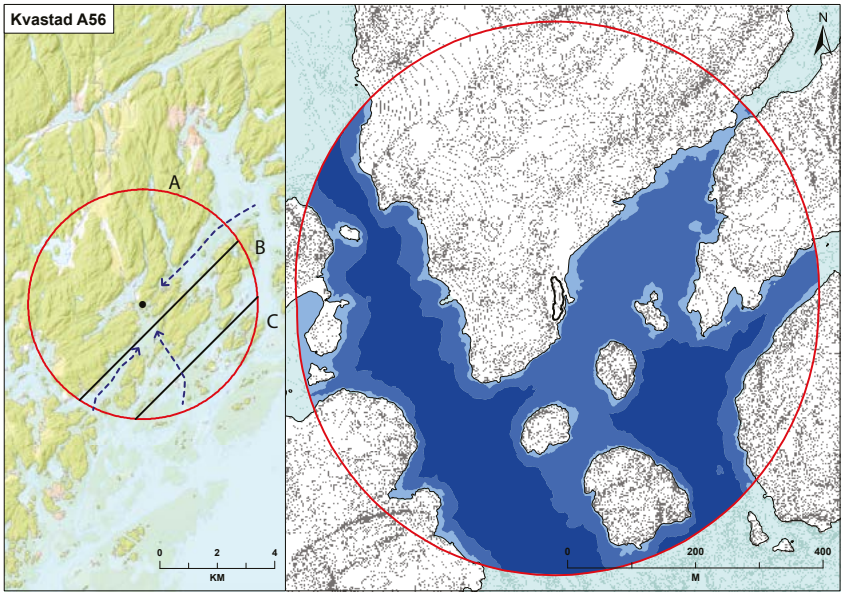

Figure 3.4.8: Kvastad A5-6 and landscape at a sea level of 45 m above present. Local catchment area/macro level (left) and immediate surroundings/micro level (right). On the macro level, the landscape has been divided into three zones, namely A: Mainland, B: Archipelago, C: Outer coast. Arrows indicate inlets to the site. On the micro level, the sea is divided into beach zone (light blue), shallow water (darker blue) and deep water (dark blue). Map: L.S. Johannessen / KHM.

Middle Mesolithic (*c.* 8300–6300 cal. BC) site locations

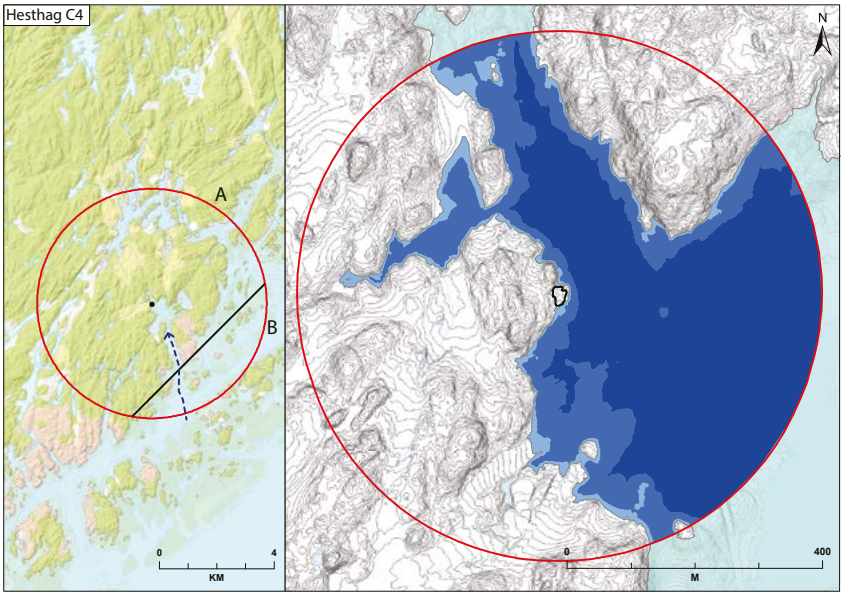

Figure 3.4.9: Hesthag C4 and landscape at a sea level of 34 m above present. Local catchment area/macro level (left) and immediate surroundings/micro level (right). On the macro level, the landscape has been divided into three zones, namely A: Mainland, B: Archipelago, C: Outer coast. Arrows indicate inlets to the site. On the micro level, the sea is divided into beach zone (light blue), shallow water (darker blue) and deep water (dark blue).
Map: L.S. Johannessen / KHM.

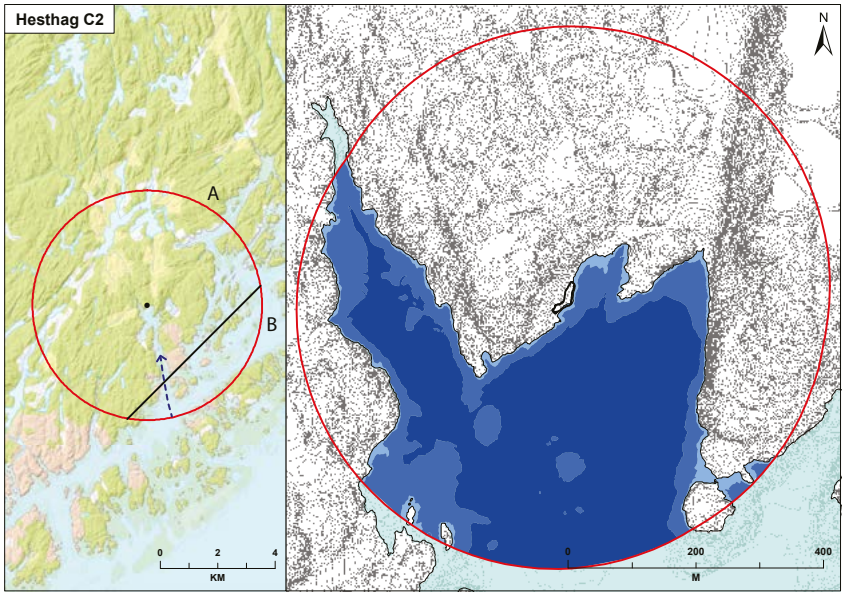

Figure 3.4.10: Hesthag C2 and landscape at a sea level of 26 m above present. Local catchment area/macro level (left) and immediate surroundings/micro level (right). On the macro level, the landscape has been divided into three zones, namely A: Mainland, B: Archipelago, C: Outer coast. Arrows indicate inlets to the site. On the micro level, the sea is divided into beach zone (light blue), shallow water (darker blue) and deep water (dark blue).
Map: L.S. Johannessen / KHM.

Late Mesolithic (*c.* 6300–3900 cal. BC) site locations

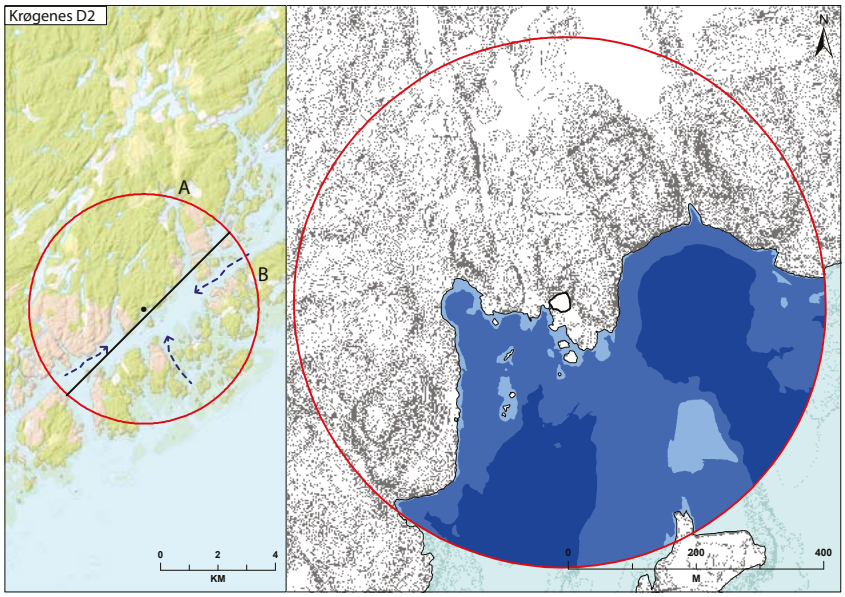

Figure 3.4.11: Krøgenes D2 and landscape at a sea level of 22 m above present. Local catchment area/macro level (left) and immediate surroundings/micro level (right). On the macro level, the landscape has been divided into three zones, namely A: Mainland, B: Archipelago, C: Outer coast. Arrows indicate inlets to the site. On the micro level, the sea is divided into beach zone (light blue), shallow water (darker blue) and deep water (dark blue).
Map: L.S. Johannessen / KHM.

Early Neolithic (*c.* 3900–3300 cal. BC) site locations

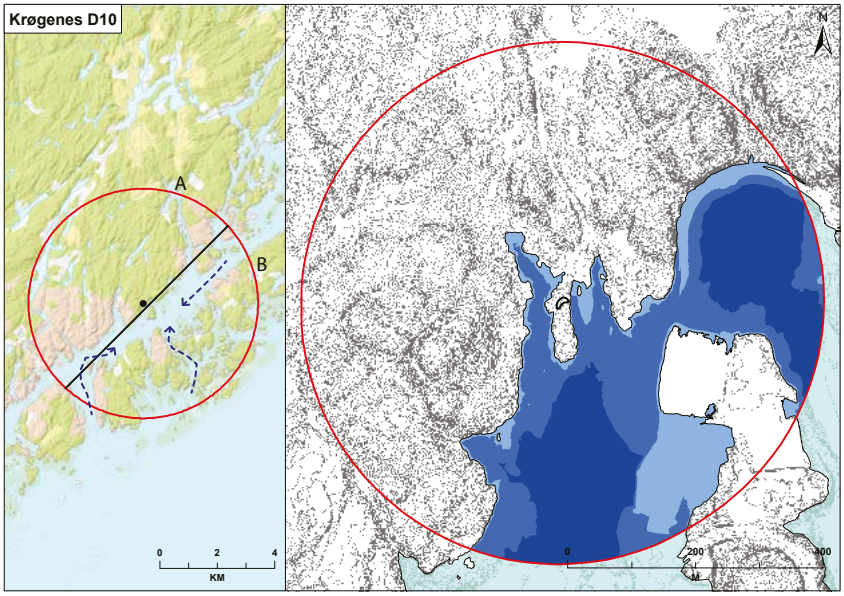

Figure 3.4.12: Krøgenes D10 and landscape at a sea level of 18 m above present. Local catchment area/macro level (left) and immediate surroundings/micro level (right). On the macro level, the landscape has been divided into three zones, namely A: Mainland, B: Archipelago, C: Outer coast. Arrows indicate inlets to the site. On the micro level, the sea is divided into beach zone (light blue), shallow water (darker blue) and deep water (dark blue). Map: L.S. Johannessen / KHM.

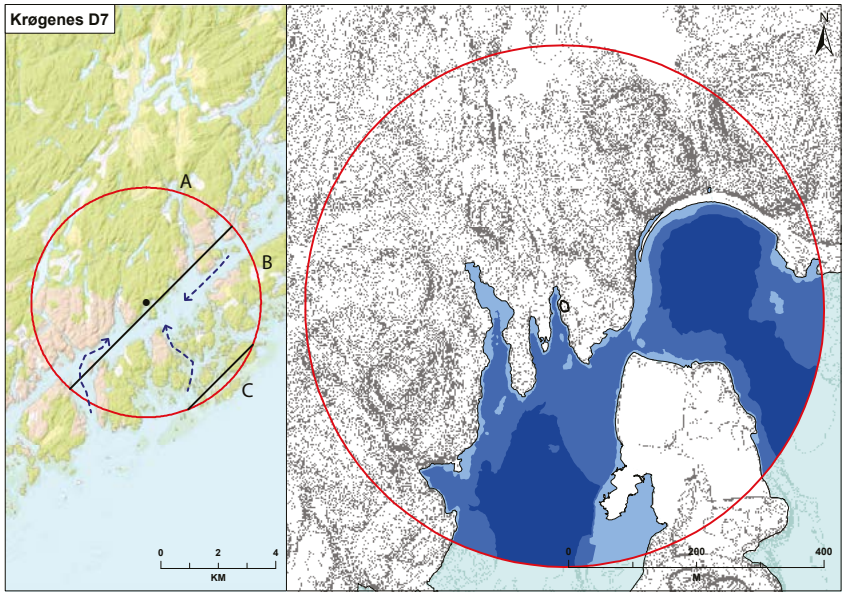

Figure 3.4.13: Krøgenes D7 and landscape at a sea level of 17 m above present. Local catchment area/macro level (left) and immediate surroundings/micro level (right). On the macro level, the landscape has been divided into three zones, namely A: Mainland, B: Archipelago, C: Outer coast. Arrows indicate inlets to the site. On the micro level, the sea is divided into beach zone (light blue), shallow water (darker blue) and deep water (dark blue). Map: L.S. Johannessen / KHM.

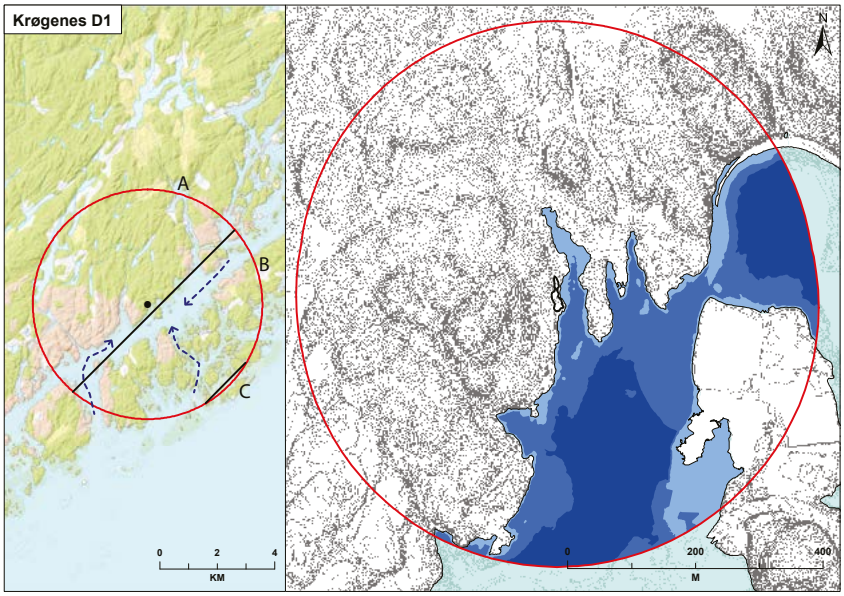

Figure 3.4.14: Krøgenes D1 and landscape at a sea level of 17 m above present. Local catchment area/macro level (left) and immediate surroundings/micro level (right). On the macro level, the landscape has been divided into three zones, namely A: Mainland, B: Archipelago, C: Outer coast. Arrows indicate inlets to the site. On the micro level, the sea is divided into beach zone (light blue), shallow water (darker blue) and deep water (dark blue). Map: L.S. Johannessen / KHM.

Middle Neolithic (*c.* 3300–2300 cal. BC) site locations

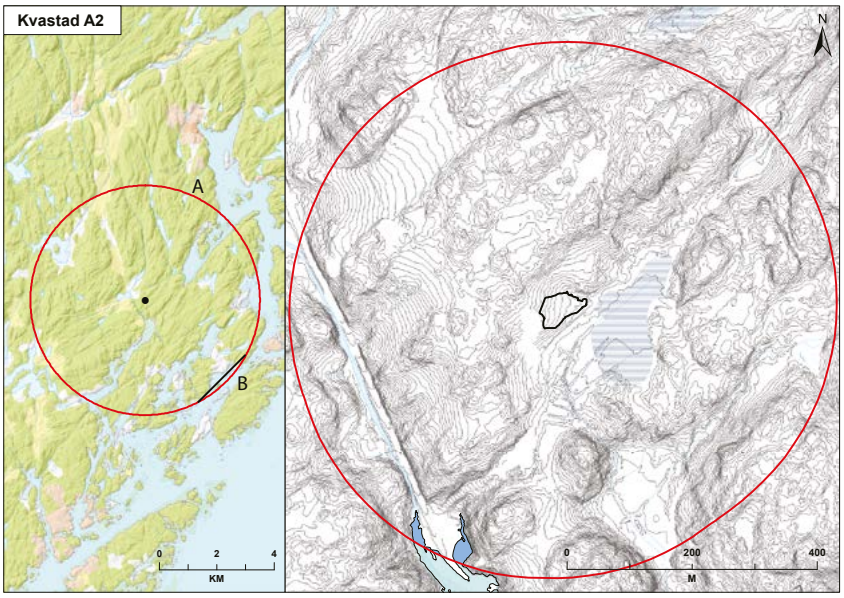

Figure 3.4.15: Kvastad A2 and landscape at a sea level of 15 m above present, corresponding to *c.* 3000 cal. BC. Local catchment area/macro level (left) and immediate surroundings/micro level (right). On the macro level, the landscape has been divided into three zones, namely A: Mainland, B: Archipelago, C: Outer coast. Arrows indicate inlets to the site. On the micro level, the sea is divided into beach zone (light blue), shallow water (darker blue) and deep water (dark blue).
Map: L.S. Johannessen / KHM.

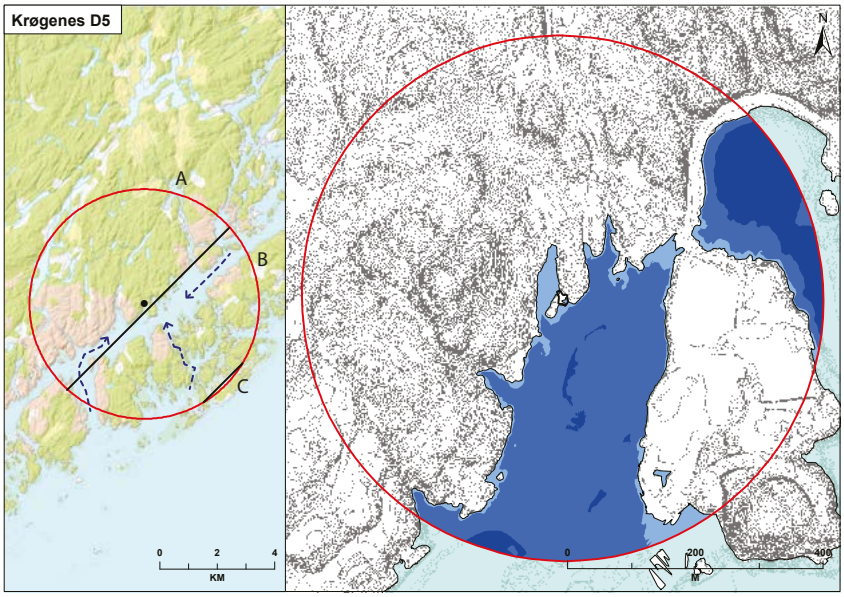

Figure 3.4.16: Krøgenes D5 and landscape at a sea level of 14 m above present. Local catchment area/macro level (left) and immediate surroundings/micro level (right). On the macro level, the landscape has been divided into three zones, namely A: Mainland, B: Archipelago, C: Outer coast. Arrows indicate inlets to the site. On the micro level, the sea is divided into beach zone (light blue), shallow water (darker blue) and deep water (dark blue).
Map: L.S. Johannessen / KHM.

Late Neolithic (*c.* 2300–1700 cal. BC) site locations

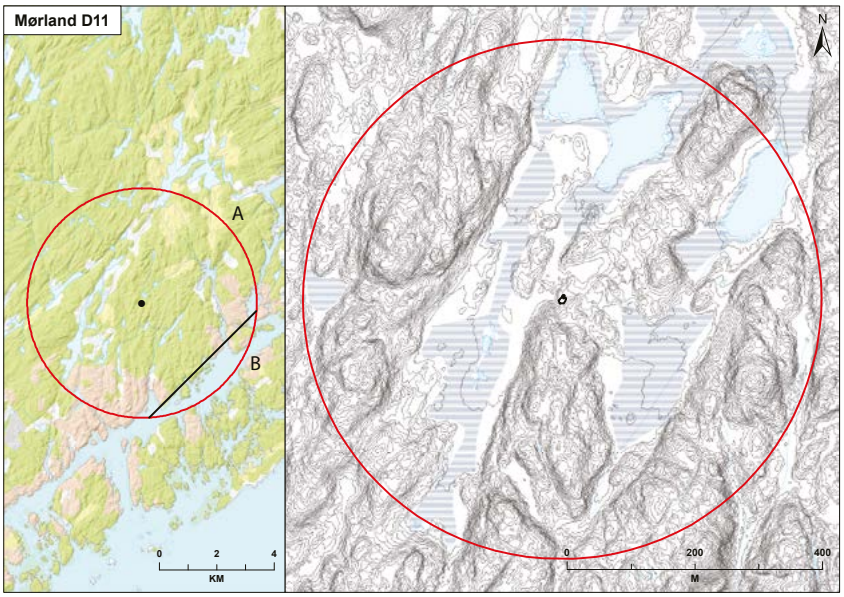

Figure 3.4.17: Mørland D11 and landscape at a sea level of 11 m above present. Local catchment area/macro level (left) and immediate surroundings/micro level (right). On the macro level, the landscape has been divided into three zones, namely A: Mainland, B: Archipelago, C: Outer coast. Arrows indicate inlets to the site. On the micro level, the sea is divided into beach zone (light blue), shallow water (darker blue) and deep water (dark blue).
Map: L.S. Johannessen / KHM.

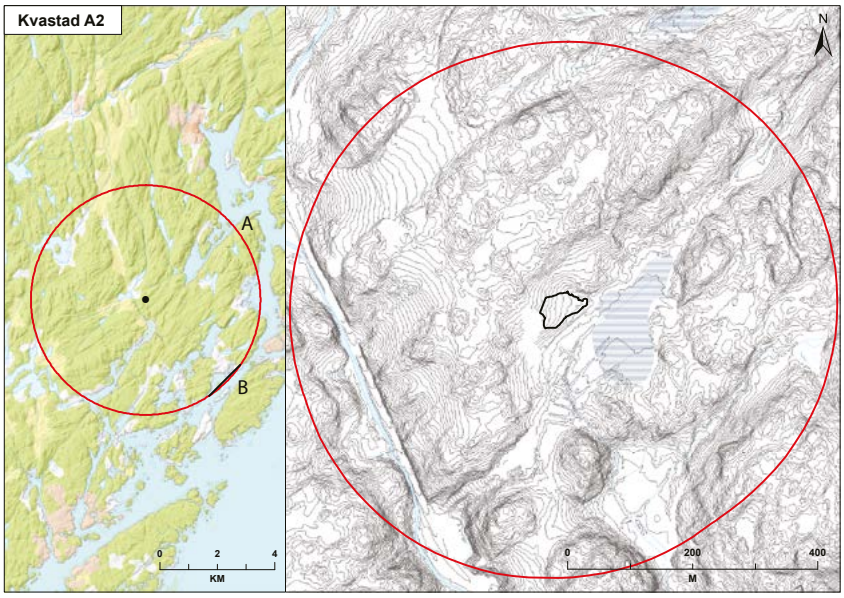

Figure 3.4.18: Kvastad A2 and landscape at a sea level of 11 m above present, corresponding to *c.* 1900 cal. BC. Local catchment area/macro level (left) and immediate surroundings/ micro level (right). On the macro level, the landscape has been divided into three zones, namely A: Mainland, B: Archipelago, C: Outer coast. Arrows indicate inlets to the site. On the micro level, the sea is divided into beach zone (light blue), shallow water (darker blue) and deep water (dark blue). Map: L.S. Johannessen / KHM.

ANALYSIS

In the following, a characterization of the sites from the E18 Tvedestrand–Arendal project will be given, based on the analyzed variables. As mentioned above, the sites only represent a restricted area, and the observed patterns may therefore be regional in character, rather than chronological.

Landscape zones and the relation to the sea

The Early Mesolithic sites display a very uniform localization in relation to the defined landscape zones. The preferred area of settlement seems to have been where the archipelago zone meets the mainland, and with the open sea within reach, at a distance of 2.5–3 km. *Sagene B2* (see figure 3.4.1), the earliest of

		Map showing 8 km diameter around site (4 km radius)												
			Landscape (%)			Distance to (km)		Fresh water		Site location				
Site	Rel.s.l.	Inlets	A	B	C	Main-land	Sea	Lakes	Rivers	Main-land	Island	Sound	Fjord basin	Bay
Early Mesolithic														
B2	55	4	32 %	55 %	13 %	1,1	2,5	4	8		X	X	X	
B4	53	4	58 %	29 %	13 %	-0,5	2,5	3	7	X				X
B6	49	4	58 %	30 %	13 %	-0,5	2,5	3	8	X				X
B1	47	3	60 %	28 %	12 %	-0,7	2,5	4	9		X	X	X	
A9	54	3	60 %	23 %	12 %	-0,7	2,7	4	5	X		X		
A1	48	3	64 %	25 %	11 %	-0,9	2,7	4	6	X		X		X
A4	50	3	61 %	30 %	9 %	-0,7	2,8	4	6	X		X		X
A5-6	45	3	62 %	27 %	11 %	-0,8	2,6	4	7	X		X		
Middle Mesolithic														
C4	34	1	84 %	16 %	0 %	-2,3	5,3	11	8	X		X	X	
C2	26	1	84 %	16 %	0 %	-2,3	5,3	14	6	X			X	X
Late Mesolithic														
D2	22	3	53 %	47 %	0 %	-0,3	4,2	12	3	X				X
Early Neolithic														
D7	17	3	54 %	45 %	1 %	-0,3	3,8	12	4	X				X
D10	18	3	52 %	48 %	0 %	-0,2	4	12	4	X				X
D1	17	3	55 %	45 %	0 %	-0,4	3,9	12	4	X				X
A2	15	0	99 %	1 %	0 %	-3,8	5,6	18	12	X				
Middle Neolithic														
D5	14	3	53 %	47 %	0 %	-0,3	3,9	13	5	X				X
Late Neolithic														
D11	11	0	93 %	7 %	0 %	-3	7,2	24	10	X				
A2	11	0	100 %	0 %	0 %	-3,9	5,7	18	12	X				

		Map shoving 800 m diameter around sites (400 m radius)											
		Seascape											
Site	Rel.s.l.	Area (m²)	Beach	Shallow	Deep	Orien-tation	Facing L/S	Landing sites				Landing sites	Exposed-ness
								dsh	dst	udsh	udst		
Early Mesolithic													
B2	55	317344	9 %	23 %	67 %	N	L	1				1D/SH	S, W/E
B4	53	87826	20 %	54 %	26 %	E	L		1		1	1D/ST, 1UD/ST	S, W/E
B6	49	44705	32 %	61 %	8 %	S	L	2				2D/ST	S, N
B1	47	282656	5 %	36 %	59 %	N	S	1			1	1UD/ST, 1D/SH	S, W/E
A9	54	406416	7 %	42 %	51 %	W	S	1				1D/SH	S, S/N
A1	48	193612	15 %	66 %	19 %	S	S	1				1D/SH	O
A4	50	267914	5 %	57 %	38 %	E	S	1				1D/SH	S, N
A5-6	45	265761	13 %	45 %	42 %	E	L		1	1		1D/ST, 1UD/SH	S, W
Middle Mesolithic													
C4	34	255092	7 %	28 %	65 %	E	S	2				2D/SH	S, W/E
C2	26	214371	6 %	27 %	67 %	E	L		1		1	1D/ST, 1UD/ST	S, W
Late Mesolithic													
D2	22	228177	9 %	52 %	40 %	S	S		1			1D/SH	S, N/S/E
Early Neolithic													
D7	17	167532	17 %	40 %	42 %	W	L			1		1UD/SH	S, N/E/S
D10	18	181033	20 %	38 %	42 %	E	L	1		1		1D/SH, 1UD/SH	S, N/S
D1	17	152589	19 %	39 %	42 %	E	L		1	1		1D/ST, 1UD/SH	S, W
A2	15	1765	100 %	0 %	0 %	E	L					0	O
Middle Neolithic													
D5	14	147522	11 %	71 %	18 %	S	S	2				2D/SH	S, N/E/W
Late Neolithic													
D11	11	0	-	-	-	W	L	-	-	-	-	-	S, S
A2	11	0	-	-	-	E	L	-	-	-	-	-	O

Table 3.4.19: Table summarizing the variables included in the study.

the sites (see Darmark, chapter 2.2.1, this volume), differs somewhat by being situated in the archipelago zone and not on the mainland, and also by having a higher percentage of archipelago in relation to mainland compared to the other Early Mesolithic sites (see fig. 3.4.20 and fig. 3.4.21).

This picture changes rather abruptly with the Middle Mesolithic sites, which are located further inland in the mainland zone, where the distance to the open sea almost doubles in relation to the Early Mesolithic. The catchment areas are heavily dominated by the mainland zone (see fig. 3.4.20 and fig. 3.4.21).

The Late Mesolithic, Early Neolithic and Middle Neolithic sites can be grouped together. These sites are again closer to the mainland/archipelago zone and have catchment areas which roughly contain equal parts of mainland and archipelago. The sea is either further away than 4 km, or just within this distance. The early phase at *Kvastad A2* (Early Middle Neolithic) deviates from the general pattern by being far away from the sea and completely in an inland setting.

The Late Neolithic sites are also characterized by being situated inland, or at least clearly land oriented.

Regarding the presence of rivers and lakes, this is – not surprisingly – roughly correlated with the size of the available landmass, and therefore the numbers tend to increase over time (table 3.4.19 and fig. 3.4.21).

Location and site characteristics

The absolute majority of the sites are located on the mainland. Only two of the Early Mesolithic sites diverge from this picture, being situated on larger islands instead. The Early and Middle Mesolithic sites also seem to frequently have access to more varied environments, with sounds, bays and fjord basins often being in proximity to the sites. The sites from later periods are to a higher degree characterized by being situated in bays (see figs. 3.4.9–3.4.16). The sites are predominantly, but not exclusively, oriented

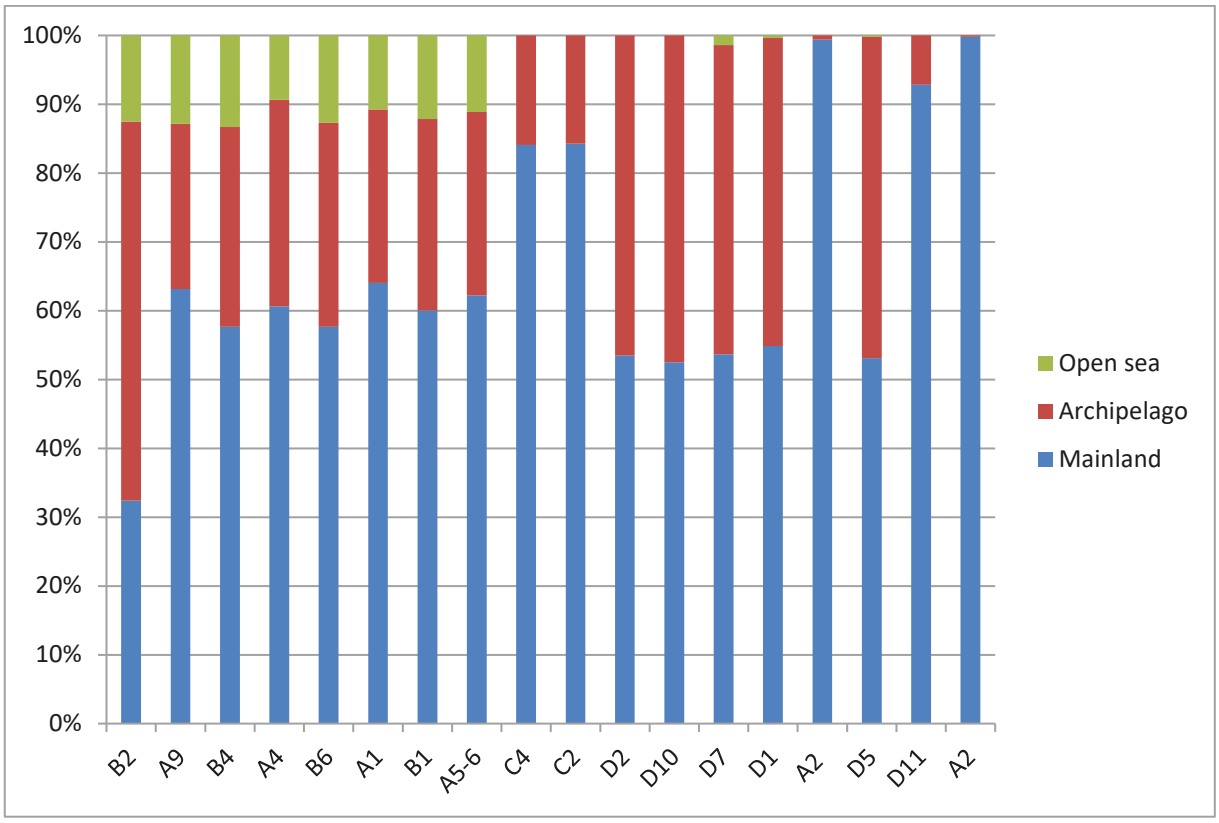

Figure 3.4.20: Diagram showing the percentages of mainland, archipelago and open sea within a 4 km radius from the Stone Age sites in the study.

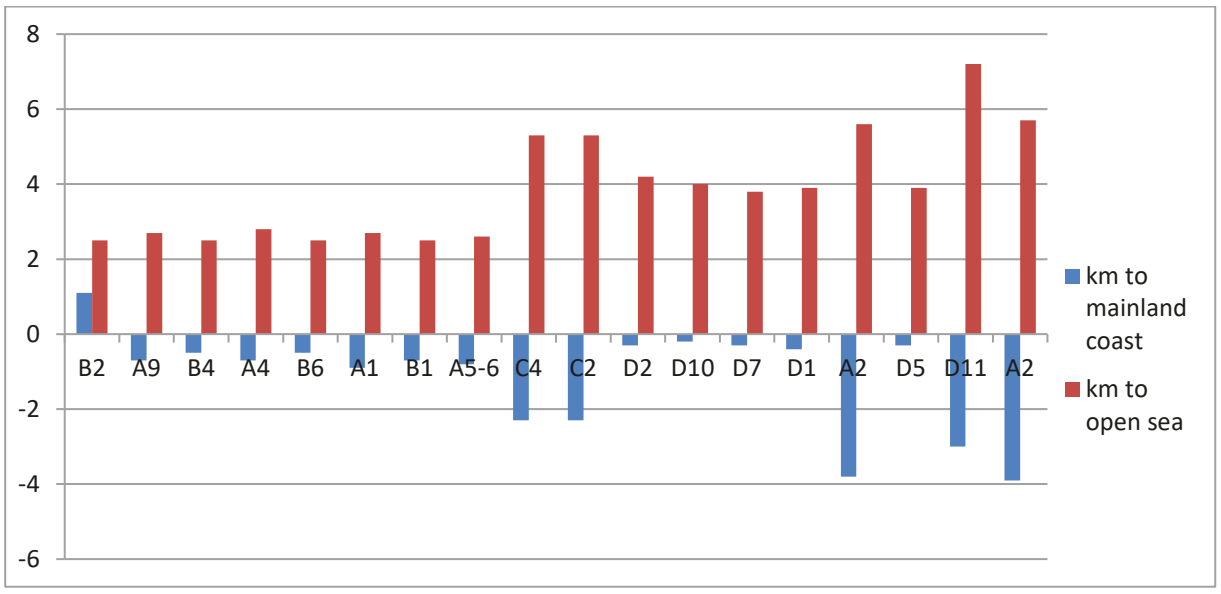

Figure 3.4.21: Diagram showing the distance to the border between mainland and archipelago and the distance to the open sea for the Stone Age sites in the study.

towards the east, *i.e.* in the general direction of the sea. However, having the sea in sight might not have been the primary reason for this orientation, since the sites are as often facing land as facing sea. No obvious chronological tendencies can be ascribed to these characteristics. Most of the sites can be described as sheltered. Very few sites are situated on larger, open surfaces; the only examples of this are *Kvastad A1* (see Stokke *et al.*, chapter 2.2.5, this volume) and *Kvastad A2* (see Stokke & Reitan, chapter 2.5.5, Reitan *et al.*,

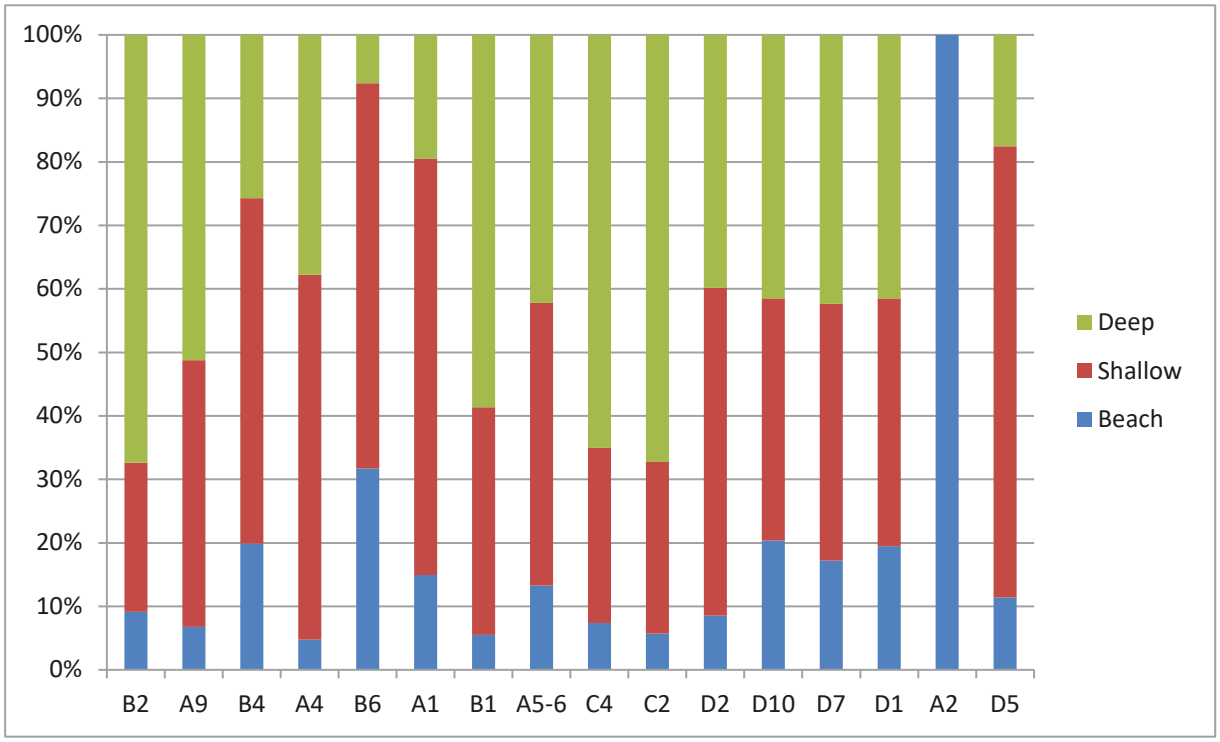

Figure 3.4.22: The percentage of water versus land within a 400 meter radius from the sites included in the study.

chapter 3.9, this volume). The Early- and Middle Mesolithic sites are often situated on topographical saddle formations, being sheltered from one or two directions. From the Late Mesolithic on, sites sheltered from three directions occur, located in cirques or on sandy plateaus surrounded by outcrops in several directions.

Seascapes

Looking at the micro level, the sites are characterized by being surrounded by bodies of water to a varying degree (fig 3.4.22). There is a general tendency for the amount of nearby water to decrease over time, with the earliest sites being situated in very marine settings with up to 80 % of the area (0.5 km^2) being sea. At the other end of the spectrum, the Neolithic sites are either located in settings where the area contains approximately 30 % sea or virtually no sea at all. The proposed trend is clearly interrupted by some of the Early Mesolithic sites (notably *Sagene B4* and *Sagene B6*, see Darmark, chapter 2.2.2, this volume), that only have small amounts of water within immediate reach.

Categorizing the water bodies according to depth shows that half of the sites are dominated by deep water (>12 m), and half of them are dominated by shallow water (2–12 m). There is no clear chronological tendency in the data set. This can also be seen in correlation with the natural topography and geology in the area (for maps, see Reitan, chapter 2.1, this volume) (fig. 3.4.23).

The majority of the sites in the Early Mesolithic are sites with defined and shallow landing sites, this can be seen in correlation to the defined depth of water bodies (see figure 3.4.23). A change is seen in the Middle Mesolithic and onwards, where most of the sites have defined and steep, or undefined and shallow, landing sites.

DISCUSSION

It is likely that this study is affected by the investigated area which is limited to four smaller areas within the route of the new E18 Tvedestrand–Arendal motorway. In addition, several sites detected during the county's test-pitting prior to the excavation project (Eskeland 2013, 2014) have not been investigated by the E18 Tvedestrand–Arendal project (*cf.* Mjærum & Lønaas 2014).

The fact that the Early Mesolithic sites are the most numerous in this study, combined with the fact that they derive from two different areas, *Sagene* and *Kvastad*, leads us to believe that these sites might actually reflect a cultural localization preference in the Tvedestrand–Arendal area during the period in question. Based on the local shore displacement curve, these sites are dated to *c.* 9000–8300 BC. Despite the

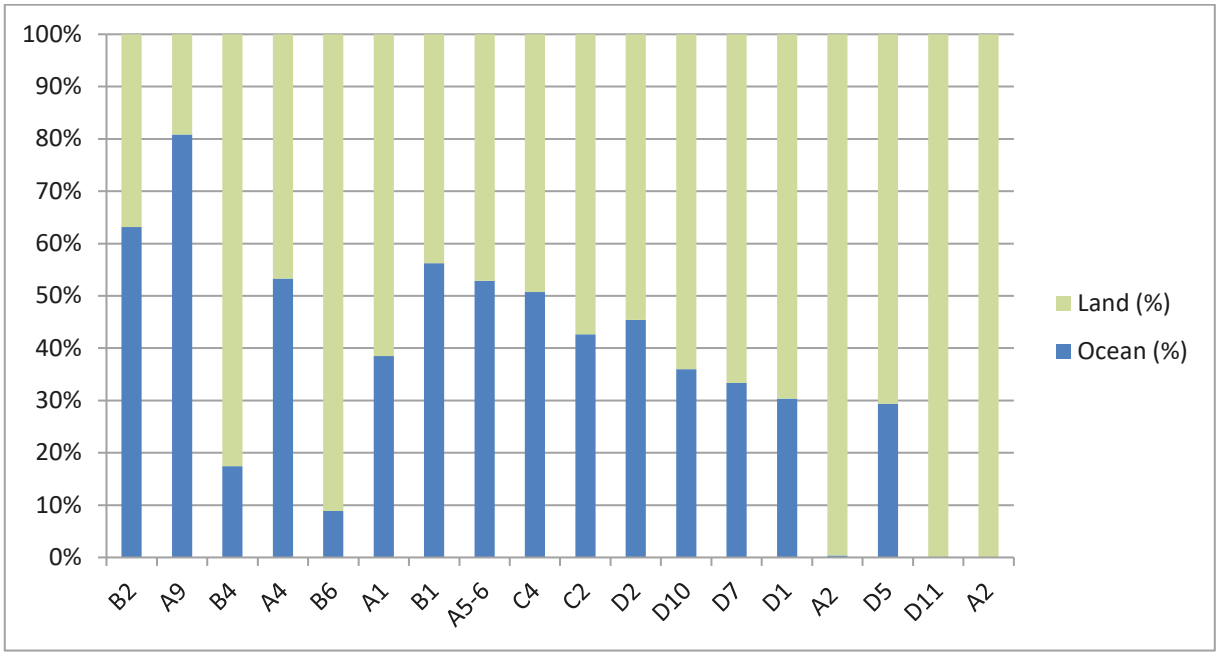

Figure 3.4.23: The percentage of beach zone, shallow water and deep water within a 400 meter radius from the sites included in the study.

changing landscape during this period, due to rapid land upheaval (*cf.* Romundset, chapter 3.2, this volume), the sites show great similarities at the macro level in terms of what type of landscape they were located in (see fig. 3.4.21 and figures 3.4.1–3.4.8). All Early Mesolithic sites, with *Sagene B2* (Darmark, chapter 2.2.1, this volume) as an exception, were located inside of the border between mainland and archipelago, less than 3 km away from the open sea. The preferred location in the Early Mesolithic is on sheltered spots on the mainland, close to sounds, and often with access to other bodies of water such as bays or fjord basins. *Sagene B2* (Darmark, chapter 2.2.1, this volume) and *Sagene B1* (Viken, chapter 2.2.3, this volume) were the only Early Mesolithic sites situated on islands.

The localization of the Early Mesolithic sites excavated within the E18 Tvedestrand–Arendal project contrasts the traditional view of Norwegian Early Mesolithic sites as being situated in very exposed locations (*cf.* Bang-Andersen 2003: 11; Åstveit 2014a: 95, with references; Breivik & Bjerck 2017) and the results from Nyland's (2012c) analysis of 57 Early Mesolithic sites from eastern, western and northern Norway. In total, 89.5 % of the sites from her analysis were located on islands, and the majority of these were situated in the archipelagic zone. The greatest similarity between our sites in the county of Aust-Agder and the sites that Nyland analyses is that the majority of sites in both analyses were located close to sounds (Nyland 2012c: 83). Breivik (2014) argues that the mixing of water in the transition zone between fjord and archipelago in the Early Mesolithic would result in high marine productivity in this zone. Due to the regional topography, this zone seems to have been less characterized by islands in Aust-Agder than it was on the western coast of Norway. This in turn could explain why most of the Early Mesolithic sites from the E18 Tvedestrand-Arendal project were located on the mainland.

The Middle Mesolithic sites clearly deviate from the other Stone Age sites in this study, as the macro landscape surrounding *Hesthag C4* (Viken, chapter 2.3.1, this volume) and *Hesthag C2* (Viken, chapter 2.3.2, this volume) is heavily dominated by mainland. This could be taken as an indication towards a more terrestrial oriented economy in the Middle Mesolithic than in the preceding phase, or as a signal of these sites having a similar function. In Solheim's (2013b: 276–282) analysis of eight Middle Mesolithic sites from the *E18 Bommestad–Sky project* in Larvik, Vestfold county (see Solheim & Damlien 2013), he found that the sites represented a dynamic system, where some settlement sites were used repeatedly and over longer periods of time, whereas, for example, butchering sites were short-lived. The results from his analysis indicate that the two Middle Mesolithic Hesthag sites excavated within the E18 Tvedestrand–Arendal project are likely to represent settlement sites that have been used repeatedly. This, in turn, leads us to believe that short-lived sites from the Middle

Mesolithic may have had other localizations in the Tvedestrand–Arendal area.

During the Late Mesolithic to the Middle Neolithic time span, the preferred site localization seems to have changed towards more sheltered positions than in the preceding phases. All of the five shore-bound sites from this period are located close to bays.

The Late Neolithic sites *Kvastad A2* and *Mørland D11* are the only ones located inland.

CONCLUDING REMARKS AND FUTURE RESEARCH POTENTIAL

This is a study aimed at showing the inherent potential that the sites from the *E18 Tvedestrand–Arendal project* hold for future studies of site function and settlement history by the use of GIS. Some tendencies have been highlighted in the text. With the exception of the pioneer phase (*c*. 9500–9000 cal. BC), absent in our material, one has to acknowledge that the Stone Age people who settled in the region would have encountered cultural landscapes, not pristine environments. This is not reflected in this study, as it has more of an eco-functional approach. It is quite conceivable that historicity and cultural connection to the land would have influenced settlement location to a higher degree than the distance to the sea or other topographical factors. A future study should consider this aspect.

Several large scale test-pitting survey projects, followed by large rescue excavation projects, have been executed in Norway over the years (*e.g.* Berg 1995, 1997; Ballin 1998; Jaksland 2001, 2012a, 2012b; Glørstad 2004a; Solheim & Damlien 2013; Jaksland & Persson 2014; Melvold & Persson 2014a; Reitan & Persson 2014; Solheim 2017; see map in Reitan, chapter 3.1, this volume). This has resulted in enormous amounts of positive and negative data with regard to Stone Age activity, particularly along the coast. Ideally, the locations of known Stone Age sites should be compared to locations known *not* to have traces of Stone Age activity. Such a study would show whether or not the landscapes where the sites are located somehow differ from the landscapes where sites have not been detected, and could shed light on new landscape aspects one should consider during test-pitting and excavation, and when offering interpretations of Stone Age sites.